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# 3 BMP Screening Tool and Considerations

Selecting the best option for stormwater treatment can be a perplexing and arduous process, especially for those who do not deal with the selection of stormwater treatment on a regular basis. The objective of this document is to provide principles, information and a BMP Screening Tool to enable users with stormwater system responsibilities to make better decisions for optimal treatment. Other chapters sections in this document discuss operating costs, expected life of a treatment option, performance over time, and maintenance requirements. This chapter focuses on a BMP Screening Tool devised to streamline the selection of current products and practices used in the industry today. It compares user needs with systems that meet those needs.

The BMP Screening Tool contains 17 treatment system components based on the document, *Critical Assessment of Stormwater Treatment and Control Selection Issues*, which was generated by the Water Environment Research Foundation (WERF 2005). The tool enhances user access to summaries and data from verification databases, refereed journal articles, and vendor information, and describes the capabilities and application limits for each BMP. Through summaries and links, the BMP Screening Tool drives users to external data and information that fit the input criteria. The expectation for the BMP Screening Tool should not be for a single ideal treatment option, but for a winnowing process that narrows the field of possible options.

USEPA has developed a BMP Siting Tool USEPA Siting Tool, which identifies suitable locations or areas for implementing various BMPs or low impact development (LID) techniques. As of the publication of this document, EPA no longer has the resources to update and maintain the siting tool.

Although regulations are an important consideration in the selection process, an assessment of BMPs relative to regulatory criteria is not included in this process. Regulations vary widely from place to place and may include guidance identifying preferred methods and treatment options, or restrictions for specific options, such as the use of infiltration only. Standards may dictate efficiency, site conditions or storm input parameters for use in the BMP Screening Tool. Anyone considering stormwater treatment and hoping to find optimal treatment options should know and understand the state and local standards and regulatory requirements. See https://www.epa.gov/npdes/npdes-stormwater-program for information about local regulatory requirements.

## 3.1 Information Needed to Use the BMP Screening Tool

It is important when selecting a BMP to determine the land use type, soil type, the pollutants to be controlled, topography, receiving waters, and drainage area. ITRC surveyed ITRC states in early 2017. Responses to this survey identified specific pollutants and site characteristics as important to their stormwater program (Figure 3-1).

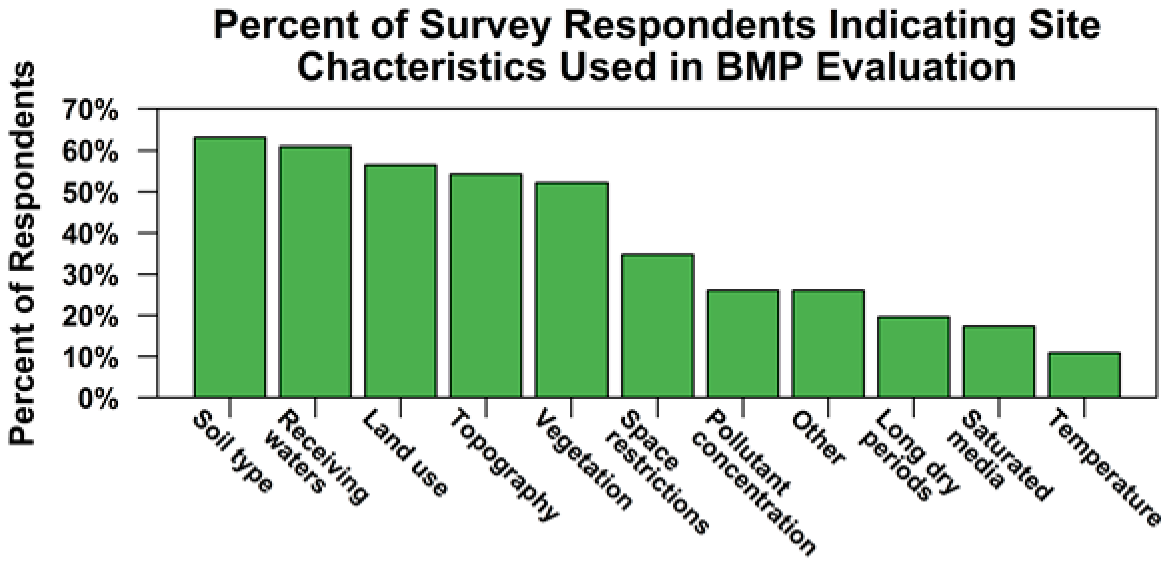


**Figure 3-1. Site characteristics important to the state, local and regional authorities surveyed in 2016. See Question 2 in Appendix A for additional details.**

Land use represents the economic and cultural activities (e.g., agricultural, residential, commercial, and industrial, mining and recreational uses) practiced at a location. Designers must determine the land use prior to the selection of a BMP since land use will influence scope and activity. Current and future land use is influenced by geographic factors, which may control or regulate the mitigation of pollutants of potential concern. Examples of land uses include agricultural, residential, commercial and light and heavy industrial. Land use affects, but does not solely determine, the pollutants and runoff rates and quantity. For instance, in an area with agricultural land use, it may be a good practice to include vegetative buffers to capture the nitrate and phosphate contaminants typically found in fertilizer runoff and prevent those contaminates from entering the watershed.

Additional tools that may assist users with understanding the site characteristics in Figure 3-1:

- USEPA National Stormwater Calculator
- National Land Cover Database (NLCD)
- USDA Soils Soil Survey Geographic Database (SSURGO) Dataset
- USEPA Water Quality and Total Maximum Daily Loads (TMDL) Assessments
- National Hydrography Dataset (NHD)

Land use and soil type largely dictates the pollutants in stormwater. Users must carefully evaluate the types of activities in the drainage area and determine the pollutants most likely entrained in the stormwater. BMPs have drastically different removal effectiveness for various pollutants. Perhaps the most important factor in choosing the proper control technology is determining the pollutants that require removal. Ideally, local monitoring data will be available for the specific area to verify the presence of the pollutants. Unfortunately sufficient data are seldom available for specific areas, so designers and engineers must generally rely upon reference sources, which indicate the types of pollutants often discharged from various activity types. Stormwater monitoring data can be quite variable for different storm events from the same location so designers and engineers should use it in conjunction with source types and not solely rely upon them when determining likely pollutants.

Many times, selection of pollutants of concern depends on the receiving waters and not just the land use. There can be occasions where a site does not require a significant level of treatment based on the land use, but may require a greater level of treatment due to limitations in the receiving water such as a TMDL. Topography determines how big a drainage basin may be, the detention time within the basin for the maximum storm flow to arrive at the treatment BMP, and where designers and engineers can locate new treatment BMPs.

Successful deployment of any BMP depends on due consideration for all of these elements. Should an incorrect determination be made of any of the elements, it is possible to significantly compromise effective removal of pollutants, or the designer may select more costly options to treat for pollutants that are not present at levels of concern.

## 3.2 General Description of BMPs

Engineers, landscape architects and other practitioners use BMPs to mitigate adverse impacts of stormwater runoff pollutants as a result of land development. BMPs include a variety of activities that can manage stormwater pollutants through source control, designed pollution prevention systems, and treatment BMPs. BMPs, when used individually or in combination, can reduce the discharge of pollutants into the environment.

Source control BMPs reduce or eliminate the transport of pollutants from site activities by keeping the pollutant source away from rainfall and runoff, thus reducing or eliminating the pollutant from ever entering into the stormwater discharge. Source control includes a very broad spectrum of activities including spill prevention, sweeping and covering potential pollutant sources with roofs or tarps.

Responsible parties (e.g., owners, facility managers) should follow source practices for all activities that have the potential to pollute, such as vehicle fueling and maintenance and outdoor material equipment storage, handling and disposal. Post-construction pollution prevention BMPs are permanent features that are designed and built into a development or redevelopment project to reduce pollution discharges after construction completion. Designers use these features to minimize runoff, maximize infiltration and reduce erosion. Examples of post-construction pollution prevention BMPs include:

- Biofiltration Systems
- Infiltration Areas and Devices
- Detention Devices
- Solids Removal Devices
- Media Filters
- Multi-Chamber Treatment Trains

## 3.3 BMP Screening Tool and Procedures

The primary purpose of this BMP Screening Tool is to drive the user to existing information on removal of stormwater pollutants from runoff treatment BMPs. BMPs include schedules of activities, prohibitions of practices, maintenance procedures, managerial practices, or structural features that prevent or reduce adverse impacts to surface and ground waters. This project focuses on structural features such as ponds, swales, ditches, and manufactured treatment devices (MTDs).

The BMP screening tool first identifies types of BMPs that are capable of treating certain pollutants and second, provides the user with information on the treatment efficiency, installation requirements, and maintenance issues for each of the BMPs.

There are two specific audiences for this report: regulatory agencies (e.g., state, county, and city) and design engineers. Each audience needs to know what pollutants an individual BMP can remove from stormwater, and how well it removes the pollutant. Regulatory agencies may use this information to create a list of approved BMPs for their jurisdiction. Design engineers may use this information, plus additional information on land use, climate and other site-specific information to select the appropriate BMP for a single use.

The tool can help identify a subset of BMPs from the included list of BMPs that are potentially suitable for the selected pollutants. The initial refinement process reduces the number of potential stormwater treatment unit processes for a site to those that have information showing they can treat a selected pollutant. The tool also allows secondary screening using additional criteria such as whether the BMP is appropriate for arid conditions. Once a user obtains the short list, they can acquire further information on the unit process from a linked information sheet that contains the following:

- A description of the BMP
- A quick description of the pollutants treated by the BMP
- Common names for the BMP
- Information on the BMP’s removal effectiveness
- Information on where the user can find additional monitoring studies showing removal effectiveness
- Links to design criteria in existing stormwater management manuals, construction guidance, and operation and maintenance information

These information sheets should not be used as design or maintenance criteria. These information sheets are part of, and not considered independent of, this guidance.

Significant available guidance on BMP design is available nationwide, including by local jurisdictions, states, USEPA, and professional organizations. For example, the American Society of Civil Engineers (ASCE) recently published *Design of Urban Stormwater Controls* documenting the state of the practice on this subject (WEF 2012), and USEPA provides a number of resources through its Green Infrastructure (GI) website (USEPA 2018). Readers are encouraged to reference these types of focused and comprehensive guidance prior to commencing on such projects, as it is not the intention of this document to exhaustively cover such topics in detail, but rather to provide a cursory overview of the related considerations as they relate to BMP performance.

The tool begins by grouping stormwater BMPs into separate components reflecting their basic method of treating stormwater. For example, surface filters and grassed swales are in one group, and media filters and bioretention are in a separate group. BMPs are grouped by their physiochemical treatment method, which means that each of the BMPs in a group will treat the same list of pollutants to the same relative level.

Within each of the groups is a rough evaluation of their ability to treat a list of pollutants. The evaluation grades the BMP's capability of removing the pollutant based on existing monitoring data and the engineering judgment of the team members. For each combination of BMP and pollutant, the team members make a yes/no determination of treatment capability. They base this determination initially on existing monitoring data (field and laboratory). If insufficient data is available for this determination, the developers look for information on similar BMPs that could indicate treatment capabilities. They next look at the method of treatment for a BMP and determine if this process could remove the pollutant (e.g., filtration BMPs can remove solid particles). Lastly, they use engineering judgement if a combination of BMP and pollutant has no other available information.

This evaluation greatly simplifies the ideal process of pollutant treatment. The BMP Screening Tool assumes that the BMP is working alone and discharging to surface waters. The tool does not differentiate between differing levels of pollutant removal by a given BMPs. For example, if one BMP can achieve a removal of 10% of a pollutant, and another can achieve 90% removal, the tool displays "Yes" for both BMPs in the pollutant removal category. The information sheets provide additional information on the level of treatment that can be expected from any BMP.

The removal efficiency decision considers both percentage of pollutant removal and the load reduction capability of the BMP (based on flow and effluent concentration). For cases where the influent concentration is quite high, the percent removal could also be high, but the effluent concentration may still be above allowable levels. Thus, treatment with respect to both cases is important. We include infiltration as one of the BMPs in the tool. This assumes runoff volume reduction, and subsequently a reduction in pollutant load.

As an example, assume a designer has a project site where total suspended solids (TSS), dissolved copper, and total phosphorus are the pollutants that must be removed. The designer can run the tool and reduce the number of potential BMPs for the site from the original 17 to a more manageable Six BMP types. To further reduce the list, the user can add secondary screening criteria of "Will the BMP experience arid conditions?"- and end up with four BMPs. The designer can now click on one of the filtered BMPs and see the information sheet with additional detail on the removal efficiency of the BMP, design criteria from various state stormwater guidance manuals, installation information, and operations and maintenance requirements.

Alternatively, a reviewing agency may receive a stormwater design proposing use of an unfamiliar BMP. The reviewer can use the tool to select the information sheet for the BMP and learn how well it works, where it is accepted, and easily find more information on design criteria, installation and maintenance.

## 3.4 Data Evaluation and Local Application

Once performance data have been collected and made available for a BMP, whether it is a manufactured BMP, GI, or a traditional land-based practice, there are common principles that designers should apply when evaluating the BMP for regulatory compliance. This section describes some of the key considerations and questions to ask in determining whether a particular BMP is suitable for local use.

Obtaining credible data is often the first step in evaluating whether a particular BMP is suitable for local use. With data in hand, local program managers and reviewers must decide if the data addresses local pollutants of concern, apply appropriate sizing criteria, and determine what level of pollutant removal to assign to the BMP. One of the most effective ways to ensure a consistent process is applied to all BMPs within a given program is to establish a written policy on submission requirements. This policy can offer guidance for BMPs to be considered for approval and can produce a published list of BMPs meeting those criteria. Consistent implementation will be a key factor in order to eliminate concerns about potential bias or unfair treatment.

### 3.4.1 Data Quality

One of the most critical decisions in evaluating any stormwater BMP is deciding if the available performance data is of sufficient quality to justify approving the use of the BMP. Researchers consider data collected as part of the established evaluation programs, such as the Washington Department of Ecology's TAPE program and the NJDEP's laboratory protocols (2.3.1 & 2.3.2). These are state of the art and recognize the usefulness of the data across North America and beyond. Engineers generally consider data collected in accordance with industry-recognized protocols to be of high quality and reliable for use in making informed regulatory decisions.

When data is available, but researchers did not collect it in accordance with recognized protocols and processes, it is important to evaluate the method by which data was collected, the amount of data that was collected, and whether or not the data is independent or collected by the entity representing the BMP. Researchers should make an effort to compare data collected using non-established protocols or methods against well-known and respected industry protocols. Some key points to consider include:

- How much data are available?

For field data, long-term studies are preferred. Recognized protocols typically call for sampling 12 or more qualified events over the course of a year or more to establish long-term performance expectations TAPE Protocol. If samples are available from only a small number of storm events, then the data may not be sufficient to estimate long-term BMP performance.

Researchers have not debated and agreed upon the appropriate amount of laboratory data needed to make informed regulatory decisions to the extent that field data has. Laboratory data should span the typical range of flow/operating rates for the BMP.

- Did the researchers use recognized methods to collect the data?

Whether lab or field, it is important to consider the methods used to collect and analyze the data in any given study since methodology can influence results. Are they the same or similar to those in well-established protocols? If not, the methods applied may have a greater potential to influence the results, so additional scrutiny should be applied.

- Are the data independent?

Ideally, researchers should provide independently collected data in support of a BMP approval decision as opposed to data collected by a manufacturer or other entity representing a specific BMP. Reviewers should provide additional scrutiny when no independent data is available.

### 3.4.2 BMP Sizing

Designers typically assign flow through BMPs a generic maximum allowable hydraulic loading rate that the water quality event must not exceed. This rate is typically expressed as gpm/ft$^2$ of settling surface for sedimentation devices or as gpm/ft$^2$ of filtration surface area for filtration devices. Monitoring data supports limiting flow-through practices to a maximum hydraulic loading rate. It is crucial to limit the maximum flow to the tested rate to ensure the BMP performs similarly to the tested configuration. Once a jurisdiction assigns the generic flow rate, designers can scale most BMPs to treat different size drainage areas as long as the designer maintains an approved hydraulic loading rate and critical geometries.

Assigning an appropriate design hydraulic loading rate to a BMP is partially dependent on whether the designer utilizes lab or field data, the level of pollutant removal desired, and other local policies specific to BMP evaluation and sizing. At a minimum, the supporting test results should show that they achieved the assigned hydraulic loading rate during the testing. Since field-testing represents long-term performance it is common practice to assign a hydraulic loading rate based on the peak rate achieved during the study. This may only occur once or twice during the course of the study since the water quality event is a relatively infrequent occurrence. Researchers should not assign hydraulic loading rates to BMPs that exceed the rates supported by the data.

When using laboratory data to evaluate a BMP, it is common to assign the maximum hydraulic loading rate, where the BMP was able to meet the pollutant reduction goals identified by the protocol. If no pollution reduction goals were in place, or the agency wishes to target a different level of pollutant reduction, you can utilize the hydraulic load rate at which a BMP achieves that removal rate. Note that some agencies opt to create a weighted average performance, based on the results of lab testing at different loading rates. This is a net annual approach often tied to local rainfall intensity distributions. This is a more complicated approach and, if utilized, it is important that the jurisdiction establishes a clear and consistent process.

### 3.4.3 Assigning Pollutant Removal Credit

BMP performance is oftentimes highly variable, so researchers base pollutant removal credit for a given BMP on the assumption that performance at future installations will be similar to the results achieved during performance monitoring. It is common to round down performance results to the closest whole number. For example, test results showing 80.4% removal would be reported as 80%. It is also common to assign BMPs generic ratings based on local regulatory requirements. For example, if the local criteria require 80% TSS removal, those BMPs capable of >80% TSS removal are approved for use as a treatment BMP. Similarly, the jurisdiction may assign MTDs with lower TSS removal results to a pretreatment category. When multiple studies for the same BMP are available, users could assign an average removal assuming the research derived all of the data from the same BMP configuration, and sizing is consistent for each.

Whatever approach used to assign pollutant removal criteria, it is important that the supporting performance data justifies the assigned credit and that the approved sizing be consistent with the sizing of the tested configuration. When performance data that were collected in accordance with a credible protocol are available, end users should feel comfortable using that information to assign pollutant removal credit to the BMP.

## 3.5 Design Plans and Specs

The BMP Screening Tool allows for a streamlined identification of current products and practices used in the industry today, with the goal of assisting final BMP design. Proper BMP selection is critical to ensure protection of water quality; however, equally as critical is the communication with the personnel installing the design itself. Detailed drawings and specifications, and the associated contractual obligations, are required to ensure correct installation of selected BMPs so they may perform as designed.

Design drawings and specifications should include information required by a contractor to properly install the BMPs (see Section 4.6.1), with sufficient detail to minimize misinterpretation of installation expectations. Standard specifications (e.g., Department of Transportation (DOT), company specific specifications) may be sufficient for some design aspects but designers should always incorporate site-specifics modifications. For vendor-specific BMPs, designers must incorporate technology-specific installation expectations, typically available from the manufacturer, into the design documents.

Clear expectations identified in the design package allow for proper BMP installation and performance, along with clear contractual obligations for the installation contractor. The following section discusses contractual obligations, along with considerations for the installation process.

## 3.6 Other Considerations

**StormWater Management Facilities near Airport Operations Areas (AOAs):** Standing bodies of water and the associated vegetative communities can attract wildlife that may present a hazard to aircraft (14 CFR 139.337(a)). If a designer situates the stormwater BMP less than 10,000 feet from an airport serving turbine-powered aircraft (or 5,000 feet for piston-driven aircraft), current federal regulations require incorporation of certain criteria into the design, installation, operation and maintenance of a stormwater BMP (14 CFR 139.337(a)).

BMPs near AOAs should drain quickly so that standing water does not attract wildlife, especially birds. Stormwater detention basins should drain completely within 48 hours to reduce attractiveness to wildlife. Steep-sided slopes along with narrow, linearly shaped water detention basins or watercourses will reduce attraction of the stormwater BMP to potentially hazardous wildlife. If expanses of open water persist, designers should employ physical barriers, such as bird balls, wire grids, or netting, to minimize access of potentially hazardous wildlife to the BMP. Physical barriers must not impede water rescue activities. States or local jurisdictions may have regulations governing the installation of some types of physical barriers on wetlands. Managing vegetation in or around water detention basins or along watercourses can reduce hazardous wildlife, especially birds. If soil conditions and other requirements allow, designers should prefer use of underground stormwater BMPs near AOAs since they may be less attractive to wildlife. Some stormwater BMPs are not likely to attract potentially hazardous wildlife, such as underground or properly maintained artificial channels.

If a designer wishes to situate a stormwater BMP within the proscribed distance from an AOA, then they should consult that airport's management during the design phase of the project, before approval of the construction project. Consultation with a qualified airport wildlife biologist is important. Airport management must approve measures to minimize the BMP's attractiveness to hazardous wildlife. For certain stormwater BMPs this may require approval from the local Federal Aviation Administration (FAA) Regional Airports Division Office.

**Public Health and Safety:** As with any design considerations, safety must be incorporated into every aspect of the design, installation and operating process. When designing the BMP, safety should be considered for construction workers, maintenance personnel and the public throughout the life of the BMP. Federal government, states, municipalities and local safety regulations must be considered for BMP safety. ASCE has developed the Public Safety Guidance for Urban Stormwater Facilities document as a resource for stormwater facility safety (Jones 2013).