

## **Inspection and Maintenance Guidance for Manufactured BMPs**

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### **Abstract**

ASCE/EWRI has assembled a Task Committee on guidelines for certification of manufactured stormwater BMPs. A nine-member subcommittee for maintenance was tasked by the larger committee to develop maintenance guidelines for manufactured stormwater BMPs. The subcommittee has developed recommendations for manufactured BMP maintenance in the following seven areas: (1) designing for maintenance, (2) defining standard maintenance triggers, (3) defining maintenance fundamentals for all manufactured BMPs, (4) defining maintenance tasks by BMP design; hydrodynamic or filter design, (5) identifying entities best able to maintain manufactured BMPs, and training requirements, (6) identifying entities to train maintenance providers, and (7) reviewing recommended disposal techniques for captured pollutants.

### **Subcommittee Composition and Methods**

Representation on the subcommittee was diverse. Serving on the subcommittee were representatives of manufactured BMP vendors (Hans DeBruijn of Terre Hill Stormwater Systems, Scott Perry of Imbrium Systems Corporation, and Mark Miller of AquaShield, Inc.), a designer (Gordon England of Stormwater Solutions, Inc.), academics (George Guo of Rutgers University, William Hunt of North Carolina State University, and Omid Mosheni of the University of Minnesota), a regulator (Richard Gee of Montgomery County, MD), and a maintenance protocol trainer (William Lord of North Carolina Cooperative Extension). The subcommittee was chaired by Dr. William F. Hunt. The principal decisions were made at a meeting held in Raleigh, NC, on December 10, 2007, and were based on several presentations, prior group email correspondence and a day-long discussion.

### **Maintenance Guidance**

Maintenance guidance was divided into seven categories: (1) designing for maintenance, (2) defining standard maintenance triggers, (3) defining maintenance fundamentals for all manufactured BMPs, (4) defining maintenance tasks by BMP design; hydrodynamic or filter design, (5) identifying entities best able to maintain

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manufactured BMPs, and training requirements, (6) identifying entities to train maintenance providers, and (7) reviewing recommended disposal techniques for captured pollutants.. Each is discussed below. All recommendations provided were the consensus of the meeting participants.

### Designing for Maintenance

To more effectively maintain any stormwater practice, including manufactured BMPs, the designer must consider the maintenance needs in the design of the BMP. Seven specific design recommendations, specifically relating to maintenance, were decided upon.

1. Vacuum trucks for cleaning BMPs are heavy trucks. A roadway designed for H<sub>2</sub>O loadings should be provided giving access (including any turn arounds) to a manufactured BMP.
2. The BMPs must be structurally designed for vertical and horizontal H<sub>2</sub>O loadings.
3. The boom of a typical vacuum truck can only reach 5 m (15 feet). The BMP should be located within 5 m (15 feet) of the access road.
4. The access road should enable a vacuum truck to reach the BMP site under its own power.

There should be easy access to all internal components and spaces of a BMP to facilitate long term cleaning, inspections, and repairs. It had been noted that many chambers within the BMPs were either not accessible or very difficult to access. Being able to visually inspect components of the BMP must be factored into the design. (Figure 1)



**Figure 1.** Manual access to every chamber of a manufactured BMP was deemed critical. (Photo courtesy of Richard Gee, Montgomery County, MD.)

5. It is recommended that access manholes have a nominal 75 cm (30 inch) diameter to facilitate cleaning and confined space entry. Not just the person(s) conducting maintenance need to “fit” through the hole, but all appurtenances such as hoses and booms. Filter boxes and certain hydrodynamic devices may require larger openings, as some components may not be able to fit through a nominal 75 cm (30 inch) diameter hole. At a minimum, a high pressure spray washer operated by a person or remotely should be able to reach all device surfaces to remove collected detritus.
6. The BMPs in roadways should be located so that one lane of traffic can remain open during cleaning and maintenance operations (Figure 2).



**Figure 2.** Locating manufactured BMPs in the roadway is sometimes an only alternative. It is essential, however, that traffic can be directed around the facility while it is being maintained. If possible, designers are urged to find a location that provides relatively easy access. (Photo courtesy of Dr. Qizhong (George) Guo, Rutgers University)

#### Maintenance Trigger

The group recognized that when the BMP is given to the property owner/ manager, the BMP must be essentially clean. It is the responsibility of the installer or contractor to leave the BMP in a clean state. After a clean BMP has been accepted by the maintenance authority, inspections should be made quarterly for one year to determine the appropriate cleanout intervals.

Cleanout operations will be triggered by any one of or combination of four circumstances:

1. A regularly scheduled cleanout interval pre-determined by the manufacturer.
2. Sediment accumulations reach the depth recommended by the manufacturer for cleaning. The appropriate depth of sediment determination should be facilitated by a mark or object placed in the BMP. This indication should be readily visible under low light conditions.
3. In filter devices the water drawdown time exceeds the drawdown time recommended by the manufacturer. An easily readable plaque should be placed inside the BMP indicating the recommended drawdown time.
4. In a filter BMP, the life expectancy of the filter media reaches the time period recommended by the manufacturer. Filter media often functions to remove pollutants based on more than just filtration (i.e. ion exchange, in which case maintenance requirements can not be dictated by visual appearance), therefore life expectancy and maintenance intervals should be pre-established to ensure performance.

It was noted that the time intervals and expense of BMP cleaning can be reduced by providing upstream pretreatment of gross solids. Removal of pollutants by a pre-treatment device, however, only shifts the burden of maintenance to a device further upstream. The total expense of maintaining a system of BMPs may or may not be less if pre-treatment is used.

#### Maintenance Fundamentals

The group discussed whether there were maintenance fundamentals that were associated with all manufactured BMPs. The alternative was that every practice was too unique for a set of across-the-board guidelines to be recommended. There were three “fundamentals” that were agreed upon.

1. It was agreed that a maintenance regulator should strongly consider creating a database listing the BMPs, their locations, cleanout dates, masses removed<sup>2</sup>, and appropriate comments for a given jurisdiction. This database would be used to schedule cleanout events. Forms should be generated and given to maintenance personnel to document cleanout activities. Tracking cleanout activities assures compliance with NPDES and TMDL requirements and allocations. The committee recognized that not every NPDES community would have the resources to dedicate to accomplish this task, though it is strongly recommended
2. A sample cleanout form will be proposed within the following year by the subcommittee.
3. The BMP manufacturer should provide an operations and maintenance manual giving thorough instructions for cleaning and maintenance of their BMP.

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<sup>2</sup> Masses removed are in both liquid and solid forms. The solid mass is the most tangible component that identifies pollutant load reduction, and it would serve a jurisdiction to verify the weight and character of the mass for reporting and credits. This method, when properly administrated, will enable the permit issuer to report the total reduction in pollutants in a region. On the other hand lax reporting reveals potential absence of maintenance.

4. The BMP cleaner should provide before and after maintenance photographs of the BMP, which can be included as part of the clean out form and added into a regulator's database.

#### Separating Hydrodynamic and Filter-based BMPs

The committee reached consensus that hydrodynamic devices and filter devices do require distinctly different cleaning operations. Hydrodynamic devices may be maintained by a functionality inspection per the manufacturer's recommendation, vacuuming the sedimentation vaults, cleaning any screens, removing accumulated oils and greases.

Some of the maintenance tasks associated with filter devices for removal of pollutants from the overall structure are similar to hydrodynamic devices, but there are an added layer of maintenance activities associated with the filter media and the associated cartridges. Filter devices are maintained by a functionality inspection per the manufacturer's recommendation, vacuuming accumulated sediments vaults, replacing or cleaning of filter cartridges or filter media, and cleaning of any drawdown pipes. Additional lifting equipment may be required to remove and/or replace filter components.

#### Responsible Party to Conduct Maintenance

There was a substantial discussion on who is best able to conduct maintenance. A corollary question was whether there should be a training/certification for professionals/firms that conduct maintenance manufactured BMPs

The group decided that BMP maintenance and cleaning should be carried out by either properly trained municipal personnel or properly trained maintenance contractors. "Properly trained" personnel are expected to be able to demonstrate their ability to carry out certain basic functions such as:

1. Showing an understanding of the operation of the BMP
2. Vacuum truck capability
3. Any special requirements of a specific BMP
4. Proper material disposal
5. Certification by the State environmental protection department to deal with disposal similarly to what is required for disposal of septic waste, trash, and residual municipal sewage sludge.
6. Documentation of cleanout with pictures submitted to regulator, owner and added into database

It was also strongly recommended that all trained personnel who conduct manufactured BMP inspection and maintenance have confined space entry training (Figure 3).





**Figure 3.** All personnel who conduct maintenance on manufactured BMPs should have completed confined space training. (Photo courtesy of Scott Perry, Imbrium)

#### Training Responsibility

The subcommittee recommended that BMP specific training should be provided by the BMP manufacturer. In the absence of training firms, detailed maintenance manuals specific to the BMP be maintained must be provided by the BMP manufacturer.



**Figure 4.** Harvested materials (in this case from a Delaware Style Sand Filter) must be disposed of in a safe manner. Placement in the appropriate type of landfill is recommended. (Photo courtesy of William Hunt, NC State University.)

### Disposal of Wastes

The proper disposal technique(s) for accumulated gross solids/ pollutants was discussed (Figure 4).

Due to the high variability of pollutant loadings within drainage basins, there exists a potential for high concentrations of various pollutants within the BMPs. Therefore it was recommended that all materials removed from a BMP should be disposed of in a properly permitted landfill in accordance with applicable local or state guidelines. The committee did not come to consensus as to whether the prospective waste material should be tested for pollutant concentrations.

### **Conclusions**

As part of an ASCE/EWRI Task Committee to develop guidelines for certification of manufactured stormwater BMPs, a nine-member subcommittee for maintenance was tasked to develop maintenance guidelines associated with manufactured stormwater BMPs. The subcommittee has developed recommendations that pertain to manufactured BMP maintenance in the following seven areas: (1) designing for maintenance, (2) defining standard maintenance triggers, (3) defining maintenance fundamentals for all manufactured BMPs, (4) defining maintenance tasks by BMP design; hydrodynamic or filter design, (5) identifying entities best able to maintain manufactured BMPs, and training requirements, (6) identifying entities to train maintenance providers, and (7) reviewing recommended disposal techniques for captured pollutants.