Chapter 5 Comprehensive Stormwater Management: Non-Structural BMPs

5.1 Introduction

The terms “Low Impact Development” and “Conservation Design” refer to an environmentally sensitive approach to site development and stormwater management that minimizes the effect of development on water, land and air. This chapter emphasizes the integration of site design and planning techniques that preserve natural systems and hydrologic functions on a site through the use of Non-Structural BMPs. Non-Structural BMP deployment is not a singular, prescriptive design standard but a combination of practices that can result in a variety of environmental and financial benefits. Reliance on Non-Structural BMPs encourages the treatment, infiltration, evaporation, and transpiration of precipitation close to where it falls while helping to maintain a more natural and functional landscape. The BMPs described in this chapter preserve open space and working lands, protect natural systems, and incorporate existing site features such as wetlands and stream corridors to manage stormwater at its source. Some BMPs also focus on clustering and concentrating development, minimizing disturbed areas, and reducing the size of impervious areas. Appropriate use of Non-Structural BMPs will reflect the ten “Principles” presented in the Foreword to this manual, and will be an outcome of applying the procedures described in Chapter 4.

From a developer’s perspective, these practices can reduce land clearing and grading costs, reduce infrastructure costs, reduce stormwater management costs, and increase community marketability and property values. Blending these BMPs into development plans can contribute to desirability of a community, environmental health and quality of life for its residents. Longer term, they sustain their stormwater management capacity with reduced operation and maintenance demands.

Conventional land development frequently results in extensive site clearing, where existing vegetation is destroyed, and the existing soil is disturbed, manipulated, and compacted. All of this activity significantly affects stormwater quantity and quality. These conventional land development practices often fail to recognize that the natural vegetative cover, the soil mantle, and the topographic form of the land are integral parts of the water resources system that need to be conserved and kept in balance, even as land development continues to occur.

As described in Chapter 4, identifying a site’s natural resources and evaluating their values and functional importance is the first step in addressing the impact of stormwater generated from land development. Where they already exist on a proposed development site, these natural resources should be conserved and utilized as a part of the stormwater management solution. The term “green infrastructure” is often used to characterize the role of these natural system elements in preventing stormwater generation, infiltrating stormwater once it’s created, and then conveying and removing pollutants from stormwater flows. Many vegetation and soil-based structural BMPs are in fact “natural structures” that perform the functions of more “structural” systems (e.g., porous pavement with recharge beds). Because some of these “natural structures” can be designed and engineered, they are discussed in Chapter 6 as structural BMPs.

5.2 Non-Structural Best Management Practices

This Manual differentiates BMPs based on Non-Structural (Chapter 5) and Structural (Chapter 6) designations. Non-Structural BMPs take the form of broader planning and design approaches – even principles and policies – which are less “structural” in their form, although non-structural BMPs do have

very important physical ramifications. An excellent example would be “reducing imperviousness” (see BMPs 5.9 and 5.10 below) by reducing road width and/or reducing parking ratios. In this way, a proposed building program can be accommodated but with reduced stormwater generation. These non-structural BMPs can be applied over an entire site and are not fixed and designed at one location. Virtually all of the Non-Structural BMPs set forth in this Chapter of the manual share this kind of site-wide policy characteristic. Structural BMPs, on the other hand, are decidedly more locationally specific and explicit in their physical form.

Sometimes called Low Impact Development or Conservation Design techniques, Non-Structural BMPs are not always markedly different from Structural BMPs. In fact, some of the BMPs described in Chapter 6, such as Vegetated Swales and Vegetated Filter Strips, are largely based in natural systems and are intended to function as they would have prior to disturbance. Nevertheless, such BMPs can be thought of as natural structures, which are designed to mitigate any number of stormwater impacts: peak rates, total runoff volumes, infiltration and recharge volumes, non-point source water quality loadings and temperature increases.

Perhaps the most defining distinction for the Non-Structural BMPs set forth in this chapter is their ability to prevent stormwater generation and not just mitigate stormwater-related impacts once these problems have been generated. Prevention can be achieved by developing land in ways other than through use of standard or conventional development practices. Prevention and Non-Structural BMPs go hand in hand and can be contrasted with Structural BMPs that provide mitigation of those stormwater impacts, which cannot be prevented and/or avoided.

Several major “areas” of preventive Non-Structural BMPs have been identified in this manual:

Protect Sensitive and Special Value Features
Cluster and Concentrate
Minimize Disturbance and Minimize Maintenance
Reduce Impervious Cover
Disconnect/Distribute/Decentralize
Source Control

More specific Non-Structural BMPs have been identified for each of these generalized areas to better define and improve implementation of each of these areas. This list of specific BMPs will be refined and expanded as these stormwater management practices become more common throughout Pennsylvania.

A uniform format has been developed for the BMPs presented in Chapters 5 and 6 of this manual. It provides as many engineering details as possible, facilitated through diagrams, graphics and pictures. There are constant tradeoffs that must be made between providing a more complete explanation for the countless variations which can be expected to emerge across the state versus the need to be concise and user friendly.
The uniform format has been applied to all of the Non-Structural BMPs included in Chapter 5, to encourage recognition that these Non-Structural techniques are every bit as essential as the techniques presented in Chapter 6 Structural BMPs.

One of the most challenging technical issues considered in this manual involves the selection of BMPs that have a high degree of NPS reduction or removal efficiency. In the ideal, a BMP should be selected that has a proven NPS pollutant removal efficiency for all pollutants of importance, especially those that are critical in a specific watershed (as defined by a TMDL or

other process). Both Non-Structural BMPs in Chapter 5 and Structural BMPs in Chapter 6 are rated in terms of their anticipated pollutant removal performance or effectiveness. The initial BMP selection process analyzes the final site plan and estimates the potential NPS load, using Appendix A. The targeted reduction percentage for representative pollutants (such as 85% reduction in TSS and TP load and 50% reduction in the solute load) is achieved by a suitable combination of Non-Structural and Structural BMPs. This process is described in more detail in Chapter 8.

5.3 Non-Structural BMPs and Stormwater Methodological Issues

The methodological approach set forth in Chapter 8 provides a variety of straightforward and conservative ways to take credit for applying Non-Structural BMPs, provided that the "specifications" defined for each BMP in Chapter 5 are properly followed.

Because so many of the Non-Structural BMPs seem so removed from the conventional practice of stormwater engineering, putting these BMPs into play may be a challenge. Many of these Non-Structural BMPs ultimately require a more sophisticated approach to total site design. Some of the Non-Structural BMPs don't easily lend themselves to stormwater calculations as conventionally performed. How do we get stormwater credit for applying any of these techniques? Taking BMPs 5.6.1 and 5.6.2 again as examples, minimizing impervious cover by reducing road width or impervious parking area directly translates into reduced stormwater volumes and reduced stormwater rates of runoff. Site planners and designers will also recognize that many of the other Non-Structural BMPs, such as clustering of uses, conserving existing woodlands and other vegetative cover, and disconnecting impervious area runoff flows, all translate into reduced stormwater volume and rate calculations. As such, these BMPs are self-crediting.