

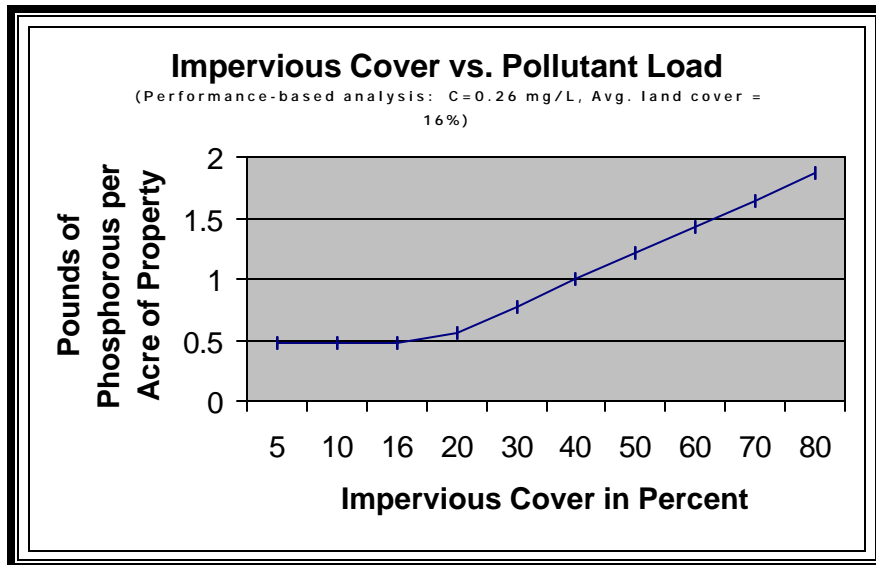
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Virginia Department of Conservation and Recreation – Water Quality Criteria

Performance and Technology-based Approaches to Water Quality Assessment

The Virginia Stormwater Management Regulations (SWMR) now reference both a performance-based and a technology-based criterion for water quality assessment. The performance-based criteria, based on the Simple Method (Refer to **Chapter 5-10** of the Stormwater Management Handbook), has been in use for the purposes of pollutant calculations and BMP implementation as required by the Chesapeake Bay Preservation Act (CBPA). The technology-based method, based on the simplistic approach of implementing what is considered to be the most appropriate Best Management Practice (BMP), or technology, for the specific development conditions, has been in use as basic compliance with the SWMR. The 1998 amendments to the SWMR have enhanced the technology approach so as to provide detailed specifications and design features necessary to promote BMPs which are more easily maintainable and more functional in the long-term. The result is a dual water quality criterion which allows for innovation in complying with the CBPA and the SWMR.

The performance-based approach is a simplistic method for associating pollutant loads with the percentage of impervious cover, based on a given pollutant loading concentration. The method assumes the amount of runoff, and the corresponding pollutant loads, are directly proportional to the degree of impervious cover. BMPs with given pollutant removal efficiencies are applied to the site to reduce post-development loads to pre-development levels associated with an average land cover condition, or default. (The reader is encouraged to refer to **Chapter 5-10** of the SWM Handbook for additional discussion of the criteria.)



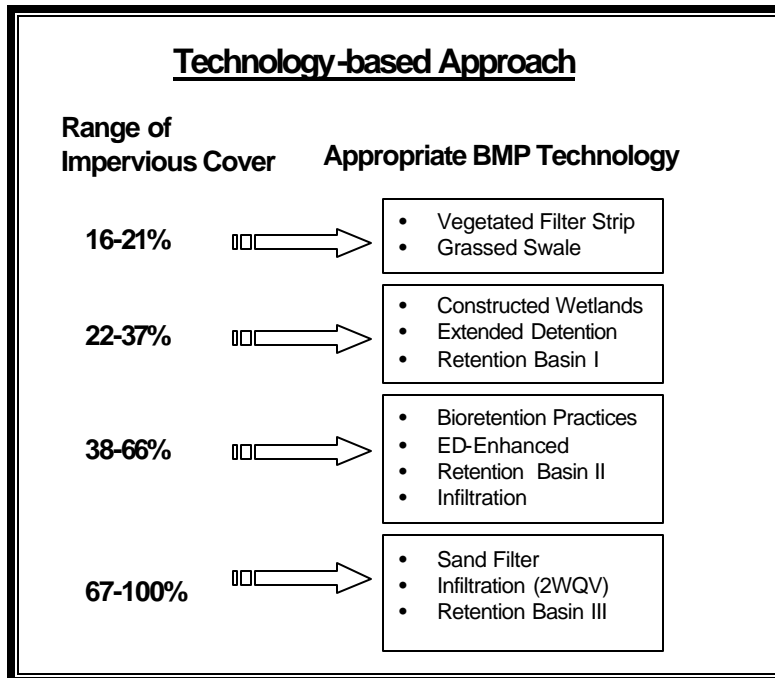
The technology-based approach is an option whereby the designer, based on the characteristics of the site (drainage area size, total impervious cover, engineering constraints, etc.), selects a BMP which is the most technologically appropriate solution to reduce post-development pollutant load.

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The detailed BMP standards and specifications referenced in the Virginia SWM Handbook are required elements necessary to achieve the referenced target pollutant removal efficiency. The intent is to shift the focus of BMP selection and design from debates over a few percentage points worth of pollutant removal efficiency to a new focus on the application of the most appropriate treatment technology for the site.

This approach assumes that the designer will apply sound engineering principles and specifications to the site design will do everything practicable to reduce the pollutant loads through site design enhancements and configuration. The technology-based criteria is most applicable in situations where the percentage of impervious cover is high such that multiple BMPs in series would be necessary to achieve the total pollutant load reduction required by the performance-based criteria. Inherent in the technology-based approach is the recognition that the application of BMPs in series will often yield little additional pollutant removal benefits (due to redundant removal pathways which target the same pollutants) versus a properly designed and maintained primary BMP with design enhancements, such as pretreatment of the runoff, and a minimization of loads generated on the site.



There are some limitations to the application of the technology-based approach. This method may not provide the most appropriate water quality assessment in situations such as the following:

- Multiple drainage areas on a site (not individually treated by the technology approach);
 - When multiple BMPs are employed to obtain compliance with a Regional (watershed-wide) Stormwater Analyses;

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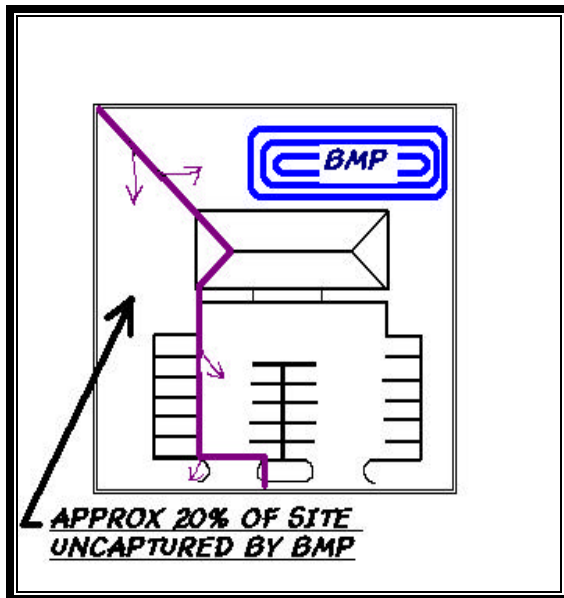
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- Sites which include: buffer equivalency calculations, redevelopment, subdivided parcels, etc.

In such instances, the performance-based approach should be employed.

The goal of providing two technical criterion for water quality assessment is to encourage localities to allow reasonable adjustments to BMP efficiencies in order to provide some latitude for a well-thought out BMP plan. An unintended result is that some designers may examine the results of each method and then select the one which is least restrictive for the development being analyzed. While the two methods will generally provide similar overall results and likewise a similar degree of water-quality protection, there may be cases where the results of such a comparison will favor one method over the other. In general, the performance-based method arrives at the result through an analytical, pollutant load and removal efficiency calculation process, and the technology-based method arrives at the result through a detailed set of specifications for Best Management Practices suited for the specific physical characteristics of the site.

The following example problem provides comparative insight as to the proper interaction and application of the two methods.



- **Situation:** A 3-Acre new development site will be developing from the 16% average land cover condition (assumed) to a 60% impervious cover condition. Only 80% (approximately) of the total site area can be easily captured within the proposed BMP system.

- **Goal:** Compare the Effectiveness of Performance vs. Technology-based approach

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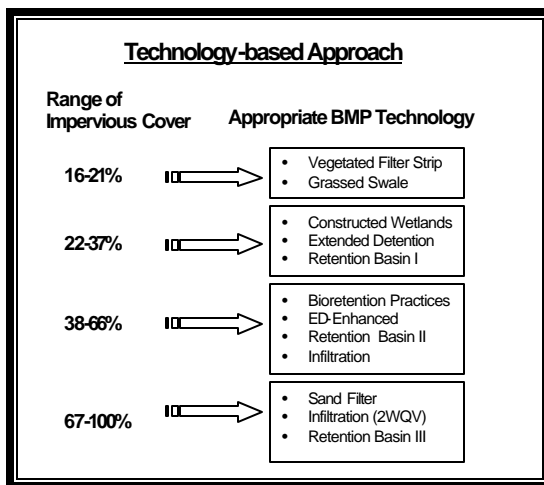
Performance Based Approach

(Pollutant loading calculations)

Under the performance based approach, we calculate the pre and post-development loads based on the assumed pre-development impervious cover equal to the average land cover (in this case 16%), and the actual post-development impervious cover.

The calculated required BMP removal efficiency is approximately **67%**.

Technology based approach



•From the technology chart, for a 60% impervious site, we would select from BMPs in the 3rd category (50% efficient) - **Bioretention basin through Infiltration.**

•In this Example - we select infiltration (1 * WQV) or a similar BMP based on given site constraints.

BMP Design

- Through the performance-based approach, we would be required to install either a single BMP or a series of BMPs to achieve a net 67% removal rate.
- Through the Technology-based approach, we select an infiltration measure for the primary BMP. As this BMP is approximately 50% efficient, and is treating approximately 80% of the site area, we have a net 40% pollutant removal. Guidance in this matter states that we should provide a secondary BMP of some kind to treat the portion of the site which is not captured by the primary BMP, so it does not run off unchecked.

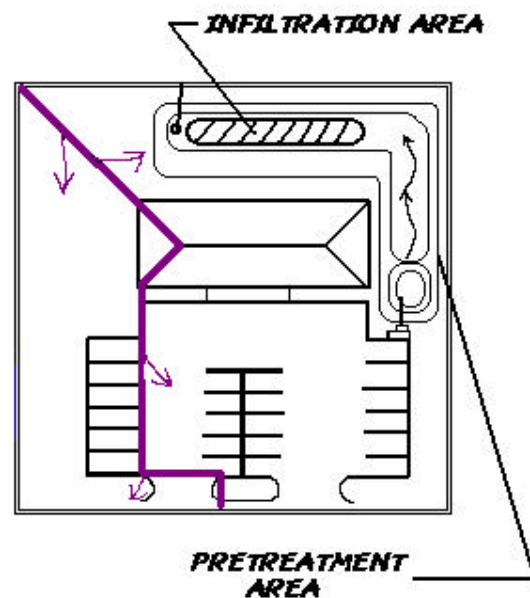
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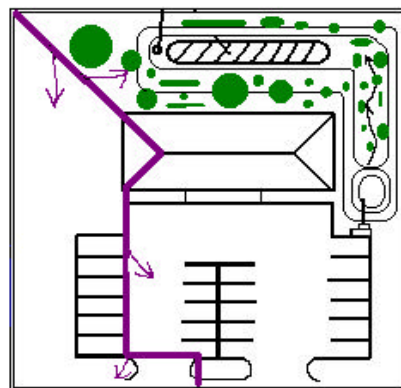
Question: How do we rectify this apparent discrepancy between the performance-based approach and the technology-based approach (67% removal required vs. 40% removal affected) ?

Answer: Sound technical specifications. The BMP standards and specifications for an infiltration BMP (an infiltration BMP is mentioned here in keeping with the above example, however, the same can be applied to any number of different BMPs) require that pretreatment measures, a landscape plan for the site and BMP buffer areas, and possibly a second BMP treating the remaining 20% be provided. The application of all these design features and enhancements will typically generate a BMP plan sufficient to meet the performance-based requirements.

Pretreatment: Pretreatment is a necessary facet of most BMP plans. It helps to ensure long-term functionality of a BMP, assists in lowering maintenance costs, and generally increases their effectiveness in removing pollutants. In this case we provide a sediment forebay/marsh area near the discharge point, coupled with a meandered trapezoidal grassed swale with check dams. Under the technology-based approach, such pretreatment measures are required outright. Under the performance-based approach, a credit for additional pollutant removal for the grassed swale and forebay/ marsh is provided.



Landscaping: A landscape plan is an integral component of a BMP Plan. Not only does landscape assist with aesthetic concerns, a properly designed and maintained landscape plan can increase pollutant removal efficiency. In this example we have provided some vegetation in mulched landscape beds in the BMP pretreatment area, which will also provide some limited biofiltration capacity. We have also provided mulched landscape beds behind the proposed structure to filter the runoff, and remove larger particulate matter prior to entry into

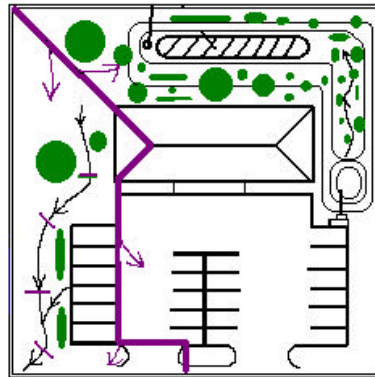


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the basin. Whereas such a landscape plan is again, required outright under the Technology-based approach, the designer could claim additional pollutant removal benefits in the form of a limited filter strip, or biofiltration under the performance approach.

Additional Treatment: As stated previously, areas not captured by the primary BMP should not go untreated. A secondary BMP in the form of additional landscaping and a grassed swale with check dam has been provided in the smaller drainage area. While such additional treatment is required outright by the Technology approach, the designer could claim credit for additional treatment affected through this BMP.



Summary

- The technology-based approach is a simpler approach to traditional BMP selection, but is accompanied by stringent standards to promote high quality Best Management Practices.
- The technology-based approach requires that adequate technology be placed on the site to provide a level of treatment consistent with the density of the development.
- The intention of the technology based standard is to implement sound site and BMP designs based on the most appropriate technology.
- The local program administrator can require pretreatment and landscaping either through the multiple BMP requirements necessary to accomplish the required load reductions, or through the technology-based approach as a technical component of an efficient BMP design.
- The performance-based removal efficiencies for water quality BMPs can be marginally adjusted for very good designs which incorporate pollutant removal enhancement features such as sediment forebays, baffle systems to prevent short-circuiting, additional extended detention features, aquatic benches, micropools, etc. Likewise, the technology-based approach implements a BMP as a starting point with similar enhancement features required in order to provide the target removal efficiency.