



# Stormwater Basin Retrofit

## Improving Stormwater Management within Existing Facilities

### Benefits of basin retrofits

Many retrofitted basins are designed to manage runoff from smaller storms, such as to hold back the water within the basin longer than the original design would allow. In addition to detaining the runoff from the small storms, the velocity of the flow discharged can be slower, which will reduce the in-stream erosion often found in streams downstream of the outfall of a traditional basin.

This ability to hold back storm runoff allows time for pollutants such as sediments, oils, grease, nutrients, and pesticides to settle out and be filtered through longer contact with basin vegetation. Also, basins with vegetation will allow for some water to infiltrate into the soil—this water will then be used by the plants for their growth.

In addition to the benefits to the environment, basins with native vegetation can be designed to require less maintenance. All basins require some maintenance, such as clearing out debris after storms, checking the outlet for any problems or damage, and mowing the basin. A basin with native vegetation can be designed to be mowed much less frequently, sometimes only once per year, which will save time and money on maintenance.

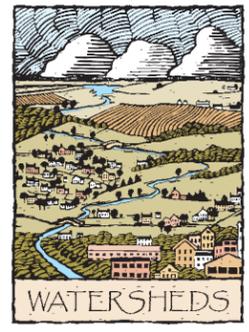
When renovating a basin, there are opportunities for public outreach and education to inform residents and the community groups about the importance of properly managing stormwater runoff.



*This 3 foot by 4 foot sign at Sidley Road basin describes the changes to the basin and the benefits of the retrofit.*

### Other sources of information and assistance:

Villanova Urban Stormwater Partnership Web site on best management practices: [www3.villanova.edu/VUSP/bmp.html](http://www3.villanova.edu/VUSP/bmp.html)  
 Perkiomen Watershed Conservancy Web pages on stormwater management: [www.perkiomenwatershed.org](http://www.perkiomenwatershed.org)  
 "Naturalized Stormwater Management Facility Design, Planting and Management Plan Guidelines":  
<http://ci.montgomery.il.us/CommunityDevelopment/NaturalizedStormwaterPlantings.pdf>



**Chester County  
 Water Resources Authority**  
 601 Westtown Road • Suite 260  
 P.O. Box 2747  
 West Chester, PA 19380-0990  
 Tel: 610-344-5400  
 Fax: 610-344-5401  
 Email: [wauth@chesco.org](mailto:wauth@chesco.org)  
 Web site: [www.chesco.org/water](http://www.chesco.org/water)

**Chester County  
 Board of Commissioners**  
 Carol Aichele  
 Donald A. Mancini  
 Patrick C. O'Donnell

**T**raditional stormwater detention basins are large, mowed depressions that detain storm runoff from large storms for a short period of time before allowing the runoff to flow out of the basin. These basins can be transformed so that they continue to reduce the peak flows from large storms while better reducing the impacts of small storms, improving water quality discharged to the receiving stream, improving the basin's visual appearance, and reducing maintenance costs.

Examples of basin retrofits include re-vegetating the basin with native grasses, trees and shrubs; modifying the outlet control structure to create a shallow impoundment; removing concrete low-flow channels; and installing infiltration measures to allow the detained stormwater to recharge the ground water system.

### Shortcomings of traditional basins

Traditional basins are often designed to reduce the increased peak flows from large storms caused by development of a site. Recent studies in stormwater management have illustrated that it is the smaller, more frequent storm events that result in streambank erosion and transport pollution to the streams.

Traditional stormwater basins do little or nothing to filter out pollutants or slow the velocity of the discharge from these smaller storms. In fact, basins with concrete low-flow channels, which are found in many older basins, heat runoff and quickly transport it through a basin, without any filtering at all.



*The retrofit of this stormwater basin at Sidley Road included small berms to increase the length of flow to allow more pollutant removal, and planting over 400 trees and 300 live stakes in the 3/4 acre stormwater basin.*

# Stormwater Basin Retrofit—A Case Study

## Sidley Road Basin, East Whiteland Township

In April 2006, the Valley Forge Chapter of Trout Unlimited led a group of volunteers and East Whiteland Township staff to transform a standard mowed stormwater basin into a highly vegetated basin that will help improve water quality of stormwater entering Valley Creek. The goals of the project were to provide a demonstration project that would illustrate an improved way to manage stormwater. The improvements to the basin include increased filtering of sediments and other pollutants from the runoff through the vegetation, modest infiltration through the soil to ground water and the use of the soil moisture for tree and shrub growth. The original purpose of the basin to detain stormwater runoff in order to minimize peak flows has been maintained.

This project was undertaken and managed by the Valley Forge Chapter of Trout Unlimited. Funding was provided by the National Fish and Wildlife Foundation (\$15,000), the Valley Creek Trustee Council (\$3,000) and the Valley Forge Chapter of Trout Unlimited (\$1,000). East Whiteland Township provided an estimated in-kind match of \$21,000 in equipment and labor, and volunteer labor was estimated at over \$3,400.

### Design

The initial design was to construct infiltration measures, such as subsurface infiltration trenches, within the basin to allow some of the runoff from small storms to infiltrate in the ground water. As part of the design and engineering work performed by Cahill Associates (West Chester, PA) test pits were dug to determine soil characteristics and soil depth. The test pits revealed that the depth to bedrock was only 14 to 16 inches, where at least 36 inches is required for infiltration to limestone.

Since the infiltration measures would not work, the design was adjusted to provide water quality improvements, by reshaping the basin, modifying the outlet control and planting native vegetation. By re-grading the basin, the time for the runoff to travel to the outlet was increased which will promote infiltration and evapotranspiration.

The vegetation plan, developed by Rolf Sauer Partners, Ltd., (Philadelphia, PA) included over 400 trees and bushes and 300 live stakes of silky and red osier dogwoods. Trees and shrubs were selected on the basis of sustaining growth in a high pH and moisture presence setting.



The modification to the outlet included covering the lowest opening with a geotextile and soil to create a shallow pool of water immediately after storm events.

### Re-grading and outlet modification

The structural modifications to the basin included re-grading the basin to create a small berm and meanders, and modification to the outlet to hold back low flows, which maintain soil moisture for the vegetation, while still controlling the larger storms.

The re-grading of the basin provided a meandering flow path from the basin inlets to the outlet which allow for settling and filtering of sediments and pollutants within the vegetation. The construction work was completed by East Whiteland Township Public Works Department under the direction of Cahill Associates.



The basin at Sidley Road in East Whiteland Township prior to the retrofit.

The in-kind services provided by East Whiteland Township totaled nearly 400 hours in labor, and their multiple contributions included hauling 55 truckloads of compost from Tredyffrin Township, re-grading the basin per design, tilling, stone removal, and the modifications to the outlet.

The modification to the outlet included covering the lowest opening in the standpipe with geotextile, and soil. The outlet structure of the Sidley Road basin includes two stand pipe outlets, one 30-inch in diameter and a larger pipe, 48-inches in diameter. The purpose of the outlet modification was to maintain the existing peak flow control for large storms while providing a small pool of water following rain-fall events to provide the necessary soil moisture for the selected plants, and allow evapotranspiration.

### Planting

The planting of the basin took place over four workdays in April 2006. Approximately 419 bushes and trees, and 300 live stakes were planted. There were nineteen types of trees and shrubs planted, and the live stakes were equal numbers of silky and red osier dogwoods. Live stakes are cuttings of plants that will take root.

Three grass varieties were planted: a low-mow mix between the top of the basin and the fence, a dry meadow seed mix on the basin slopes, and a wet meadow seed mix for the basin bottom where water is often present.

Volunteers from Trout Unlimited worked all four work days, and the Ecology Club of Great Valley High School participated on two of the work days. All volunteers were given instructions on proper planting technique by members of Rolf Sauer Partners. In addition to the planting and seeding, an erosion control mat was placed and staked where the two basin inlets discharged into the basin.



Students from the Ecology Club of Great Valley High School planting trees and shrubs near the live stakes close to the inlet of the basin.



The basin operated as designed during this storm event on June 26, 2006. The created berms are evident as the basin fills.

### Results

According to Trout Unlimited, the trees and bushes are doing very well at 20 weeks after planting. The survival rates of the trees and shrubs has been on the order of 80 percent and the survival rate for the live stakes has been about 55 percent.

The grasses were slow in establishing and weed control is an issue that will continue until the grasses are established. It is expected that it will take three to four years for the maturing of the vegetated area.

The change in floor contours and flow direction has been successful and the modification to the basin outlet to allow a small ponding has performed as designed.

### Maintenance

Yearly cutting will be required along with control of invasive weeds, as needed. Thus far, the weeds have grown faster than the meadow-mix seed causing additional maintenance needs. East Whiteland Township has begun a weed control program for the basin.