Article 143

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Stormwater Retrofits: Tools for Watershed Enhancement

Improving aquatic habitat, water quality, and biodiversity within impacted urban streams and rivers are objectives for watershed managers. Stormwater retrofitting is just one available watershed restoration tool. Stormwater retrofits are a series of structural stormwater practices designed to mitigate erosive flows, reduce pollutants in stormwater runoff, and promote conditions for improved aquatic habitat.

Other watershed restoration tools that restore stream habitat and stabilize stream banks are necessary and important for watershed restoration, but without establishing a stable, predictable hydrologic water regime, these tools may not be effective. Erosive conditions and damaging frequent stormwater flows will remain. To successfully improve a stream's overall aquatic health, stormwater retrofitting is a watershed manager's most reliable tool.

Recent efforts in Maryland have identified methods for locating, designing, and constructing retrofits in urban watersheds. Scouting for retrofit sites requires a sound understanding of how, where and which stormwater practices are appropriate for particular situations. This requires an understanding of urban streams, hydrology and stream morphology, and an ability to envision possibilities for enhancement. It is also helpful to have an imaginative approach when attempting to identify appropriate alternatives. Six examples of urban retrofits are identified in Table 1. These retrofits must be adopted to varying site-specific conditions but represent the most common options for urban retrofitting.

Table 1: Retrofit Examples

- Retrofit existing older stormwater management facilities (detention ponds)
- Construct new stormwater practices at upstream end of road culverts
- Construct new stormwater practices at storm drainage pipe outfalls (end of pipe)
- Construct small instream practices in open channels
- Construct "on-site" measures at the edges of large parking areas
- Construct new stormwater practices within highway rights-of-way (cloverleaves)

Stormwater retrofits only emphasize pollutant reduction. It should be recognized that *quantity* frequently creates the most severe urban stream impacts. Watershed managers should look for opportunities to combine quantity and quality controls together in stormwater retrofits.

Stormwater Retrofit Options

1. *Retrofit existing stormwater management facilities*

This option involves converting existing detention facilities (usually dry detention basins) into more functional treatment practices. Older basins are usually modified to become stormwater wetlands or wet ponds. This is perhaps the easiest retrofit option since stormwater is already managed in a distinct location and there is already some resident acceptance and understanding of stormwater management. In addition, modifying existing facilities usually involves minimal impacts to secondary environmental resources (e.g., wetlands, forest cover, migration barriers, etc.)

The retrofit process begins with an analysis of the existing hydraulic characteristics of the facility, reviewing the type of storage originally provided (e.g., two-year, and 10-year storms), and evaluating whether available storage exists for additional water quality treatment. The pond bottom can usually be excavated to create more permanent pool storage (for pond and wetland systems), the embankment can be raised, or the outlet structure modified to obtain additional storage for extended detention.

Another option is to increase the flowpath from inflow point to discharge point by using baffles, earthen berms or pond micro-topography to improve settling conditions. The goal of this type of retrofit is to maintain the original design purpose of the basin as much as possible, while providing additional pollutant treatment. A typical retrofit of an existing detention basin is shown in Figure 1.

2. *Construct new stormwater practices at upstream end of road culverts*

This stormwater retrofit option is installed upstream from existing road culverts by constructing a control structure and excavating a micro-pool. The control structure can consist of a gabion or concrete weir structure or a riser/barrel configuration. The micro-pool