**Virginia Stormwater BMP Clearinghouse Committee Meeting**

Virginia Department of Forestry Building, Training Room
Charlottesville, VA
June 11, 2009

Meeting minutes by Jane Walker

**Committee Members Present:**
Rishi Baral, Stafford County
Joe Battiata, Williamsburg Environmental Group
Gary Boring, New River-Highlands Resource Conservation & Develop. (RC&D) Council
Joanna Curran, University of Virginia (UVA)
Julia B. Hillegass, Hampton Roads Planning District Commission (HRPDC)
Greg Johnson, Patton Harris Rust and Associates (PHR&A)
Mary E. Johnson, Va. Association of Soil and Water Conservation Districts (VASWCD)
Roy T. Mills, Virginia Department of Transportation (VDOT)
Doug Moseley, GKY & Associates, Inc.
David Powers, Michael Baker, Jr. Inc.
David Sample, Virginia Tech
James Talian, City of Lynchburg

**Department of Conservation and Recreation (DCR) Staff Present:**
Scott Crafton
Chuck Dietz
Ved P. Malhotra
John McCutcheon

**Virginia Water Resources Research Center (VWRRC) Staff Present:**
Jane Walker

**Others Present:**
Tom Fitzpatrick, Hydro International
Brad Gianotti, BaySaver
Stephen Kindy, VDOT
Jim Lapping, BaySaver
John Newton, Henrico County
Glen Payton, Filterra
Jeff Perry, Henrico County
Scott Perry, Imbrium Systems, Inc.
Scott Reed, Chesapeake Bay Nutrient Land Trust
Matt Venable, New Kent County
Andy Virostek, Camtek Const. Products Corp.
Keith White, Henrico County

**Call to Order and Introductions:**
Ved Malhotra (DCR), substitute chair for Lee Hill, called the meeting to order. Each person introduced herself or himself. A special welcome was extended to new member Julia Hillegass, who was attending her first meeting as a member of the Clearinghouse Committee. Julia is serving the term from 2009-2011 as are Gary Boring, Greg Johnson, Mary Johnson, James Talian, and Kevin Young.

**Minutes from January 13, 2009 Meeting:**
There were no corrections to the minutes from the most recent Clearinghouse Committee meeting held January 13, 2009 (the March 12, 2009 meeting was cancelled).

A member requested that names be included in the minutes when suggestions are made. Scott Crafton (DCR) explained that DCR's policy concerning minutes is to omit names unless the person is part of DCR staff or contracted by DCR. The member mentioned that it would be helpful to know whether a suggestion was made by a committee member or a non-committee member. Jane Walker (VWRRC) added that she attempts to identify committee members as such, and refers to non-members in more vague terms within the meeting minutes.

Another member noted that the January minutes reflect different requirements concerning the certification process than what is stated in the current draft of the Virginia Technology Assessment Protocol (VTAP). Ved Malhotra explained that the meeting minutes document the discussion at the last meeting. The VTAP differs from this discussion because DCR staff has updated the VTAP since that meeting. The updates are based on the discussions from the Research Protocol Subcommittee meetings and Clearinghouse Committee meetings as well as discussions within DCR.

**Stormwater Regulation Update:**
Ved Malhotra provided an update concerning the proposed new stormwater regulation. He explained that the regulation is expected to be published in the *Virginia Register of Regulations* on June 22, 2009. The 60-day comment period will be begin on June 22 and end in late August. Ved encouraged the committee members to participate in the comment process.

Five public hearings will be held across Virginia. All of the public hearings begin at 7:00 p.m. and are scheduled for the following days and locations:

June 30th Hungry Mother State Park
Hemlock Haven Conference Center
380 Hemlock Haven Lane
Marion, Virginia 24354

July 1st Augusta County Government Center
Board of Supervisors Meeting Room
18 Government Center Lane
Verona, Virginia 24482

July 7th City of Manassas
City Council Chambers
9027 Center Street
Manassas, Virginia 20110

July 9th City of Hampton
City Council Chambers
22 Lincoln Street, 8th Floor
Hampton, Virginia 23669

July 14th Virginia General Assembly Building
910 Capitol Street, Senate Room B
Richmond, Virginia 23219

One member offered to send the Virginia Regulatory Town Hall Web link that lists the hearing dates and location to the rest of the committee members. Another member mentioned that the Virginia Section of the American Society of Civil Engineers (ASCE) has circulated the dates.

DCR will take the final regulation to the Virginia Soil and Water Conservation Board at a special October 2009 meeting. Following a review of the final regulation by Department of Planning and Budget, Secretary of Natural Resources; and Governor's Office; the regulation will be filed for publication with the Registrar. The regulation shall not become effective until July 1, 2010.

**Design Charrettes Updates:**
Ved Malhotra explained that 10 design charrettes were held in Virginia to explain and improve the runoff-reduction method. More than 400 participants attended the charrettes. The runoff-reduction spreadsheet continues to be refined based on the feedback from the charrettes.

**Status of Virginia Technology Assessment Protocol (VTAP):**
Ved stated that the purpose of the meeting was to hear the suggestions and comments of the members of the Clearinghouse Committee.

One member asked if DCR has a schedule for when it expects the VTAP to be complete and put into use. Ved Malhotra explained that DCR has reviewed Sections 1-5 of the VTAP but has not reviewed the initial Sections 6-8 or a consensus draft of Section 6 developed by a subgroup of the Research Protocol Subcommittee.

The member commented: given the extended lag time expected for when the VTAP goes into practice, the Clearinghouse will not be helping localities in the short term. Localities are currently struggling with what BMPs they should install to properly treat stormwater runoff. The member suggested that the Clearinghouse should start a registration application for vendors to complete what their product is designed to do, how it is sized, and what parameters it targets. Another member suggested that the Web site must clearly state that inclusion of the device in this registration process does not indicate an endorsement or recommendation by the Clearinghouse Committee or DCR.

Another member suggested that the Clearinghouse could list an inventory of what BMPs are already installed. It was suggested that localities could provide this information.

These two inventories would begin to put the Clearinghouse on the radar screen of local governments for being the "go-to" place for information about managing stormwater runoff. Ved asked if the localities were unaware of the Clearinghouse. A committee member replied that from his perspective the Clearinghouse is not on the radar screen of local governments.

A representative of a local government added that an inventory of available manufactured treatment devices (MTDs) would be helpful to local governments. He added that local governments would not appreciate having to develop an inventory of BMPs established within their jurisdiction. He added that DCR already has that information. A Clearinghouse Committee member supported the view and said that developing an inventory should not be the responsibility of the localities but of the vendors. Vendors should identify the localities in Virginia where their products are installed.

VTAP Section 1-- Introduction:

Jane Walker summarized that Section 1 of the VTAP describes DCR's and the Virginia Soil and Water Conservation Board's authorities relative to the evaluation process; the purpose of the VTAP; its applicability; the roles and responsibilities of the various entities involved in the process; and the protocol limitations, release of liability, and disclosure (See Appendix 1).

A member noted that the purpose defines the VTAP as a procedure for approving and listing MTDs in the Clearinghouse. This prompted him to ask if the Clearinghouse would be evaluating only MTDs or if it also would be evaluating innovative and traditional BMPs. A committee member commented that low impact development and stormwater ponds are not monitored and evaluated. He predicts that about 90% are not properly maintained and thus not functioning as designed. Another member added being flabbergasted that rain gardens, grass swales, and other BMPs are not being monitored. It was suggested that it is unfair to single out proprietary devices for evaluation and assume that traditional and other nonproprietary devices are functioning as expected.

Other members added that they had always been under the impression that the Clearinghouse would evaluate all BMPs (proprietary and non-proprietary). A committee member asked how an innovative non-proprietary BMP would be listed on the Clearinghouse.

DCR staff replied to these questions by saying that the VTAP is initially being developed to evaluate MTDs, but the expectation is that the Clearinghouse Committee will eventually be evaluating other BMPs. DCR's priority is to begin with MTDs and then move to non-proprietary devices. Later, other protocol documents will be developed that focus on non-proprietary BMPs. A member added that prioritization is needed because the Clearinghouse Committee only meets once a quarter. Scott Crafton (DCR) added that subcommittees that meet more often would likely be needed to develop protocols for other BMPs.

Jane Walker noted the document currently states its purpose to establish minimum "field" monitoring guidelines, but that laboratory monitoring data is accepted and thus lab guidance is also provided. She recommended the removal of the word "field" in the purpose.

VTAP Section 2 -- BMP Performance Goals

Section 2.1 -- A discussion was held regarding the BMP performance goals for stormwater runoff volume reduction. DCR staff clarified that if underground-storage devices provide only void space for water storage, they will not have to undergo the assessment process. If, however, a device is used to reduce water volume and has a filtering medium for water quality improvement (that could get clogged, etc.), it will need to undergo the assessment process. (Likewise, if the proponent wants credit for the device's ability to improve water quality, the removal of pollutants will also need to be demonstrated before credit is granted.)

A committee member recommended that a sentence be added to the VTAP that acknowledges that volume reduction may not work in Tidewater. Another member suggested that proponents should not try to get volume reduction credits for devices installed in Tidewater if it won't work in that region. A third committee member expressed concern that if the Clearinghouse lists certified devices, manufacturers will put them in all areas of the state, even those areas where they may not function properly. Scott Crafton suggested that a disclaimer could be published when posting approved products on the Clearinghouse. The proponent would be required to provide information of where the product may be installed and expected to perform as designed. Review of this information will be part of the evaluation process. Another member suggested that site restraints should be included on the Clearinghouse, e.g., "The device is approved for X, Y, and Z, but site constraints prevent putting it in Tidewater." Limitations of the device must be disclosed.

Another member noted that there is a two-fold process associated with this approval process just as there is with using the runoff-reduction spreadsheet. First, proponents must demonstrate that the device works, and second, proponents must show that the device works at the particular site where it is to be installed (site compliance).

Section 2.2 -- Jane Walker explained that the section on stormwater runoff peak rate control is currently under development. A first draft of this section should be included in the next version.

Section 2.3 – Jane Walker stated that although target levels are provided for total phosphorus (TP), total suspended solids (TSS), and suspended-sediment concentration (SSC) as currently described in the VTAP, "devices will be assigned pollutant removal efficiencies based upon the conditions under which the device was tested and the resulting verified data pursuant to the VTAP."

A committee member asked: given that the Chesapeake Bay TMDL lists nitrogen, should nitrogen be included in the VTAP? Others suggested that there may be TMDLs for bacteria, metals, and other parameters. Should these be included as well? As currently written, the VTAP only specifies certification for TP. Scott Crafton proposed that the process could be expanded to show that in the future, products may be certified for nitrogen, etc. It was suggested that a place holder could be inserted into the document. Ved added that we are not stopping proponents from

testing for other pollutants; we just are not certifying products for the removal of other pollutants. A committee member added that unless we ask for data, we will not get it. A member stated that if only certified products are allowed to be installed in Virginia and there is no certification process for the removal of water quality pollutants besides phosphorus, we could be essentially preventing the use of some products. It was suggested to add "at this time" to a sentence on page 11 of the VTAP so that it reads: "Certifications for the removal of pollutants other than TP will not be granted in Virginia at this time."

A member suggested removing the recommended density of particles in Table 1. The density provided, 2.65 g/cm$^3$ (based on non-cohesive quartz at 25$^o$C) is used in laboratory testing, not field testing.

It was suggested to change the title of Table 1. As currently written, the title suggests that unless a site represents the characteristics described in the table, it would not be representative of a typical post-construction site. Also, Table 2 refers back to Table 1 as representing the typical urban stormwater conditions in Virginia. Because field data used in the evaluation process must be derived from testing sites representative of the typical urban stormwater conditions expected in Virginia, the particle size distributions of field sites would need to represent the distribution described in Table 1.

A member questioned the usefulness of Table 1 and asked its source. She explained that a typical particle size distribution (PSD) does not exist because it depends on the area over which the water has flowed, the timing of the flows, etc. Research shows considerable variability in repeat sampling from the same location. This member suggested that instead of having a table with a defined particle size distribution, the VTAP could require that the final effluent have no more than X% of particles in each size range. More updated definitions for particle size can be found in particle size charts by the USGS and ASCE.

Another member asked if the protocol is designed for soil types not found throughout Virginia. It was explained that members of the Research Protocol Subcommittee offered that soil type is not as important in urban settings (where MTDs tend to be used) because of the amount of impervious surfaces. Particles found in urban stormwater tend to be similar no matter what soil type underlies the concrete and pavement.

Under Section 2.2.1, it was suggested to change one sentence to read: "The mean Event Mean Concentration (EMC) of TP in urban/suburban runoff (influent) in Virginia for BMP compliance computation and site conditioning is 0.26 mg/L."

Attention was called to the limit on how long TSS/SSC would be allowed for an initial TP credit, only until December 31, 2015. This time limit is designed to encourage the collection of TP data for the future while accepting current data for use in getting the program started.

<u>VTAP Section 3 – BMP Certification Designations</u>

Jane Walker provided a brief description of the three designation uses to be granted for MTDs in Virginia: Pilot Use Designation (PUD), Conditional Use Designation (CUD), and General Use Designation (GUD). For certification in Virginia, laboratory data will need to be collected by testing the device at full-scale size. TSS and SSC lab testing is to be performed using Sil-Co-Sil

106. Field data should be derived from testing sites representative of the typical urban stormwater conditions expected in Virginia. The manufacturers requested that the typical urban stormwater conditions in Virginia be clearly defined. The VTAP provides this information in Table 2, which describes the expected precipitation (type II distribution), temperature, and particle size distribution (the table previously discussed). Because the information above applies to all testing, it was suggested that this information be pulled aside into a separate section instead of being included in the PUD section. It was also suggested that the sentence regarding poor performing devices that are a safety hazard be removed.

It was mentioned that if only practices on the Clearinghouse are approved for use in Virginia, other MTDs designed for metals, etc. can't be used. It was suggested, therefore, that reciprocal certification for removal of sediment, metals, etc. be applied. A member suggested that reciprocal certification should only be granted for TSS certified in New Jersey, and not devices certified in Washington where the seasons (and rain patterns) are different than those in Virginia.

Jane Walker presented the table below as a summary of the requirements and entitlements of each certification use; it was suggested to include this table in the VTAP. It was clarified that all test sites are not required to be in Virginia but instead test sites must have stormwater runoff conditions representative of those in Virginia.

| | Required | Test Parameter | # Installed in Virginia (**Max**) | Min # of Test Sites in Va. | Retrofit Required if Poor Perform. |
|---|---|---|---|---|---|
| PUD | Full-scale Lab or Field | TP, TSS, or SSC | 1-**5** | All | >2 |
| CUD based on lab data | Full-scale Lab | TP or >80% removal of TSS/SSC | 1-5 | 1 | >2 |
| | | | 6-**10** | 2 | >2 |
| CUD based on field data | ≥2 Field Sites | TP or >80% removal of TSS/SSC | 1-5 | 1 | >2 |
| | | | 6-10 | 2 | >2 |
| | | | 11-**15** | 3 | >2 |
| GUD | ≥5 Field Sites | TP | No Limit | None | None |

One member expressed concern that a field-tested product through an existing state run testing protocol – such as New Jersey's – that shows an 80% removal of TSS or SSC would be granted only an initial TP removal credit of 25%, same as that which has only demonstrated laboratory performance. Such a low removal credit would be unlikely to help the site meet its TP removal goal so the product would likely not be allowed to be installed and tested.

This member additionally pointed out that testing a device in the lab would only take several weeks and cost about $50,000, whereas conducting two field studies may take 3-6 years and cost much more ($600,000-$700,000 or more), yet both devices would receive essentially the same certification, CUD. Although given five more installations for the product with field data, testing would be required at 3 sites, making the installation of 5 more cost prohibitive. This setup sends the wrong message to the manufacturers. The message we should send to them is the following: "We want field data, not lab data." He suggested that the VTAP encourage field testing with more of an incentive. He added that there is little difference between the PUD and the lab-tested CUD. He recommended moving the lab-tested CUD certification to a PUD level and/or giving more credit to the field-tested CUD certified devices. The credit could be in the form of allowing more installations and/or granting a higher TP credit than simply 25% for products showing an 80% removal of TSS or SSC in the field (e.g., a 35-45% TP removal credit). Reputable field testing that demonstrates TSS performance serves to validate sizing and longevity. Many of the filter products may achieve TSS removal or even TP removal in the lab but will behave very differently when exposed to real-site conditions (organics, biofouling, low specific gravity of solids, etc.), which will expose the sizing required (filter surface area, flow rates, etc.).

A representative of a BMP manufacturer expressed concern that the requirements in the current VTAP document would be cost prohibitive for all BMP manufacturers to operate in Virginia. To reach the GUD level, each tested product would cost the manufacturer more than 1.5 million dollars and take at least 5-6 years of work at the manufacturer's expense. Manufacturers cannot afford such expenses. Investors of companies generally want to see a return on their investment well within 7-years; a return on their investment would be difficult under the proposed system.

For most technologies to be developed prior to field monitoring, a 2 to 5 year investment in the technology, business, and personnel has already been established. If the VTAP is accepted as currently written, Virginia would be considered "not business friendly" in his opinion. He explained that the consensus document for Section 6 that was developed by a group of the Research Protocol Subcommittee was based on in-depth monitoring of one field site, well beyond that of current TAPE and TARP field test protocols. He proposed that the VTAP summary table reflect the work that went into the development of the consensus document for Section 6. Alternatively, he suggested that the requirements for a GUD could be those currently proposed for the CUD based on field data and reciprocity – i.e., two field studies showing TP removal. He added that 2 field studies should be manageable by a vendor/manufacturer, if reciprocity is considered and fully accepted based on the VTAP science principals. Another way to soften the blow would be to allow more installations in Virginia so that manufacturers could sell more products, and thus generate revenue to cover the costs associated with testing the product. The key point to summarize the solution to mitigate risk for all BMPs (manufactured and non-manufactured), is that at the end of the day, the science coming from this process should be valid and applicable. Thus, the requirements should not be based on arbitrary and prohibitive numbers.

A committee member requested that the last column of the summary table be removed. Including the requirement to retrofit any sites would "kill the whole program before it gets started." He added that even in North Carolina, poorly performing MTDs have not been pulled from the ground mainly because the emphasis is placed on ensuring viability before they are allowed to be installed. Scott Crafton recalled that when he was working with the Research Protocol Subcommittee that the subcommittee recommended to not require retrofits but instead, the number of installations should be limited to allow for testing.

A representative of a local government asked how the testing would be implemented. If a product being tested is found to perform poorly, will the locality be considered out of compliance? Unless some form of waiver is provided, localities will only use GUD products. As a second point, he suggested that all installations in Virginia be posted on the Clearinghouse website so that localities will know not to approve more devices than allowed.

As a general comment, one member of the Clearinghouse Committee suggested that a list of acronyms be included at the beginning of the document.

<u>VTAP Section 4: Assessment Process:</u>
Jane Walker summarized that this section contains an overview of the VTAP process, the method for requesting/revising use level designations, assessment timelines, how Quality Assurance Project Plans (QAPPs) are approved, requirements of performance testing, and the means by which use designations are granted. She reviewed the flow chart illustrating the certification process in Virginia (Figure 1 on page 19 of the VTAP), and asked if there were any needed corrections or additions to the chart. Jane stressed that there are three required deadlines (in bold type) for maintaining the PUD and CUD certifications: submission of progress reports, the product-specific QAPP, and the technical evaluation report (TER). Failure to meet these deadlines may result in the suspension or cancellation of a designation. There were no comments regarding this section.

VTAP Section 5: Use Level Designation Application:
Jane Walker offered that each application has six components: (1) completed application form, (2) performance claim, (3) theory/technology description, (4) remediation action plan, (5) technical evaluation report, and (6) certification statement.

It was suggested to delete the particle density information listed on the table on page 27 of the VTAP and elsewhere throughout the document. On the application form (Appendix A of the VTAP), it was suggested to request what parameter(s) is being tested as well as what parameters the device is designed to treat. For Appendix A -- Question 6 BMP History, it was suggested that latitude and longitude be specified so that applications do not arrive with a general descriptions for the location, e.g., "northern Virginia." Under question 11 of the application form, it was suggested that a certification number be included for products that have been certified. It was also suggested that the states specified under TARP should only include New Jersey – none of the other TARP states have a functioning certification process.

VTAP Section 6+:
Jane Walker stated that a sub-group of the Research Protocol Subcommittee reviewed the originally developed Sections 6-8 of the VTAP (6-Quality Assurance Project Plan, 7-Status Reports, and 8-Technical Evaluation Report) and combined the last three sections into one section called "Section 6-Field Monitoring Protocol." She has reviewed the updated document, but DCR staff has not completed their reviewed yet.

David Sample explained that based on the suggestion by the Research Protocol Subcommittee, he pulled together a team of national experts in the management of phosphorus in stormwater runoff. This team currently consists of the following individuals:

- Allen Davis, University of Maryland
- Tom Grizzard, Virginia Tech
- Rob Roseen, University of New Hampshire
- David Sample, Virginia Tech
- John Sansalone, University of Florida.

The team intends to develop a phosphorus testing protocol to assess the performance of MTDs for the treatment of stormwater. They will consider maintenance, statistical frequency testing, etc. They expect to have a draft document by late August.

Provided the expert team is able to submit its document in August, the intention is for the Clearinghouse Committee to be able to review the document and the remaining parts of the VTAP at the September meeting.

**Next Meeting Dates:**
Ved Malhotra reminded everyone of the committee's next meetings, which are scheduled for September 10, 2009 and December 10, 2009. One member stated that he liked the DOF Training Room best for a meeting location. Jane Walker offered to try to reserve the room for future meetings.

**Adjourn:**
Ved Malhotra asked if there was any other business. One member asked if anyone had considered how the nutrient trading bill might impact the BMP evaluation process. It was explained that DCR has a workgroup working on the impacts of the nutrient trading bill.

With no further business, the meeting was adjourned.

## Appendix 1 – Draft VTAP

## Handout Distributed Prior to Meeting

# Guidance for Evaluating Stormwater Manufactured Treatment Devices

# Virginia Technology Assessment Protocol (VTAP)

Prepared by:

Virginia Department of Conservation and Recreation

Research Protocol Subcommittee of the
Virginia Stormwater BMP Clearinghouse Committee

You can print or download this document from DCR's Website at:
http://www.dcr.virginia.gov

or from the Virginia Stormwater BMP Clearinghouse at:
http://www.vwrrc.vt.edu/swc

For more information contact:
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**June 2009**

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# 1 -- Introduction

The Virginia Department of Conservation and Recreation (DCR) evaluates and approves manufactured (proprietary) devices deemed to be reasonable methods of prevention, control, and/or treatment of stormwater runoff. Methods under consideration or approved by DCR are listed in the Virginia Stormwater Best Management Practices (BMP) Clearinghouse: http://www.vwrrc.vt.edu/swc. This document, the *Virginia Technology Assessment Protocol* (VTAP), describes the assessment process for listing manufactured treatment devices in the Clearinghouse.

Virginia DCR also publishes the *Virginia Stormwater Management Handbook* (DCR 1999). The handbook, currently being revised, provides information for stormwater management programs regarding basic hydrology and hydraulics, stormwater best management practice selection and pollution removal efficiencies, and administrative guidelines to support compliance with state stormwater regulations. A link to the handbook as well as additional information can be found in the Clearinghouse: http://www.vwrrc.vt.edu/swc.

## 1.1 – Authority

Virginia's Stormwater Management Programs are implemented according to the Virginia Stormwater Management Law and Virginia Stormwater Management Regulations. The law is codified at Title 10.1, Chapter 6, Article 1.1 of the *Code of Virginia,* and the regulations are found at Section 4 VAC50-60 of the *Virginia Administrative Code*. The Law provides authority for the Virginia Soil and Water Conservation Board to *". . . establish minimum design criteria for measures to control nonpoint source pollution and localized flooding . . . ."* (§10.1-603.4 2) and to *". . . [delegate to the Department (sic DCR) . . . any of the powers and duties vested in it by [the law] . . . ."* (§10.1-603.2:1.2). By extension, DCR thus maintains the authority to establish, approve and update standards and specifications of the best management practices (BMPs) that may be used within Virginia to control stormwater runoff.

Because treatment technologies are evolving rapidly, the DCR needs to be able to make changes to BMP standards and add new practices as new information becomes available. For this reason, DCR has partnered with the Virginia Water Resources Research Center (VWRRC) to establish the Virginia Stormwater BMP Clearinghouse Committee (Clearinghouse Committee). DCR staff and members of the Clearinghouse Committee have worked together to develop and design the Virginia Stormwater BMP Clearinghouse. The Clearinghouse (http://www.vwrrc.vt.edu/swc/) is where the approved list of BMPs – both public domain practices and manufactured treatment devices (MTDs) – and their associated standards and specifications will be found. This guidance document shall be used to evaluate MTDs for certification in Virginia. These approved removal efficiencies will be the ones that state agencies and local stormwater management programs will recognize and approve when the devices are used in specific stormwater management plans.

As new stormwater regulations are developed in Virginia (2009), it is expected that the Clearinghouse will be referenced within the new regulations. This VTAP document was developed by the DCR and the Clearinghouse Committee in anticipation of updated stormwater regulations in Virginia.

# 1.2 -- Purpose of Virginia Technology Assessment Protocol (VTAP)

The purpose of VTAP is to:

1. Define the structure and procedures to follow for approving and listing manufactured stormwater treatment technologies in the Virginia Stormwater BMP Clearinghouse.
2. Establish minimum field monitoring guidelines and methods for evaluating and reporting on the appropriate uses of manufactured stormwater treatment technologies.

DCR and the Clearinghouse Committee support the Technology Acceptance Reciprocity Partnership (TARP) and thus the *TARP Protocol for Stormwater Best Management Practice Demonstrations* (see the "TARP Protocol" section below). Use of the TARP Protocol, however, does not eliminate state review or approval of projects proposing to use TARP-certified stormwater management technologies, nor does it require Virginia to "rubber stamp" the approval or certification of another state. Those seeking reciprocal certification from Virginia of practices and methods previously certified by another state must still demonstrate consistency with the procedures articulated in this document.

The VTAP is an extension of the TARP Protocol and is specific to Virginia, which has established total phosphorus load limits. It provides a means to obtain a reasonable level of statistical confidence in the performance of a manufactured treatment device with respect to its operation and total phosphorus reductions. The VTAP defines a testing protocol and process for evaluating and reporting on the performance and appropriate uses of manufactured treatment devices that address post-construction stormwater runoff.

By obtaining accurate and relevant data, evaluators can assess performance claims and make informed decisions whether or not to approve manufactured treatment devices for use in Virginia. Local governments statewide can apply the use level designations listed in the Clearinghouse to evaluate the suitability of these devices for use in their communities.

## TARP Protocol

For technology evaluations following the elements of the TARP Protocol, the state partners in California, Massachusetts, Maryland, New Jersey, Pennsylvania, and Virginia have agreed to:

1. Address technology review and approval barriers in policy and regulations that do not advance knowledge of a technology's performance or recognize innovative approaches to meet environmental protection goals;
2. Accept the performance tests and data, and acknowledge the approval results of a partner's review of a technology demonstration, as appropriate, in order to reduce subsequent review and approval time;
3. Increase expertise in the applications and advantages of technologies that may have superior environmental and economic benefits for controlling stormwater pollution;
4. Use the TARP Protocol, as appropriate, for state-led initiatives, grants, and verification or certification programs where the objective is to document performance efficiency and cost of best management practices;
5. Share technology information with potential users in the public and private sectors using existing state supported programs; and
6. Monitor and evaluate the results of using the TARP Protocol, and periodically review and revise the Protocol to maintain its viability.

**The TARP Protocol describes a set of uniform criteria acceptable to the endorsing states. However, specific state requirements must be considered when applying for certification or verification of a stormwater BMP in a particular state. Each partner reserves the right to evaluate any application and request specific information in order to satisfy an individual state's requirements.**

# 1.3 -- Applicability

***This testing protocol is designed for detention, flow-based (volume and peak rate) manufactured treatment devices (MTDs) and may not be suitable for all stormwater treatment practices.*** The protocol is NOT intended for use in evaluation of erosion and sediment control technologies or products. This protocol is also NOT intended for conducting research on conventional/traditional (i.e., public domain) BMPs.

The assessment protocol deals with MTDs that are designed for (1) reducing stormwater runoff volume, (2) reducing peak runoff rate, and/or (3) reducing total phosphorus (TP). Devices designed to remove pollutants other than phosphorus (e.g., nitrogen, oil/grease/hydrocarbons, metals, bacteria, etc.) will not be certified in Virginia. However, links to information about MTDs approved in other states for the removal of pollutants other than phosphorus will be provided in the Clearinghouse.

This protocol is not intended for conducting research on experimental devices. Technologies with limited data will only be evaluated for the **Pilot Use Designation** (PUD). The DCR will not consider an application for a **Conditional Use Designation** (CUD) or a **General Use Designation** (GUD) unless the application includes sufficient performance data that clearly demonstrate acceptable feasibility and the likelihood that the device will achieve desired performance levels using the manufacturer's recommended sizing criteria, pretreatment requirements, and maintenance schedule.

# 1.4 -- Roles and Responsibilities

## 1.4.1 -- Virginia Department of Conservation and Recreation (DCR)

The Virginia Department of Conservation and Recreation is responsible for the Stormwater Management Programs in Virginia (see **Section 1.1 -- Authority**). For this reason, the DCR may obtain recommendations from outside evaluators and the Clearinghouse Committee, but is ultimately responsible for granting or denying use designations.

The Department of Conservation and Recreation:

- Assumes the duties of the contracted evaluators (see below) when necessary;
- Grants use level designations;
- Approves extensions and changes made to use level designations;
- Provides oversight and analysis of all submittals to ensure consistency with the DCR's stormwater management requirements; and
- Reviews new information and updates the VTAP as needed.

## 1.4.2 – DCR's Contracted Evaluators

The DCR may contract with a qualified and independent individual or entity to assist with the assessment process.

When contracted, DCR's evaluators:

- Review all applications for completeness;
- Review all quality assurance project plans (QAPPs);
- Provide recommendations to the DCR for approval or denial of QAPPs;
- Review technology evaluation reports (TERs) for completeness and conformance with Clearinghouse procedures and protocols; and
- Provide recommendations and assessments to the Clearinghouse Committee and DCR regarding pollution removal efficiencies to assign to devices and whether or not to certify/approve devices at requested use designation levels.

## 1.4.3 -- Clearinghouse Committee

Members of the Virginia Stormwater BMP Clearinghouse Committee will review technology evaluation reports and provide recommendations to the DCR. The reviewers represent both academics and practitioners that have experience with stormwater BMPs but are not affiliated with the proponent of the technology or other stormwater BMP manufacturers/vendors.

The Clearinghouse Committee:

- Interacts with the DCR staff to assess how well the VTAP process satisfies the DCR's stormwater treatment BMP selection objectives;
- Meets quarterly to provide oversight review of use level designation applications and technology engineering reports; and
- Provides recommendations and assessments to the DCR regarding pollution removal efficiencies to assign to devices and whether or not to certify/approve devices at requested use designation levels.

## 1.4.4 -- Virginia Water Resources Research Center

The Virginia Water Resources Research Center facilitates the VTAP review process by coordinating with the DCR and the Clearinghouse Committee.

The Virginia Water Resources Research Center:

- Develops and maintains the Virginia Stormwater BMP Clearinghouse under the direction of the DCR and the Clearinghouse Committee; and
- May facilitate outside research and evaluations, when requested, by coordinating with stormwater BMP designers, regulators, researchers, and manufacturers regarding the scientific review of existing BMP test data or new monitoring and testing.

## 1.4.5 -- Proponent of Technology

The proponent of the technology refers to the person(s) who are promoting the project through the VTAP process. The proponent can be the manufacturer, the product vendor, consultant, etc.

The proponent:

- Submits the use level designation application;
- Submits QAPPs for all field monitored test sites;
- Informs the DCR of changes in the QAPP; production, manufacturer standing, key personnel, etc.;
- Submits interim status reports; and
- Submits the technology evaluation report (TER).

## 1.4.6 – Proponent's Technical Advisor

The proponent's technical advisor provides outside, objective oversight of performance testing. This qualified technical advisor is paid for by the proponent of the technology and is not provided by the DCR, the DCR's contracted evaluators, the Clearinghouse Committee, or the VWRRC.

The DCR *requires* the use of a technical advisor for all applications: **Pilot Use Designation** (PUD), **Conditional Use Designation** (CUD) and **General Use Designation** (GUD). Independent consultation must begin at the onset of the testing program.

At a minimum, the technical advisor:

- Reviews and approves the QAPPs for all field-monitored test sites;
- Provides oversight of QAPP implementation at field-test sites by periodically inspecting site conditions, sampling equipment, sample handling, etc.;

- Prepares a TER that includes a summary of test results and research conclusions and compares these with the proponent's performance claims;
- Provides information about the technology to DCR and the Clearinghouse Committee to be included in the Clearinghouse.

# 1.5 -- Protocol Limitations, Release of Liability, and Disclosure

This protocol has been published for the purpose of evaluating or generating performance claim data for manufactured stormwater treatment technologies for certification in Virginia. Neither the DCR; its contracted partners, including the VWRRC; nor the Clearinghouse Committee accept responsibility or liability for performance of stormwater technologies being evaluated using the VTAP.

# 2 -- BMP Performance Goals

## 2.1 -- Stormwater Runoff Volume Reduction

**Runoff volume reduction** is defined as the total volume of rainfall and runoff reduced through canopy interception, soil infiltration, evaporation, rainfall harvesting, engineered infiltration, extended filtration or evapotranspiration at small sites. Stormwater management experts throughout the United States, participating in a panel of experts for the National Academies of Science during the past two years (2007-2008), have recently recommended that stormwater managers should change our strategies for reducing pollution. Instead of relying simply on the various treatment processes employed in stormwater BMPs, we should focus our compliance criteria on reducing the volume of runoff. In response, the Virginia DCR has been working to incorporate the **Runoff Reduction Methodology** as part of the draft revisions of the Virginia Stormwater Management Regulations. The intent of Virginia's Runoff Reduction Methodology is to (1) reduce the total volume of runoff carrying pollutants, and (2) to maintain predevelopment hydrology.

**Pollution treatment** is defined as the change in pollution concentration in runoff due to the treatment processes the practice incorporates. The **total pollutant load** removed by a practice is the product of the runoff volume reduction and reduction achieved by the practice's pollution treatment process(es). Virginia's new approach to water quality protection will, in fact, provide for enhanced pollution reduction as runoff volume is reduced and, in the process, accomplish a significant amount of groundwater recharge using the same BMPs.

Manufactured treatment devices for which the proponents desire to receive certification for runoff volume reduction must demonstrate the percentage of the total runoff flowing into the device that is removed from the flow prior to runoff exiting the device. Proponents must also demonstrate whether that removed flow is (1) permanently removed from the surface discharge (e.g., through infiltration into a stone base or soil beneath the device), (2) shunted aside temporarily for slower discharge following the storm event, or (3) is subject to some other specified process.

## 2.2 -- Stormwater Runoff Peak Rate Control

This section is currently under development.

## 2.3 -- Stormwater Runoff Quality Control

The goal of the VTAP regarding runoff quality control is to determine how much a specific MTD can remove total phosphorus (TP). MTDs seeking certification for runoff quality control in Virginia will only be approved for TP removal (see **Section 1.3 – Applicability**).

The removals cited below are desired targets associated with reductions in TP. Each target lists the removal efficiency and describes the influent characteristics, i.e., concentration and particle size distribution (PSD), under which the device was assessed.

- Total Phosphorus (TP) Target:

- 50% TP removal for influent with TP concentrations ranging from 0.15 mg/L to 0.5 mg/L and a mean particle size distribution described in Table 1.

- TSS Target:
  - 80% removal of TSS for influent with TSS concentrations ranging from 100 mg/L to 200 mg/L and a mean particle size distribution described in Table 1;
  - > 80% removal of TSS for influent with concentrations greater than 200 mg/L and a mean particle size distribution described in Table 1; and
  - < 20 mg/L of effluent TSS for influent with concentrations less than 100 mg/L and mean particle size distribution described in Table 1.

- SSC Target:
  - 80% removal of SSC for influent with SSC concentrations ranging from 100 mg/L to 200 mg/L and a mean particle size distribution described in Table 1;
  - > 80% removal of SSC for influent with concentrations greater than 200 mg/L and a mean particle size distribution described in Table 1; and
  - < 20 mg/L of effluent SSC for influent with concentrations less than 100 mg/L and mean particle size distribution described in Table 1.

The VTAP program is open to certifying devices with influent characteristics (e.g., concentration and PSD) and pollutant reduction efficiencies that differ from the cited target levels. Devices will be assigned pollutant removal efficiencies based upon the conditions under which the device was tested and the resulting verified data pursuant to the VTAP. Table 1 represents a PSD associated with typical stormwater runoff from a post-construction site.

Table 1. Typical particle size distributions from a post-construction site.

| Particle Size (microns -- μm) | Percent Sandy Loam by Mass (%) | Description |
|---|---|---|
| 1-2 | 5 | Clay |
| 2-50 | 2-8 um, 15%<br>8-50 um, 25% | Silt |
| 50-100 | 15 | Very Fine Sand |
| 100-250 | 30 | Fine Sand |
| 250-500 | 5 | Medium Sand |
| 500-1000 | 5 | Course Sand |

*Recommended density of all particles regardless of size is 2.65 g/cm$^3$

**The 8 μm diameter is the boundary between very fine silt and fine silt according to the definition of American Geophysical Union. The reference for this division/classification is: Lane, E.W., *et al.* (1947). Report of the Subcommittee on Sediment Terminology. *Transactions of the American Geophysical Union* 28(6): 936-938.

A secondary goal of the VTAP is to exhibit removal of other pollutants (e.g., sediment, nitrogen, oil/grease/hydrocarbons, metals, bacteria, etc.). Certifications for the removal of pollutants other than TP will not be granted in Virginia. The Clearinghouse, however, will provide web links to information about MTDs approved in other states.

## 2.2.1 -- Total Phosphorus (TP) Treatment

The proposed water quality regulatory criteria in Virginia's Stormwater Management Regulations (4VAC 50-60-63) are aimed at removal of Total Phosphorus (TP). The proposed criteria is essentially a load limit or no-net-increase type of standard, stating that after development, the load of phosphorus leaving the development site in stormwater runoff may not exceed 0.28 lb./acre/year. The mean Event Mean Concentration (EMC) of TP in urban/suburban runoff (influent) in Virginia is 0.26 mg/L. These criteria may provide the basis for testing for Virginia certification.

Until December 31, 2015, proponents that show a reliable 80% removal or greater of TSS or SSC using field or laboratory data (Benchmark Particle Size Distribution Sil-Co-Sil 106) will be granted a reciprocal TP credit of 25% removal (based upon existing literature) at the CUD level until field testing is performed for TP removal and device-specific results are obtained. TP removal for the **General Use Designation** will be based on the results of performance field testing of TP, not TSS or SSC data.

## 2.2.2 -- Total Suspended Solids (TSS) and Suspended Sediment Concentration (SSC) Treatment

DCR has not established water quality regulatory criteria pertaining to the removal of total suspended solids (TSS) or suspended sediment concentration (SSC) from stormwater runoff. Although MTDs are not certified for TSS or SSC in Virginia, the Clearinghouse will provide web links to information about MTDs approved for TSS or SSC in other states. In addition, TP certification at the PUD or CUD level may be awarded in Virginia for devices that have been based on TSS or SSC data if the submitted data is considered to be valid.

# 3 -- BMP Certification Designations

Use designations are based on the quality and quantity of performance data and other information that the proponent supplies. There are three use designations for manufactured treatment devices in Virginia: **Pilot Use Designation** (PUD), **Conditional Use Designation** (CUD), and **General Use Designation** (GUD). The goal for the proponent is to obtain a GUD, whereby the technology may be marketed throughout Virginia, subject to conditions that the DCR may apply as a result of the testing and assessment of the practice. The device may not be installed in Virginia unless the DCR grants it the status of PUD, CUD, or GUD.

## 3.1 -- Pilot Use Designation (PUD)

The **Pilot Use Designation** (PUD) allows limited use of devices for the purpose of collecting field performance data according to the VTAP when the performance data do not meet the standards of applying for CUD or GUD. A PUD certification for phosphorus treatment may be granted for MTDs that were tested for TSS or SSC removal in the laboratory at full-scale size using Sil-Co-Sil 106. Because devices will be assigned pollutant removal efficiencies based upon the resulting verified data, there is no specified TP, TSS, or SSC removal level required by DCR for phosphorus treatment at the PUD certification level.

The DCR's evaluators (contracted and/or internal staff) and the Clearinghouse Committee will review all PUD applications and make recommendations to the DCR. The DCR will grant a PUD certification if it believes the practice has merit and should have field performance testing conducted.

Devices with PUD certification will be listed as such in the Clearinghouse. Before installing a PUD practice in Virginia, the proponent must receive approval from the DCR for its product-specific QAPP and site-specific QAPP. The DCR may impose conditions for installations in Virginia. During the testing period, DCR will limit the number of installations of PUD devices in Virginia to a maximum of five. Testing is required at all installations in Virginia, and the proponent of the technology must notify DCR of all installation sites in Virginia.

The use of testing data collected in other states is allowed for assessment by the DCR. However, any field data to be included in the assessment process must be derived from testing sites representative of the typical urban stormwater conditions expected in Virginia (Table 2). For the assessment of the MTD, the developed QAPP for each test site outside of Virginia is needed and thus must be submitted to DCR for review and approval as a test site for certification in Virginia.

Table 2. Typical urban stormwater conditions in Virginia.

| Condition Influencing Stormwater | Conditions Found in Virginia |
|---|---|
| Precipitation | Type II Distribution<br>(Distribution obtained at NOAA Atlas 14) |
| Temperature | 26.0°F-86.1°F Long-term Monthly Average<br>44.6 °F-66.7°F Long-term Annual Average<br>(From Virginia State Climatology Office:<br>http://climate.virginia.edu/virginia_climate.htm) |
| Particle Size Distribution | Refer to Table 1 (Lane, E.W., *et al.* 1947) |

PUD certification applies for a specified testing period (typically two years), after which the practice may NOT be installed in Virginia until monitoring has been completed, and the test data are evaluated. Once the data have been evaluated, the proponent has three options: (1) submit a technical evaluation report (TER); (2) request an extension from DCR for more time to conduct additional testing; or (3) cancel the certification request. The DCR will grant extensions on a case-by-case basis but will not allow additional installations during the extension period. No additional installations are allowed until the TER is approved by DCR and a CUD or GUD is granted. Notice: at least two field test sites that represent the typical urban stormwater conditions in Virginia are needed for a CUD certification that allows up to 15 installations in Virginia. Monitoring from at least five test sites that represent the typical urban stormwater conditions in Virginia is needed to receive a GUD.

The proponent of a poor performing PUD technology must remove any device in Virginia that is deemed (by whom—DCR, OSHA, local government, permit holder?) to be a safety hazard. The proponent of a poor performing PUD technology is not required to remove the first two devices installed in Virginia but must implement its established remedial action plan as outlined in the application at these sites. Retrofits or replacements with an established BMP, to be made by the proponent, are required at all other installation sites in Virginia if testing shows poor performance.

# 3.2 -- Conditional Use Designation (CUD)

The **Conditional Use Designation** (CUD) is for MTDs that have undergone rigorous testing. Proponents of MTDs with extensively tested laboratory performance data and/or some field testing data may chose to submit a CUD application. Proponents seeking CUD certification for total phosphorus treatment should either have performance data showing TP removal or performance data showing TSS/SSC removal greater than 80%. If TSS/SSC testing was performed in the laboratory, the results must be based on full-scale size testing using Sil-Co-Sil 106. The CUD certification should be sought when data are insufficient to adequately evaluate performance claims under typical urban stormwater conditions in Virginia and/or the data were not collected in a manner consistent with the VTAP protocol.

Performance test data collected in other states are allowed by the DCR for assessment. However, any field data to be included in the assessment process must be derived from testing sites representative of the typical urban stormwater conditions in Virginia (Table 2).

The DCR's evaluators (contracted and/or internal staff) and the Clearinghouse Committee will review all CUD applications and make recommendations to the DCR. The DCR will grant a CUD certification if it believes the practice has merit and should have field performance testing conducted. The DCR grants CUD certifications based on submission of sufficient performance data, the recommendations from its evaluators and the Clearinghouse Committee, and comments received from peer reviewers. Devices with CUD certification will be listed in the Clearinghouse. Proponents of technologies not granted a CUD must request to have their device immediately considered at the PUD level (PUD review fees waived) or resubmit the application at a later date at the CUD level (and pay all associated CUD review fees).

Technologies granted a CUD certification by the DCR are allowed to be installed in Virginia while more extensive field testing occurs. Proponents of CUD technologies must submit a product-specific QAPP and site-specific QAPP for each test site and cannot begin performance testing at sites in Virginia until both QAPPs are approved.

During the testing period, DCR will limit the number of installations of CUD devices in Virginia to a maximum of 10 if the certification is based on laboratory data and a maximum of 15 if based on field data from at least two sites that represent the typical urban stormwater conditions in Virginia. Testing is not required at all installations, but the proponent of the technology must notify DCR of all installation sites in Virginia. Monitoring that documents the influent and effluent conditions must take place at the first installation site in Virginia, and the results must be provided to DCR in the status report. The performance testing site may be moved to another site at a later date if found to be more appropriate. Of the first five CUD installations in Virginia, at least one must serve as a test site (Table 3). If six to 10 CUD devices are installed in Virginia, at least two distinct field sites must be tested. If 11-15 CUD devices are installed in Virginia, at least three distinct field sites must be tested.

Table 3. The number of allowed installations and corresponding number of test sites required for manufactured treatment devices (MTDs) with a Conditional Level Designation (CUD).

| | # of Installed CUD Devices in Virginia | Minimum # of Test Sites in Virginia |
|---|---|---|
| CUD based on lab data | 1-5 | 1 |
| | 6-10 | 2 |
| CUD based on field data | 1-5 | 1 |
| | 6-10 | 2 |
| | 11-15 | 3 |

The use of testing data collected in other states is allowed for assessment by the DCR. However, any field data to be included in the assessment process must be derived from testing sites representative of the typical urban stormwater conditions in Virginia (Table 2). For the assessment of the MTD, the developed QAPP for each test site outside of Virginia is needed and thus must be submitted to DCR for review and approval as a test site for certification in Virginia.

CUD certification applies for a specified testing period (typically two years), after which the practice may not be installed in Virginia until monitoring has been completed, and the test data are evaluated. Once the data have been evaluated, the proponent has three options: (1) submit a technical evaluation report (TER); (2) request an extension from DCR for more time to conduct additional testing; or (3) cancel the certification request. The DCR will grant extensions on a case-by-case basis and reserves the right to allow or disallow for the continuation of marketing during the extension period.

The proponent of a poor performing CUD technology must remove any device in Virginia that is deemed (by whom—DCR, OSHA, local government, permit holder?) to be a safety hazard. The proponent of a poor performing CUD technology is not required to remove the first two devices installed in Virginia but must implement its established remedial action plan as outlined in the application at these sites. Retrofits or replacements with an established BMP, to be made by the proponent, are required at all other installation sites in Virginia if testing shows poor performance.

# 3.3 -- General Use Designation (GUD)

The **General Use Designation** (GUD) confers a general acceptance for the treatment device based on validated field performance claims. At a minimum, a product should have a substantial data set that verifies

- sizing for the land use type that was monitored -- specific treatment flow rate (gpm/ft$^2$ of filter media if a filtering device, or surface area of treatment chamber if a settling device) or volume capture;
- treatment performance (qualified by testing minimum and maximum influent loads, etc.);
- maintenance requirements and frequency of maintenance; and
- longevity for typical urban conditions in Virginia.

To obtain a GUD certification, field testing for TP removal is required. The testing and evaluation must conform to the requirements in the VTAP and represent application conditions expected in Virginia.

Devices seeking a GUD certification must have been field tested in at least five sites that are representative of urban stormwater conditions in Virginia. The easiest way to ensure that the testing occurs under the required conditions is to pick field test sites located in Virginia. When including test sites outside of Virginia, the proponent must show that the site will represent conditions commonly expected in Virginia (Table 2). Typical weather must be characterized by similar rainfall patterns, such as Type II rainfall. Providing storm intensity information and particle size distribution data from the proposed site will help assess how well the site represents conditions in Virginia. For the assessment of the MTD, the developed QAPP for each test site outside of Virginia is needed and thus must be submitted to DCR for review and approval as a test site for certification in Virginia.

To apply for the GUD certification, the proponent of the technology submits a GUD application, complete with QAPPs for the field test sites and TER, to the DCR. The DCR's evaluators (contracted and/or internal staff) and the Clearinghouse Committee will recommend to the DCR that a GUD certification be granted if they find the performance claims to be validated. The DCR grants GUD certifications for technologies based on submission of sufficient performance data, the recommendations from its evaluators and the Clearinghouse Committee, and comments received from peer reviewers. Proponents of technologies not granted a GUD must specify to have their device immediately considered either at the PUD or CUD level (PUD or CUD review fees waived, respectively) or resubmit the application at a later date at the GUD level (and pay all associated GUD review fees).

Devices with GUD certification will be listed as such in the Clearinghouse. Technologies with a GUD certification from the DCR may be used anywhere in Virginia, subject to conditions the DCR may apply as a result of the testing and evaluation of the practice. Technologies that receive a GUD certification have no expiration date. If at a later date, it is discovered that a GUD certified technology is not performing at the level of the approved performance claim, the practice will be removed from the Clearinghouse until revisited so that either the design criteria are improved to achieve the listed performance or the performance claim is corrected.

# 4 -- Assessment Process

The Virginia Stormwater BMP Clearinghouse will maintain a vendor list in the Clearinghouse to assist local jurisdictions in identifying stormwater technologies and products. Technologies undergoing testing to meet GUD criteria may be listed in the Clearinghouse with either a pilot use designation (PUD) or a conditional use designation (CUD). Special restrictions apply to technologies with a PUD or CUD (refer to **Section 3 -- BMP Certification Designations).**

## 4.1 -- Overview of Virginia Technology Assessment Protocol

The assessment process in Virginia, illustrated in Figure 1, begins when the proponent submits a PUD, CUD, or GUD application package to DCR (application fee applies, see Table 4). Submitted applications are reviewed for completeness, and if complete, the DCR's evaluators (contracted or internal staff) will assess the application package and propose a use designation. If recommended by the DCR's evaluators, the technical evaluation report (TER), submitted as part of the application package, will be included in the Clearinghouse for peer review and comment. The DCR's evaluators will respond to the public comments and present their recommendations to the Clearinghouse Committee. The Clearinghouse Committee will review the application package, recommendations made by DCR's evaluators, and the public comments. The Clearinghouse Committee will develop a use designation recommendation and submit it to the proponent and to the DCR. The DCR will review all recommendations and determine an appropriate use designation. Certified technologies will be included in the Clearinghouse.

Table 4. Application and review fees for manufactured treatment devices seeking certification in Virginia.

| Type of Review | Fee |
|---|---|
| Application Review | |
| PUD | $ |
| CUD | $ |
| GUD | $ |
| Product-specific QAPP Review | $ |
| Site-specific QAPP Review | $ |
| TER Review | $ |
| Re-review fee | Re-review fees are a percentage of the initial review fee. |

Technologies that do not meet the GUD criteria may be listed in the Clearinghouse as either a PUD or a CUD. Once a PUD or CUD has been awarded, the proponent must provide quarterly status reports to the DCR. Proponents of technologies with certifications at the PUD or CUD level must contract with a technical advisor (an objective outside party) to develop and submit a product-specific QAPP to the DCR. Furthermore, for each field-testing site, a site-specific QAPP will need to be developed and approved by the DCR. Even if the testing site is located outside the state of Virginia, QAPPs are required for Virginia certification. Both product-specific and site-specific QAPPs will be reviewed by DCR's evaluators (QAPP review fees apply, see Table 4); the members of the Clearinghouse Committee will have the opportunity to review and comment

on the QAPPs. DCR will review all recommendations and approve or disapprove the QAPPs. Proponents may not begin performance testing at sites in Virginia until the DCR has approved both the product-specific QAPP and the site-specific QAPP. If the either QAPP is disapproved by DCR, the proponent must modify and resubmit the plan (re-review fees apply). Once the QAPPs are approved by DCR, field performance testing in Virginia may begin.

At the end of the testing period, the proponent of a MTD with either a PUD or a CUD submits a TER to DCR. The TER is reviewed in the same manner as the initial application package (described in the first paragraph of this section) (TER review fees apply). Approved technologies will be listed in the Clearinghouse. If the TER of the field-tested technology is disapproved for the CUD or GUD, the proponent will be notified of the DCR's decision and reason for it. The proponent may respond to DCR's disapproval by requesting to conduct additional testing and/or requesting to resubmit the TER (re-review fees apply). DCR may grant this permission at its discretion.

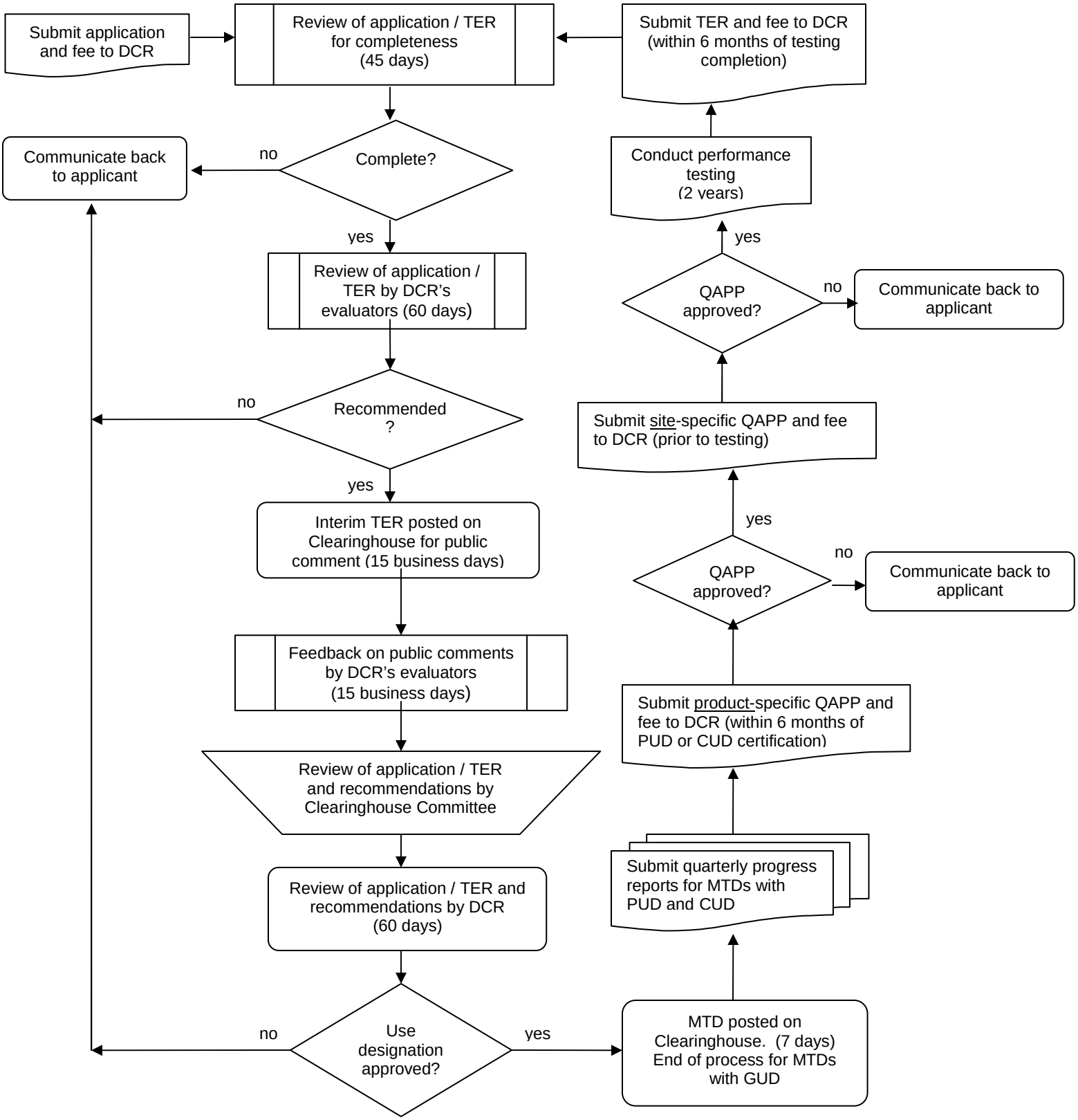


Figure 1. Flow chart illustrating the certification process in Virginia for stormwater manufactured treatment devices (MTDs).

# 4.2 -- Requesting/Revising Use Level Designations

The first step for a proponent wishing to market a manufactured treatment device in Virginia will be to amass the product information and data to determine the use designation level for which to apply. The proponent will need to ask a fundamental question:

**Does the technology have field data that represent the typical urban stormwater pollutant load and rainfall characteristics in Virginia, and do these data meet the VTAP requirements?**

To determine the answer to this question, the proponent of the technology must be familiar with the VTAP as described in this document.

The following may be helpful guidance in selecting the most appropriate use designation level for which to apply:

- Proponents of MTDs with limited laboratory performance data and no, or limited, field testing data should submit a PUD application.
- Proponents of MTDs with extensively tested laboratory performance data and/or some field testing data may chose to submit a CUD application. MTDs seeking CUD status for total phosphorus treatment should either have performance data showing TP removal or performance data showing TSS/SSC removal greater than 80% based on full-scale size testing using Sil-Co-Sil 106.
- Proponents of MTDs with field performance data that were
  (a) collected at sites representing typical urban stormwater conditions in Virginia, and
  (b) conform to the VTAP
  should submit a GUD application.
- Proponents of MTDs with field performance data that do not meet either (a) or (b) above should submit a CUD application.

Proponents seeking a technology use level designation by the DCR will need to submit an application fee (Table 4). Proponents should mail their submission to the following address:

Virginia Department of Conservation and Recreation
Stormwater Management BMP Clearinghouse
203 Governor Street, Suite 206
Richmond, VA 23219-2094
E-mail: BMPClearinghouse@dcr.virginia.edu

The application will be initially reviewed for completeness. Submit two paper copies and an electronic version (E-mail attachment or CD) to the address above. Submit two paper copies and an electronic copy of quality assurance project plans, interim status reports, requests for extensions, and other correspondences to this address as well. Additional hard copies of submittals may by requested by DCR.

For assistance, please contact:

Ved P. Malhotra, P.E.
Stormwater Compliance Engineer
Virginia Department of Conservation and Recreation
Email address: Ved.Malhotra@dcr.virginia.gov
Phone: (804) 786-1863
Fax: (804) 786-1796

# 4.3 -- Assessment Timeline

The timelines below include required deadlines in bold-type font. Failure to meet these deadlines may result in a suspension or cancellation of a designation. The remaining items provide guidelines for the amount of time expected for a given step in the process. The evaluators will review submittals as quickly as possible and will communicate with the proponent of the MTD if delays or problems arise.

## 4.3.1 -- PUD Assessment Timeline

1. PUD application package, including the TER, is reviewed for completeness – Within 45 calendar days
2. If application is complete, PUD application is reviewed by DCR's evaluators (contracted and/or internal staff) – Within 60 calendar days
3. If recommended by DCR's evaluators, interim TER is listed in the Clearinghouse for peer review – 15 business days
4. DCR's evaluators review peer comments – 15 business days
5. Clearinghouse Committee reviews application and recommendations -- The Clearinghouse Committee meets quarterly and will review applications in the order they were received. Depending on the number of applications and TERs to be reviewed, the submitted application will be assessed at the earliest possible Clearinghouse Committee meeting.
6. DCR reviews application and recommendations – Within 60 calendar days
7. Proponents of technologies not granted a PUD may resubmit an updated application at a later date (and pay all associated PUD review fees). If approved by DCR, a MTD granted a PUD is listed in the Clearinghouse – Within 7 calendar days
8. Reporting time begins once granted the PUD. **Submit quarterly progress reports to DCR on April 15th, July 15th, October 15th, and January 15th for the preceding three-month period.** Continue submitting progress reports until TER is submitted.
9. **Submit product-specific QAPP that meets the VTAP's requirements within six months of receiving the PUD.**
10. Product-specific QAPP is reviewed by DCR's evaluators – Within 60 calendar days
11. If product-specific QAPP is approved, submit site-specific QAPP amendments prior to BMP installation in Virginia.
12. Site-specific QAPP is reviewed by DCR's evaluators – Within 30 calendar days
13. If site-specific QAPP is approved, monitor field installation – two years.
14. **Submit TER that meets the VTAP's requirements within six months of completing testing. PUD certification expires 30 months from the time when testing begins.** This timeframe allows for 24 months of monitoring and 6 months for writing the TER.
15. The TER is reviewed for completeness – Within 45 calendar days
16. If TER is complete, DCR's evaluators review the TER – Within 60 calendar days
17. If recommended by DCR's evaluators, interim TER is included in the Clearinghouse for peer review – 15 business days
18. DCR's evaluators review peer comments – 15 business days
19. Clearinghouse Committee reviews TER and recommendations -- The Clearinghouse Committee meets quarterly and will review applications in the order they were received. Depending on the number of applications and TERs to be reviewed, the submitted TER will be assessed at the earliest possible Clearinghouse Committee meeting.
20. DCR reviews TER and recommendations – Within 60 calendar days

21. The DCR issues a CUD or a GUD, revokes the PUD, or allows for an extension.

Failure to submit the product-specific QAPP within 6 months of receiving a PUD results in a cancellation of the PUD and removal from the Clearinghouse. The proponent must reapply for the PUD. Proponents with a PUD have a maximum of 12 months to begin implementation of the product-specific QAPP or communicate why. Failure to submit progress reports, failure to demonstrate satisfactory progress during the testing period, or failure to submit a TER within 6 months of completion of testing risks suspension or cancellation of the PUD and possible removal from the Clearinghouse. A suspension limits the additional installations to one in Virginia during the suspension period. The DCR will remove the suspension when the proponent demonstrates satisfactory progress in completing the required component. A cancellation requires the proponent to resubmit an application for the desired use level designation.

If proponents of PUD technologies require extensions on use level designation components (QAPPs, TER), they must submit a request to the DCR at least 2 weeks before the due date. The DCR will grant extensions only if the proponent shows that progress is being made.

## 4.3.2 -- CUD Assessment Timeline

1. CUD application package, including the TER, is reviewed for completeness – Within 45 calendar days
2. If application is complete, CUD application is reviewed by DCR's evaluators (contracted and/or internal staff) – Within 60 calendar days
3. If recommended by DCR's evaluators, interim TER is listed in the Clearinghouse for peer review – 15 business days
4. DCR's evaluators review peer comments – 15 business days
5. Clearinghouse Committee reviews application and recommendations -- The Clearinghouse Committee meets quarterly and will review applications in the order they were received. Depending on the number of applications and TERs to be reviewed, the submitted application will be assessed at the earliest possible Clearinghouse Committee meeting.
6. DCR reviews application and recommendations – Within 60 calendar days
7. Proponents of technologies not granted a CUD must request to have their device immediately considered at the PUD level (PUD review fees waived) or resubmit an updated application at a later date at the CUD level (and pay all associated CUD review fees). If approved by DCR, MTDS granted a CUD are listed on the Clearinghouse – Within 7 calendar days
8. Reporting time begins once granted the CUD. **Submit quarterly progress reports to DCR on April 15th, July 15th, October 15th, and January 15th for the preceding three-month period.** Continue submitting progress reports until TER is submitted.
9. **Submit product-specific QAPP that meets the VTAP's requirements within six months of receiving the CUD.**
10. Product-specific QAPP is reviewed by DCR's evaluators – Within 60 calendar days
11. If product-specific QAPP is approved, submit site-specific QAPP amendments prior to BMP installation in Virginia.
12. Site-specific QAPP is reviewed by DCR's evaluators – Within 30 calendar days
13. If site-specific QAPP is approved, monitor field installation – two years.

14. **Submit TER that meets the VTAP's requirements within six months of completing testing. CUD certification expires 30 months from the time when testing begins.** This timeframe allows for 24 months of monitoring and 6 months for writing the TER.
15. The TER is reviewed for completeness – Within 45 calendar days
16. If TER is complete, DCR's evaluators review the TER – Within 60 calendar days
17. If recommended by DCR's evaluators, interim TER is included in the Clearinghouse for peer review – 15 business days
18. DCR's evaluators review peer comments – 15 business days
19. Clearinghouse Committee reviews TER and recommendations -- The Clearinghouse Committee meets quarterly and will review applications in the order they were received. Depending on the number of applications and TERs to be reviewed, the submitted TER will be assessed at the earliest possible Clearinghouse Committee meeting.
20. DCR reviews TER and recommendations – Within 60 calendar days
21. The DCR issues a GUD, revokes the CUD, or allows for an extension.

Failure to submit the product-specific QAPP within 6 months of receiving a CUD results in a cancellation of the CUD and removal from the Clearinghouse. The proponent must reapply for the CUD. Proponents with a CUD have a maximum of 12 months to begin implementation of the product-specific QAPP or communicate why. Failure to submit progress reports, failure to demonstrate satisfactory progress during the testing period, or failure to submit a TER within 6 months of completion of testing risks suspension or cancellation of the CUD in the Clearinghouse. A suspension limits the additional installations to one in Virginia during the suspension period. The DCR will remove the suspension when the proponent demonstrates satisfactory progress in completing the required component. A cancellation requires the proponent to resubmit an application for the desired use level designation.

If proponents of CUD technologies require extensions on use level designation components (QAPPs, TER), they must submit a request to the DCR at least 2 weeks before the due date. The DCR will grant extensions only if the proponent shows that progress is being made. The DCR reserves the right to allow or disallow for the continuation of marketing during the extension period.

## 4.3.3 -- GUD Assessment Timeline

1. GUD application package, including the TER, is reviewed for completeness -- Within 45 calendar days
2. If application is complete, GUD application is reviewed by DCR's evaluators (contracted and/or internal staff) – Within 60 calendar days
3. If recommended by DCR's evaluators, interim TER is listed in the Clearinghouse for peer review – 15 business days
4. DCR's evaluators review peer comments – 15 business days
5. Clearinghouse Committee reviews application and recommendations -- The Clearinghouse Committee meets quarterly and will review applications in the order they were received. Depending on the number of applications and TERs to be reviewed, the submitted application will be assessed at the earliest possible Clearinghouse Committee meeting.
6. DCR evaluates application package and all recommendations and issues a GUD or CUD or denies the GUD. – Within 60 calendar days
7. Proponents of technologies not granted a GUD must request to have their device immediately considered at the PUD or CUD level (PUD or CUD review fees waived,

respectively) or resubmit an updated application at a later date at the GUD level (and pay all associated GUD review fees). If approved by DCR, MTDS granted a GUD are listed in the Clearinghouse – Within 7 calendar days

# 4.4 -- Approving Quality Assurance Project Plan (QAPP)

A product-specific quality assurance project plan (QAPP) *must be submitted to DCR within six months of* obtaining a PUD or CUD and *before* initiating performance testing (review fees apply). In addition, a site-specific QAPP is needed for each field testing site (review fees apply). Development of the QAPPs should be a collaborative effort between the proponent of the device and the proponent's technical advisor. **Section 6 -- QAPP** outlines the requirements of the QAPP.

The DCR will identify evaluators to review and provide recommendations concerning approval of QAPPs, and the members of the Clearinghouse Committee will have the opportunity to review and comment on the QAPPs. DCR will make the final decision concerning QAPP approval. The proponent should not begin performance testing until both the product-specific and site-specific QAPPs are approved. Even if testing sites are located outside the state of Virginia, QAPPs are required for Virginia certification. If either the product-specific or site-specific QAPP is disapproved by DCR, the proponent must modify and resubmit the plan (re-review fees apply). Once the QAPPs are approved by DCR, field performance testing in Virginia may begin.

When a substantive change to the QAPP is warranted, the author of the plan must revise it to document the change and submit the revised plan to the DCR for approval.

# 4.5 -- Requirements of Performance Testing

A QAPP must be approved by the DCR before initiating any performance testing. Performance testing must follow the procedures outlined in the approved QAPP. Performance testing should be designed to meet all requirements of the VTAP, with the goal of obtaining the **General Use Designation**. Data used in the assessment must be derived from field testing sites of the typical urban stormwater conditions in Virginia. Proponents of PUD and CUD technologies do not have to test at all installations but must at least begin a monitoring program at the first installation in Virginia. If warranted, the proponent may move the testing site to a different location in Virginia at a later date.

# 4.6 -- Granting a Use Level Designation

The DCR grants a use level designation based on the information submitted and best professional judgment. Submitting the appropriate amount of data does not guarantee that the DCR will grant a use level designation. The DCR bases decisions on the system performance and factors that influence the performance (e.g., sizing, maintenance).

Certain restrictions apply to technologies granted a PUD or CUD (refer to **Section 3.1 – Pilot Use Designation** and **Section 3.2 – Conditional Use Designation**). The DCR may place restrictions on the use of the technologies granted a GUD.

Proponents of technologies not granted a CUD must request to have their device immediately considered at the PUD level (PUD review fees waived) or resubmit the application at a later date at the CUD level (and pay all associated CUD review fees). Likewise, proponents of technologies not granted a GUD must specify to have their device immediately considered either at the PUD or CUD level (PUD or CUD review fees waived, respectively) or resubmit the application at a later date at the GUD level (and pay all associated GUD review fees).

For approved technologies, the manufacturer shall provide design standards and specifications and operations/maintenance specifications for the technology that are consistent with the accepted research findings. This information and other qualifying information shall be provided to DCR by the proponent's technical advisor for listing in the Clearinghouse.

# 5 -- Use Level Designation Application

For efficient review of the application for a pilot use designation (PUD), conditional use designation (CUD), or general use designation (GUD), complete all required components before submitting the application to DCR. In addition to providing the information requested in this document, DCR, the Clearinghouse Committee, and/or other evaluators contracted by DCR may request additional information on a case-by-case basis.

At a minimum, an application *must* include:

- Use Designation Application Form
- Performance Claim
- Theory/Technology Description
- Remediation Action Plan
- Technical Evaluation Report
- Certification Statement

## 5.1 -- Use Designation Application Form

Complete the use designation application form in Appendix A.

- Develop a title for the technology assessment project and use this title in all submittals associated with the project (e.g., QAPP, Status Reports, Technical Evaluation Report).
- Be sure to check the desired designation level for which the technology is to be evaluated: Pilot Use Designation, Conditional Use Designation, or General Use Designation (See **Section 3 -- BMP Certification Designations**).
- If either the Pilot Use Designation or the Conditional Use Designation has been certified previously by Virginia DCR or certification has been granted in another state, the applicant shall indicate that this designation has been achieved, along with the date of approval.

## 5.2 -- Performance Claim

The performance claim will be used to evaluate the use designation. Performance claims should be objective, quantifiable, replicable, and defensible. Wherever possible, include information about anticipated performance in relation to climate, design storm and/or site conditions. Claims that are overstated should be avoided, as they may not be achievable.

Because the Virginia stormwater management (SWM) regulations focus water quality compliance criteria on reduction of total phosphorus (TP), water quality certification in Virginia is awarded only for TP removal (refer to **Section 2.2 – Stormwater Runoff Quality Control**). Thus proponents of MTDs seeking certification for runoff quality control in Virginia must include total phosphorus reduction claims.

The performance claim should include the following descriptions:

- List of pollutant constituents that will be used to evaluate performance.
- Reduction of pollutants from stormwater runoff and what those reductions are based upon (i.e., reduction of the event mean concentration (EMC) through the device's

treatment processes, reduction of runoff volume, a combination of both, etc.). See Appendix B.

- The conditions under which those reductions were achieved; e.g., the specific influent and effluent concentrations of pollutants in tests (mean/median/range), the particle size distribution of sediments in tests (entire distribution, specify $D_{50}$), the flow volumes treated versus volumes that by-passed the device, etc.
- Application limitations of technology if known to exist.
- The basis for sizing of the technology (e.g. hydraulic loading at a specific head, concentration of influent, etc.).

An example of a stormwater treatment BMP performance claim could be:

The Model X system can be used in the treatment of stormwater runoff from commercial sites. It can capture and treat the first half-inch of a 24-hour storm from a 10-acre contributing drainage area. During testing, flow rates of 100 gpm to 400 gpm were observed, with no flow being bypassed. Inflow TP concentrations ranged between 0.15 mg/L and 0.50 mg/L (mean: 0.38 mg/L, median: 0.34 mg/L), and the $D_{50}$ for the influent was 28 µm (refer to Table 1 for the entire particle size distribution). Under these conditions, an event mean concentration removal rate for total phosphorus (TP) of 60%± 5% (at a 95% confidence level) can be achieved.

Table 1. Particle size distributions for evaluating the Model X system.

| Particle Size* (microns -- µm) | Percent Sandy Loam by Mass (%) | Description |
|---|---|---|
| 1-2 | 5 | Clay |
| 2-50 | 40 | Silt |
| 50-100 | 15 | Very Fine Sand |
| 100-250 | 30 | Fine Sand |
| 250-500 | 5 | Medium Sand |
| 500-1000 | 5 | Course Sand |

*Particle density of 2.65 g/cm$^3$

# 5.3 -- Theory/Technology Description

Begin this section by listing the title of the practice and include a photograph of the BMP. Then provide a detailed description of the MTD. The description should ensure that the reader can understand completely how the technology works.

This section is to be organized in such a way that the information can be lifted from the application and included in the Clearinghouse. Thus, the application should contain as many of the elements from the list below as applicable. At a minimum, all topic headings should be addressed. The standard and specifications information for non-proprietary, post-construction BMPs listed in the Clearinghouse can be used as examples for the types of information to provide and the format to use in presenting the information (www.vwrrc.vt.edu/swc).

## 5.3.1 -- Description of Practice

Provide a detailed description of how the device works and include the purpose of the BMP:

- Summarize the underlying scientific and engineering principles for the technology. Describe the physical, chemical, or biological treatment processes.
- Describe significant modifications and technical advancements in the technology design.

- Include details on the relevant treatment mechanisms such as those in Table 5:

| Table 5. Measurements to describe for various BMP mechanisms. | |
|---|---|
| **Mechanism** | **Measurement** |
| Exchange Capacity / Sorption Capacity (dissolved pollutants) | Each medium's anion or cation exchange capacity and target pollutant's overall removal capacity indicated by isotherms (mass/mass) and breakthrough (pollutant load per volume) analyses (capturing typical range of stormwater pollutant concentrations and hydraulic loading rates). |
| Hydrocarbon Sorption | Capacity -- Pollutant mass absorbed or adsorbed per mass (mass/mass). Absorbent type -- Each medium's percent organic matter or organic carbon. |
| Gravity Separation | Detention time, length to width ratio, hydraulic loading rate for design flow, removal efficiency versus flow rate, particle size distribution, and specific gravity for each system type or size. |
| Filtration | Filter media grain size distribution, clean media hydraulic conductivity, hydraulic conductivity versus sediment loading (provide sediment grain size distribution and dry density used in analysis), provide typical and maximum operational hydraulic gradient. |
| Biological | Describe target pollutant's specific degradation mechanisms and estimated half-life versus temperature, provide estimated stormwater contact time (or detention time) for design flow, and provide target pollutant's estimated treatment efficiency versus flow rate. |

## 5.3.2 -- Performance Criteria

List the expected treatment performance capabilities. Describe the advantages of the technology compared to conventional stormwater systems providing comparable stormwater control.

## 5.3.3 -- Site Installation Requirements and Impacts

Address any and all site installation requirements and likely impacts resulting from the installation of the technology. As a guide, be sure to consider at least the following:

- Siting location -- Contributing drainage area, upstream controls (non-structural and structural), available space needed, soil characteristics, hydraulic grade requirements, hydraulic capacity, depth to water table.
- Land use – Report any utility requirements. List restrictions to installations within proximity of underground utilities, overhead wires, and hotspot land uses. Provide needed setbacks from buildings and vehicle loading allowances.
- Limitations – Consider the physical constraints to installing the BMP within karst terrain, steep terrain, flat terrain, cold climates, sites with shallow groundwater tables, linear highway sites, etc. Also include limitations associated with the BMP's weight and buoyancy, transportability, durability, energy requirements, consumable materials, etc.
- Environmental impacts – Describe likely impacts resulting from the construction, operation, and maintenance of the technology. Address community and environmental

concerns, including safety risks and liability issues, local codes, winter operation, mosquitoes, aesthetics, etc.

## 5.3.4 – Design and Sizing

Divide this section into specific subsections that adequately describe design and sizing. The use of tables can be helpful to convey information.

Show standard drawings, including a schematic of the technology and a process flow diagram. Photographs may also be useful. Describe any alternative technology configurations.

Describe the following information --

- Siting and design specifications to achieve stated performance, include:
  - Pollutants that should and could be addressed;
  - Pollutants that will not be addressed;
  - Pollutants that may be increased;
  - Range of operating conditions for the technology, including minimal, maximal, and optimal influent conditions to achieve the performance goals and standards, and for reliability of the technology;
  - Description of bypass process; and
  - Description of pretreatment and preconditioning of stormwater, if appropriate to achieve stated performance of the BMP.
- Physical description of each treatment system component:
  - Engineering plans/diagrams showing each of the functional components;
  - Equipment dimensions; and
  - Description of each component's capacity.

Provide a detailed description of the overall sizing methodology. Include a discussion of technology hydraulics and system sizing to meet performance standards and goals (e.g., to handle the water quality volume, rate of runoff, type of storm, or recharge requirements). When applicable, include the structural design, hydraulic design, soil infiltration rate testing, etc.

## 5.3.5 -- Material Specifications

When applicable, include a table that lists each construction material. For non-proprietary and patented materials, include specifications. Include raw material specifications for all non-proprietary treatment media.

## 5.3.6 -- Construction Sequence and Inspection

List the steps to construction in chronological order. Begin with protection during site construction.

## 5.3.7 -- Operation and Maintenance

Describe special operation instructions and maintenance needed to sustain performance, include:

- Preventative maintenance procedures to be implemented during the course of the field test as well as long-term maintenance;

- Personnel, supplies, replacement materials and/or parts availability (e.g., filter media) and equipment needed to operate and maintain the facility;
- Recommended maintenance schedule;
- Maintenance checklist;
- Access ports and dimensions provided to facilitate maintenance;
- Generation, handling, removal, and disposal of discharges, emissions, and waste byproducts in terms of mass balance, maintenance requirements, and cost;
- Special licensing or hauling requirements, safety issues, and access requirements associated with operation or maintenance of the technology; and
- Projected operational and maintenance (O&M) costs.

## 5.3.8 – System Longevity

Assuming the device is designed, installed, and maintained correctly, what is the expected life of the BMP? In addition list factors that cause it to not perform as designed:

- Describe circumstances where the technology can add, transform, or release accumulated pollutants?
- If applicable, does the filter medium decompose or is it subject to slime/bacteria growth?
- How is underperformance diagnosed and treated?
- What is the warranty?
- What initial/ongoing user support is provided?
- Does the vendor charge for support?

## 5.3.9 -- References

List any sources of published information, including Websites, cited in the theory/technology description section. List sources alphabetically. Follow the formatting used for the following citation examples:


ASTM International. 2006. Standard Guide for Selection, Installation and Maintenance of Plants for Green Roof Systems. Standard E2400-06. ASTM International, West Conshohocken, PA. Available online: http://www.astm.org/Standards/E2400.htm (accessed October 22, 2008).

Gowland, D. and T. Younos. 2008. Feasibility of Rainwater Harvesting BMP for Stormwater Management. Special Report SR38-2008. Virginia Water Resources Research Center, Blacksburg, VA. Available online: http://www.vwrrc.vt.edu/special_reports.html (accessed October 22, 2008).

Schueler, T. 2008. Technical Support for the Baywide Runoff Reduction Method. Chesapeake Stormwater Network, Baltimore, MD. Available online: www.chesapeakestormwater.net (accessed October 22, 2008).

Schueler, T., D. Hirschman, M. Novotney and J. Zielinski. 2007. Urban Stormwater Retrofit Practices Manual 3: Urban Subwatershed Restoration Manual Series. Center for Watershed Protection, Ellicott City, MD. Available online: http://www.cwp.org/Store/usrm.htm (accessed October 22, 2008).

### 5.3.10 -- Appendices

Include any additional information requested by the evaluators in appendices.

## 5.4 -- Remediation Action Plan

Include a generic remediation action plan that specifies what actions will be taken by the proponent if the device is found to perform at a substandard level.

## 5.5 -- Technical Evaluation Report

A Technical Evaluation Report (TER) should be submitted as part of the application once laboratory and/or field testing have been completed. A TER is required for technologies seeking a PUD, CUD or GUD certification. Information about developing the TER is described in **Section 8 -- Technical Evaluation Report.**

## 5.6 -- Certification

Include both the signature of a company representative and date of certification. Use the following certification statement:

> "I certify that all information submitted is true and correct. The information was accumulated using approved methods specified in the Virginia Technology Assessment Protocol, unless otherwise noted. I understand that any misrepresentation or misuse of information will result in immediate denial of the technology being demonstrated and may prohibit me or the company I represent from seeking future approvals."

# Appendix A

## Use Designation Application Form
## For Manufactured Treatment Devices

Complete the following form for each technology seeking a use designation certification in Virginia and submit an electronic version and two paper copies of the completed form as part of the application package. Insert additional columns and rows as needed.

Project Title:

MTD Name: Today's Date:

## 1 Basic Product Information

**Proponent**
Company name:
Address: Street City State Zip

**Proponent Contact**
Name (to whom questions should be addressed):
Address: Street City State Zip
Phone number:
Fax number:
E-mail address:

**Technical Advisor**
Name:
Address: Street City State Zip
Phone number:
Fax number:
E-mail address:

**Manufactured Treatment Device**
MTD model serial #:
MTD common (marketing) name:
Specific size/capacity of MTD model:

## 2 Use Designation Currently Sought (check only one)

☐ Pilot Use (PUD)
☐ Conditional Use (CUD)
☐ General Use (GUD)

## 3 Certification Request (check all that apply)

☐ Stormwater Runoff Volume Reduction
☐ Stormwater Runoff Peak Rate Control
☐ Stormwater Runoff Quality Control (Total Phosphorus)

## 4 Treatment Pollutants (check all that apply)

☐ Total Phosphorous
* Although certification in Virginia is only granted for total phosphorus, check pollutants for which MTD is designed to treat.
☐ Floatables/trash
☐ Sediment
☐ Nitrogen
☐ Bacteria
☐ Oil & grease
☐ Heavy metals
☐ Organic toxicants

☐ Other (describe):

**Use Designation Application Form for Manufactured Treatment Devices (MTDs)** **Page 2**

Project Title:

MTD Name: Today's Date:

## 5 Warranty Information (describe or attach details)

## 6 BMP History

How long has this specific model been on the market?

List other applications of this exact model/size and location of this application:

## 7 Device Intended Application (check all that apply)

☐ Pre-treatment for downgradient BMP
☐ Water quality treatment
☐ Flood control
☐ Channel protection
☐ Other:

## 8 Basis for Treatment (check one and fill in blanks)

☐ **Volume-based** (captures & treats Water Quality Volume [WQV]) – Specify WQV: cubic feet
☐ **Flow rate-based** (provides treatment up to a set rate of flow) – Specify treatment flow rates and hydrologic methods used. Specify the flow rates that are treated and provide documentation:
- ☐ i. All flows up to the year, 24-hour storm event.
- ☐ ii. Peak flows associated with water quality storm event ( inches of rainfall; cfs)
- ☐ iii. Other (specify):

If flow rate-based system, can MTD treat without flush-out/resuspension/scouring.
- ☐ Yes (Provide validating documentation); specify design features to prevent resuspension of captured particles/pollutants:
- ☐ No. If no, explain why:

☐ **Other** (describe):

## 9 Water Quality Treatment Mechanisms (check all that apply and provide brief description)

☐ Sedimentation/settling:
☐ Infiltration:
☐ Filtration (specify filter media):
☐ Adsorption/cation exchange:
☐ Chelation/precipitation:
☐ Chemical treatment:

☐ Biological uptake:
☐ Other (describe):

Project Title:

MTD Name: Today's Date:

## 10 Design Features of Interest (answer each of the following questions.)

Pre-treatment/removal of larger particles achieved via which of the following?
☐ No pre-treatment
☐ Internal settling/sedimentation chamber
☐ Upgradient (separate) settling/sedimentation device
☐ Other (describe):

By-pass/diversion of larger flows (not designed for treatment) via which of the following?
☐ Internal by-pass for larger flows
☐ Upgradient flow splitter used to divert water quality storm to device
☐ Other (describe):

## 11 Independent Performance Certification (check all that apply)

Has the device been "certified or performance verified" by any of the organizations below?
☐ **No** (skip to next question)
☐ **Yes**; Continue below and include date of certification.

- ☐ **Virginia DCR**
  - ☐ PUD (date awarded: )
  - ☐ CUD (date awarded: )
- ☐ **State Agency** (list):
  - ☐ Approved (date awarded: )
  - ☐ Performance certified (date certified: )
  - ☐ Status pending
  - ☐ Other (explain):
- ☐ **TARP** (CA, MA, MD, NJ, PA, VA, IL only) –
  - ☐ Approved:
    - ☐ Tier I (date awarded: )
    - ☐ Tier II (date awarded: )
    - ☐ Tier III (date awarded: )
  - ☐ Performance verified
  - ☐ Other (explain):
- ☐ **TAPE** (WA State only)
  - ☐ Approved:
    - ☐ PLD - Pilot Level Designation (date awarded: )
    - ☐ CUD - Conditional Use Designation (date awarded: )
    - ☐ GULD - General Use Level Designation (date awarded: )
  - ☐ Performance Certified (date certified: )
  - ☐ Status pending
  - ☐ Other (explain):
- ☐ **NJCAT** (NJ)
  - ☐ Interim Certification (date awarded: )
  - ☐ Final Certification (date awarded: )
- ☐ **Other** (provide documentation of testing protocol, status of device and results of testing):

Project Title:

MTD Name: Today's Date:

## 12 Vendor-initiated Performance Testing (check all that apply):

Has the device been tested and it's performance reported?

☐ **Laboratory Tested**
- ☐ Manufacturer (directly tested)
- ☐ Contractor retained by manufacturer
- ☐ Tested by third party (e.g., not associated or tied financially to manufacturer)

☐ **Field Tested**
- ☐ Manufacturer (directly tested)
- ☐ Contractor retained by manufacturer
- ☐ Tested by third party (e.g., not associated or tied financially to manufacturer)

## 13 Results of Vendor-initiated Performance Testing

Has the MTD been tested for pollutants of concern? (Check all that apply)

☐ **Phosphorous**; please provide lab or field results in the TER. Removal rates for phosphorus based upon measured:
- ☐ Total Phosphorus (TP)
- ☐ Particulate Phosphorus (PP)
- ☐ Soluble Phosphorus (SP)
  - ☐ Soluble Reactive Phosphorus (SRP)
  - ☐ Soluble Unreactive Phosphorus (SUP)
    - ☐ Check here if reported % removal, load reduction, and/or effluent concentrations are provided over a range of influent concentrations, and list the range of influent concentrations

Although certification in Virginia is only granted for total phosphorus, check all pollutants for which MTD has been tested.

☐ **Sediment**; please provide lab or field results in TER.

Removal rates for sediment based upon:
- ☐ Total Suspended Solids (TSS)
- ☐ Suspended Sediment Concentration (SSC)
  - ☐ Check here if reported % removal, load reduction, and/or effluent concentrations are provided over a range of influent concentrations, and list the range of influent concentrations

☐ **Nitrogen**; please briefly describe.
- ☐ Check here if reported % removal, load reduction, and/or effluent concentrations are provided over a range of influent concentrations, and list the range of influent concentrations

☐ **Oil/Grease**; please briefly describe.
- ☐ Check here if reported % removal, load reduction, and/or effluent concentrations are provided over a range of influent concentrations, and list the range of influent concentrations

☐ **Heavy metals**; please briefly describe.
- ☐ Check here if reported % removal, load reduction, and/or effluent concentrations are provided over a range of influent concentrations, and list the range of influent concentrations

☐ **Bacteria**; please briefly describe.
- ☐ Check here if reported % removal, load reduction, and/or effluent concentrations are provided over a range of influent concentrations, and list the range of influent concentrations

☐ **Organic toxicants**; please briefly describe.
- ☐ Check here if reported % removal, load reduction, and/or effluent concentrations are provided over a range of influent concentrations, and list the range of influent concentrations

☐ **Other**; please briefly describe.
- ☐ Check here if reported % removal, load reduction, and/or effluent concentrations are provided over a range of influent concentrations, and list the range of influent concentrations

Project Title:

MTD Name: Today's Date:

## 14 Particle Size Distribution (PSD)

If laboratory test results are included in the TER and TSS/SSC results are reported, was Sil-Co-Sil 106 used in the test runs?

☐ Yes
☐ No. If no, explain what was used instead:

What method and equipment were used to determine PSD?

Provide average PSD for field test sites in the tables below. Please create additional tables as needed.

| Description | Particle Size in microns (μm) | Percent by mass (%) [Sandy Loam] | | | | | Particle Density (Specific Gravity, g/cm3) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Site 1 | Site 2 | Site 3 | Site 4 | Site 5 | Site 1 | Site 2 | Site 3 | Site 4 | Site 5 |
| Clay | 1-2 | | | | | | | | | | |
| Silt | 2-8<br>8-50 | | | | | | | | | | |
| Very Fine Sand | 50-100 | | | | | | | | | | |
| Fine Sand | 100-250 | | | | | | | | | | |
| Medium Sand | 250-500 | | | | | | | | | | |
| Course Sand | 500-1000 | | | | | | | | | | |

| Description | Particle Size in microns (μm) | Percent by mass (%) [Sandy Loam] | | | | | Particle Density (Specific Gravity, g/cm3) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Site 6 | Site 7 | Site 8 | Site 9 | Site 10 | Site 6 | Site 7 | Site 8 | Site 9 | Site 10 |
| Clay | 1-2 | | | | | | | | | | |
| Silt | 2-8<br>8-50 | | | | | | | | | | |
| Very Fine Sand | 50-100 | | | | | | | | | | |
| Fine Sand | 100-250 | | | | | | | | | | |
| Medium Sand | 250-500 | | | | | | | | | | |
| Course Sand | 500-1000 | | | | | | | | | | |

Project Title:

MTD Name: Today's Date:

Describe/document how and why the PSD used for testing deviates from the recommended PSD presented below:

| Description | Particle Size in microns (µm) | Percent by mass (%) [Sandy Loam] | Recommended Particle Density (Specific Gravity, g/cm3) |
|---|---|---|---|
| Clay | 1-2 | 5 | 2.65 |
| Silt | 2-50 | 2-8 µm, 15%*<br>8-50 µm, 25% | 2.65 |
| Very Fine Sand | 50-100 | 15 | 2.65 |
| Fine Sand | 100-250 | 30 | 2.65 |
| Medium Sand | 250-500 | 5 | 2.65 |
| Course Sand | 500-1000 | 5 | 2.65 |

## 15 Maintenance Considerations (check all that apply and briefly explain maintenance procedures/standards)

What is the generic inspection and maintenance plan/procedure? (attach necessary documents):

Is there a maintenance track record/history that can be documented?
☐ No, no track record.
☐ Yes, track record exists; (provide list of local or regional devices currently in use and maintenance track record info)

What is the expected maintenance frequency, per year?
i. Total life expectancy of device and/or media (if relevant):
ii. For media or amendments functioning based on cation exchange or adsorption, how long will the media last before breakthrough (indicator capacity is nearly reached) occurs?:

Maintenance contract offered by:
☐ Vendor
☐ Other commercial entities (Provide names and contact info):

Is the maintenance procedure and/or are materials/components proprietary?
☐ Yes, proprietary;
- ☐ Device lends itself to competitive bidding for maintenance
- ☐ Recourse / options exist if the vendor goes out of business

☐ No, not proprietary;
- Are local certified contractors available?
  - ☐ Yes; provide a list with contact information.
  - ☐ No; local contactors are not available
- Does the device lend itself to competitive bidding for maintenance?
  - ☐ Yes; provide a list of local, certified, maintenance companies and their contact information.
  - ☐ No, local competitive bidding not possible because only one maintenance company certified locally.

Project Title:

MTD Name: Today's Date:

Maintenance complexity (Check all that apply):

☐ Confined space training required for maintenance
☐ Liquid pumping and transportation
    Specify method:
    Specify certified disposal locations:
☐ Solids removal and disposal
    Specify method:
    Specify certified disposal locations:
☐ Hazardous waste disposal
    Specify method:
    Specify certified disposal locations:

Other noteworthy maintenance parameter? (describe):

# Appendix B

# Treatment Efficiency Calculation Methods

Slightly modified from Center for Watershed Protection's

Tool 8: BMP Performance Verification Checklist Appendices

www.cwp.org/postconstruction (Accessed April 15, 2009)

# Treatment Efficiency Calculation Methods

The pollutant removal efficiency of a BMP refers to the pollutant reduction that is achieved by comparing the influent and effluent of a BMP or treatment train. Pollutant reduction can be determined on either a concentration or load/mass basis and is typically expressed as a percentage.

*Concentration-based methods* use the ratio of pollutant concentrations or event mean concentrations (EMCs) at the outflow to pollutant concentrations or EMCs at the inflow as the basis for calculating BMP efficiency. As a general rule, concentration-based methods often result in slightly lower performance efficiencies than mass-based methods. This may be attributed to the fact that BMPs that reduce runoff volume are also reducing pollutant loads, but a concentration-in versus concentration-out study does not account for water losses that occur through infiltration and evapotranspiration, or storage within the BMP. For this reason, the pollutant removal efficiency of these types of BMPs may be under-reported using concentration-based methods.

*Mass-based methods* use pollutant loads as the basis for calculating BMP efficiency. Pollutant load is the total amount of a pollutant conveyed over a specified duration. The pollutant loading from a given storm can be estimated using pollutant EMCs and flow data. Mass-based methods are influenced by the volume of water entering the BMP and water losses within the BMP (e.g., evapotranspiration and infiltration), so they are more accurate for BMPs that reduce runoff volume (Winer 2000).

The Efficiency Ratio method and the Summation of Loads methods are recommended for use by ASCE and EPA (2002) and DCR. Use of either method should be supplemented with an appropriate statistical test indicating if the differences in mean EMCs between the outflow and inflow are statistically significant.

| Methods to Estimate BMP Efficiency (from Center for Watershed Protection 2008; compiled from ASCE and USEPA 2002) | | | |
|---|---|---|---|
| **Method** | **Type of Method** | **Formula** | **Comments** |
| **Efficiency Ratio (ER)** | **Concentration** | $ER = 1 - \frac{Average\ outlet\ EMC}{Average\ inlet\ EMC}$<br><br>Where the EMC = $\frac{\sum_{j=1}^{n} CiVi}{\sum_{j=1}^{n} Vi}$<br><br>Where: *Ci* = event inflow concentration; *Vi* = event inflow volume | • Most useful when loads are directly proportional to the storm volume.<br>• Weights EMCs from all storms equally.<br>• The accuracy varies with BMP type.<br>• Minimizes impacts of smaller/cleaner storms on performance calculations.<br>• Can apply log normalization to avoid equal weighting of events. |
| **Summation of Loads (SOL)** | **Mass** | $SOL = \frac{sum\ of\ outlet\ loads}{sum\ of\ inlet\ loads}$<br><br>Where the Load = C*i*V*i*<br><br>*Ci = average concentration within period i; Vi = volume of flow during period i* | • Loads are calculated using concentration and flow volume and are summed for the number of events measured.<br>• A small number of large storms can significantly influence results.<br>• Removal of material is most relevant over entire period of analysis<br>• Uses a mass balance approach.<br>• Effluent concentration may still be high despite high removal efficiency |