pennsylvania environmental council

MAINTAINING STORMWATER BASINS on Your Property – Fall 2008

This basin was recently converted from a mowed-turf grass dry detention basin into a naturalized basin. The result: an attractive wildflower and tall grass meadow with reduced mowing and maintenance requirements for the basin owner. (See ideas for basin naturalization in Tips for Improving Your Basin, Page5).

WHY MAINTAIN YOUR BASIN?

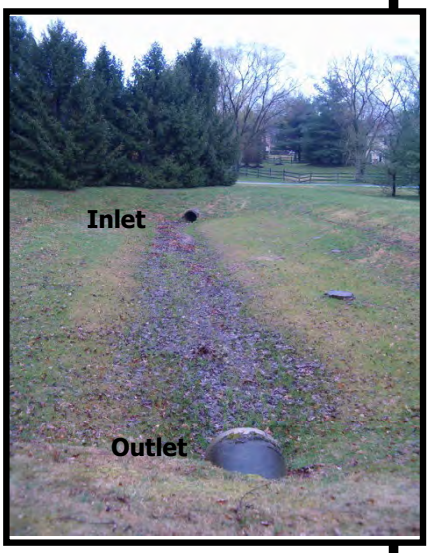
- To ensure the basin controls stormwater runoff and contribrutes to the reduction of flooding problems.
- Basins that are not properly maintained will eventually malfunction. When basins fail, very serious hazards can occur, including severe flooding and damage that can be difficult and costly to repair and cleanup.
- Lack of proper operation and maintenance is often cited as the number one reason for failure of stormwater facilities.
- Malfunctioning or improperly installed basins can cause **non-point source pollution** and degrade water quality in our streams and rivers.
- The Federal Clean Water Act requires that stormwater runoff be controlled to protect streams and rivers. In Pennsylvania, the Department of Environmental Protection requires that municipalities ensure stormwater facilities are properly inspected and maintained.

WHAT IS A DRY DETENTION BASIN?

Most basins in Pennsylvania were designed as "dry detention basins". Dry detention basins are intended to temporarily hold stormwater during and immediately after storms, and drain in between storms. Dry detention basins are large earthen depressions constructed to receive stormwater runoff from roads during storms, and to allow that water to drain away at a controlled rate. Every basin is designed to capture a certain volume of stormwater from streets, rooftops and other impervious surfaces in a specific drainage area. In general, dry detention basins are designed to drain within 24 hours after a storm. NOTE: basins designed for *extended detention* or as *wet ponds* retain stormwater for an extended period (in some cases up to 72 hours); wet stormwater ponds are designed to remain wet year round.

"An ounce of prevention is worth a pound of cure."
It is easy and inexpensive to inspect and clean out a stormwater basin compared to the high cost of repairing a neglected basin and cleaning up flood damage and water pollution caused when basins malfunction.

These two images show two typical dry detention basins. All **dry detention basins** have: 1) an *inlet structure*, typically metal or concrete pipe, that conveys runoff into the basin from a developed area; 2) a primary *outlet structure* through which stormwater from most storms exits the basin; and 3) an *outfall structure (typically a pipe) that* discharges stormwater from the basin onto land or into a waterway. Basins also have a secondary spillway to divert water from large storms. Some basins have a concrete **low flow channel** to quickly route stormwater from the inlet in a straight path directly to the outlet.



THE BASICS OF BASIN MAINTENANCE:

(1) Prevent Sediment and Litter Accumulation

Stormwater basins naturally collect sediment, including gravel, sand, and mud, as well as other debris like litter. Any materials that can be transported by stormwater runoff will be carried into a basin, and can accumulate there. To maintain its capacity and function, a basin should be kept free of excessive debris, litter and sediment. Here are some tips for controlling sediment and litter accumulation in your basin:

- **Institute a litter prevention program**. Institute litter programs to help prevent litter from entering storm drains and being carried into basins and waterways. For example, stencil storm drains with "no dumping" message as a reminder that storm drains are not for dumping; prohibit uncontrolled trash from collecting curbside; require trash cans be covered with securely fitting lids; institute a street cleaning program in your neighborhood.

- **Ensure Compliance with Local and State Earth Disturbance and Erosion Control Laws**. Any person or site engaged in excavation or grading that temporarily or permanently exposes soil to rain and runoff, including construction and farming activities, must control the dirt and prevent it from migrating off site. (Sites 1 acre or more must obtain a permit prior to earthwork.) Anyone in the neighborhood who fails to control erosion on their property could be allowing their dirt to accumulate in your basin!

(2) Control Erosion

Erosion can occur on gradual slopes as well as steep slopes both within and outside our basins. When erosion occurs, it can result in soil, rock or other material being transported by stormwater runoff to down slope properties, roads and waterways where it is a source of sediment pollution. When erosion occurs up slope in a drainage area or within the basin itself, it can result in excess sediment accumulation and can hinder basin performance. Excessive accumulation of sediment and other eroded debris can rapidly clog basin inlet and outlet structures and contribute to basin failure. Some basins can trap a certain amount of sediment; close monitoring is needed, however, to ensure basins do not discharge sediment pollution into our waterways.

- **Stabilize areas subject to erosion.** Preventing erosion can often be achieved using well-selected vegetation or rock. Grass and other vegetation when established help the earth to withstand erosive forces of stormwater runoff. Rock, sometimes called **rip rap**, can also be used to control erosion in a basin; rock helps hold soil in place and also helps control erosive velocities of runoff. Stabilization can also be achieved using man-made products. For example, turf reinforcement matting is a woven matting material that be installed along with vegetation to provide stabilization in hard-to-control areas. (See *PA Stormwater Best Management Practices Manual (PA BMP Manual)* for more information.)

- **Modify slope in areas subject to erosion**. Erosion is often caused by fast flowing stormwater runoff, which is a function of the slope of land, type of land cover (including

plants, soil or rock), and the volume of water. Re-grade land to reduce slopes that are erosion prone, including areas inside and outside the basin. Provide more stable ground cover such as deep-rooted and water-tolerant plants, rock or other material to hold the soil in place.

- **Divert runoff.** Divert runoff into a more gradual and stable area. Stormwater can be diverted or re-routed within a basin using earthen berms or rock berms. Materials used to establish a permanent diversion should be strong and stable and not subject to erosion, migration or premature deterioration.

- **Disperse runoff.** Disperse runoff using a **level spreader** (See *PA BMP Manual)*) or modified grade downslope of outfall pipe to diffuse or spread water over a larger level area. Create sheet flow conditions to help prevent channelization, gully formation and erosion.

- **Slow flows on steep slopes**. All erosion caused by stormwater flowing on steep slopes should be controlled. Slopes can be recontoured, cut back or extended to reduce steepness and grade in erosion-prone areas. **Retentive grading** and **check dams** can be used to control flows on slopes (see *Tips for Improving Basin Performance* below.) **Rip rap** is often relied upon to control erosion; however, its use generally is only a temporary solution, can be unsightly and doesn't necessarily solve the erosion problem at its source. It is recommended that an engineer be consulted to identify the best long-term control practice to manage steep slopes.

(3) Ensure Basins Drain Properly

In general, "dry" detention basins should completely drain within 24 hours and dry out between storms. Each basin is designed to drain within a certain time period; however, sometimes basins aren't installed properly or conditions within the basin hinder proper drainage. One common problem with basins is the outlet structures malfunction and impede drainage.

- **Identify the cause of improper drainage (i.e., drainage that isn't consistent with basin design).** Excess sedimentation or siltation in the basin can alter the bottom grade and hinder stormwater flow through the basin, which can hinder proper drainage. Clogged outlet control structures are often the cause of drainage problems. Poorly installed outlet structures are also a cause of outlet malfunction. Activities during site development and construction (i.e., excessive compaction of basin soils) can severely limit stormwater from soaking into basin soils. If it appears that that your basin was not installed consistent with its design, consult the responsible design firm or your municipality.

- **Clean-out clogged pipes and basin structures.** Clogs caused by excessive litter, leaf matter, tree debris/dead branches, soil or grass clippings should be addressed immediately by removing material causing the clog and properly disposing of materials off site.

- **Repair or replace corroded, rusted, cracked pipes and structures.** If any conveyance structure, including an inlet or outlet, appears damaged or deteriorating, consult a water resource expert or an engineer to determine the extent of damage and identify needed repairs.

(4) Overall Conditions

Basic conditions all basin owners should be aware:

- **Keep basin drainage area (i.e., streets and land that drain to the basin) clean and free of debris and litter**. Every basin receives stormwater runoff from a specific upslope "drainage area" where precipitation hits the earth and flows into the basin either as overland flow

The accumulated leaf, litter and sediment debris in front of basin inlet and outlet structure is restricting flow through these basin structures.

Cleaning out debris and sediment will easily correct this maintenance problem.

Definitions for terms used in this publication

Berm: An elevated mound, or rise, constructed of compacted earth, rock or other material, installed to contain, divert or direct stormwater flow and accumulation. In many basins earthen berms comprise the outside basin walls; berms can be constructed within a basin to direct or extend a stormwater flow path.

Check Dam: A relatively small embankment constructed across the slope (or parallel to the slope) to control the flows down a slope including the flow of stormwater down a channel or swale. Multiple check dams are often used in series to create terraces to control flows and mitigate erosion on a slope. Check dams generally are not found in older dry detention basins, but their use is increasing.

Conveyance: In this context, a structure such as a pipe or earthen channel that conveys or directs stormwater in a specific path.

Invasive Plant: Undesirable non-native plant that tends to overtake other plants and can readily out-compete native plants and even damage existing mature trees and plants. Invasive plants are undesirable because they limit the growth of more diverse plants, including natives, and overtime adversely impact a diverse landscape and native plant habitat.

Low Flow Channel: A narrow pathway that directs stormwater in a straight line through a basin from the inlet to the basin outlet.

Non-Point Source Pollution: Unlike pollution that enters our waterways through a discreet pipe from an industrial or sewage plant, non-point pollution originates from many diffuse sources and activities. Non-point source pollution is caused when rainwater flows over land and picks up pollutants in its path, such as oil, grease, fertilizers, and even soil, and then discharges pollutants into a creek or river.

Retentive Grading: A stormwater management practice that involves modifying an earthen slope to create terraced or plateau-like steps to convey runoff gradually down a slope to control erosion.

Rip rap: Large rock installed to slow the flow of stormwater and control erosion. Rip rap is often used as a temporary measure; with a more permanent long-term erosion control solution to include more thoughtful and comprehensive basin repair, redesign or retrofit.

Stabilization: Practices that control soil erosion in areas prone to erosive action of stormwater runoff. Stabilization methods include seeding and mulching in areas of disturbed earth, construction, gardening or tilling that has left soil or earth loose (i.e., uncompacted) and exposed such that it readily erodes, or washes away when exposed to rain or runoff. Other stabilization practices include planting deep-rooted vegetation, rip rap, and erosion control turf matting.

Trash Rack: A metal device installed in front of an outlet pipe opening that traps and screens out debris to prevent it from entering the pipe. Trash racks require regular cleaning to ensure they are not restricting flows.

or through underground storm pipes. When littered streets; bare ground, exposed soil or other evidence of erosion; and piled grass clippings, leaves or debris are exposed to rain or located in the flow path of stormwater runoff materials can be readily conveyed into your basin. Accumulation of this material in pipes and basins can cause premature clogs and over time will impact basin function.

- **Maintain proper grade.** The bottom of the basin generally should be graded consistent with the design. In general, dry detention basins should appear level, but should be moderately sloped in the direction of the outlet.

- **Stabilize your basin.** In general, basins should be "stabilized" with vegetation such as grasses or other plants to hold the soil in place and prevent erosion of basin soils. Use of rock, **rip rap** or other turf protection materials in the basin is an option for stabilizing soil when vegetation alone is ineffective. **Invasive plants** should be removed from the basin. Chemical fertilizers and pesticides should not be used within basins. See *Tips for Improving Basin Performance* (below) which suggest basin planting options for the basin.

- **Ensure basin berms and structures are sound**. All basin structures including basin berms or walls, inlets/outlets, pipes should be stable and sound with soil compacted in a level and secure manner where the structure's outside surface contacts the earth. Cracked or rusted pipes, signs of erosion, hollowed areas, caving in or slumping berms, are all indications that basin structures may be unstable and not sound, and in need of an in-depth inspection by an engineer.

- **Ensure basin overflow spillway is unimpeded**. The overflow spillway is the area designed to safely carry water out of the basin in major storms. The overflow, or emergency, spillways located along the basin's outside wall should be clearly visible and free of obstructions. The spillway should be level side-to-side to evenly convey water out of the basin in high flow conditions and prevent erosion. There should be no signs of channelization or preferential flow paths on spillways.

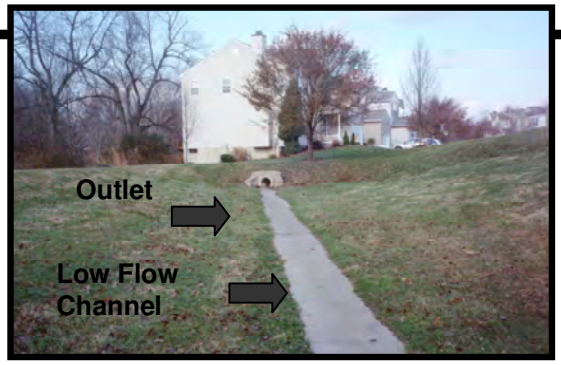
(5) Regularly Inspect Your Basin

- It is recommended that basins be inspected at least twice a year and after major storms of more than 2" of precipitation. Conduct inspections in early spring early in the growing season and mid-way through the growing season or in the fall. Inspections mainly consist of looking at basin structures to determine whether basin clean out is needed or if other maintenance or repair may be necessary. Sediment removal should only occur when sediment and soils are dry.

TIPS FOR IMPROVING BASIN PERFORMANCE

Conventionally designed dry detention basins are one of the many culprits contributing to damage and erosion observed in many urban and suburban streams today. As such, efforts are underway to modify the design and function of these basins to better control stormwater runoff, improve water quality by reducing non-point pollution, and enhance basin appearance. Contact your municipality prior to undertaking basin improvements and check local ordinances and permit requirements; your municipality may recommend ways to improve your basin.

♦ Replace mowed turf grass with native meadow plantings including perennial native grasses and wild flowers to reduce mowing needs and enhance basin aesthetics. Plant selected native shrubs and trees to shade meadow plants and help prevent unwanted **invasive plant** growth. Refer to PA Native Plant Society for guidance on plants (www.pawildflower.org) and/or consult a landscape architect. Prior to preparing a design for converting a mowed turf grass basin into a native landscape, obtain okay from your municipality.



The concrete low flow channel visible in the center of this basin quickly transports stormwater to the basin outlet limiting the extent to which stormwater soaks into basin soils. This basin can be retrofitted by removing the low flow channel and adjusting bottom grade to disperse water across the entire basin. This type of retrofit would filter non-point source pollutants, replenish ground water, irrigate vegetation, and better protect receiving streams from impacts of fast moving unfiltered stormwater runoff.

♦ If basin repair is needed consult an engineer for technical assistance and consider a basin retrofit to improve function, performance, and appearance. This can be a good opportunity to create an attractive naturalized basin with flowering native plants and shrubs. Consult the Conservation District office in your County and their Website for engineering firms experienced with stormwater management and specifically stormwater best management practices (BMPs) and basin retrofitting.

♦ Amend and improve basin soils that are over compacted and limit percolation of stormwater into the ground within basins. The soil can be tilled and amended with sand or leaf mulch, then revegetated to enhance basin performance and increase infiltration of stormwater into the ground.

♦ Extend the flow path of stormwater and remove concrete low flow channels within basin to increase stormwater contact with basin soils and vegetation. This retrofit will improve opportunities for filtering out non-point source pollutants, replenish groundwater and irrigate plants. Contact your municipality to verify this retrofit is allowed in your community.

A naturalized basin, like this one, enhances basin performance by filtering non-point pollutants and slowing stormwater flows through the basin; is an attractive native landscape; and is less costly to maintain since mowing is virtually eliminated.

♦ Modify outfall location to slow flows, reduce erosion and protect down slope land, vegetation and streams. Repair and retrofit practices employed at outfall areas to protect land and water can include level spreaders, retentive grading, check dams. The *PA BMP Manual* describes practices.

♦ Install additional stormwater BMPs upslope in the drainage area to capture, divert and infiltrate stormwater and reduce reliance on large basins and help restore watershed health. Some BMPs include rain barrels, rain gardens, and vegetative roofs.

Dry Detention Stormwater Basin Inspection Checklist for use by Basin Owners

Name(s) of Person Inspecting the Basin: _____ Basin:_____

Date of Inspection: _____

	No	Yes *	Notes / Follow-up items
Overall Observations			
1) Any reports of basin not functioning?			
2) Does stormwater remain in the basin more than 72 hours after a storm?			
3) Are there any structures in the basin used during site construction no longer in use?			
4) Is water entering the basin "short-circuiting" by directly exiting the basin outlet without coming in contact the basin bottom soil and vegetation?			
Inlet: A structure within the basin designed to convey runoff from the drainage area into the basin, typically concrete and/ or a metal pipe.			
1) Signs of breakage, damage or corrosion or rusting of inlet structure/pipe?			
2) Excess debris or sediment accumulation in or around the inlet potentially clogging the inlet opening/pipe?			
3) Signs of erosion, scour or gullies; undermined or undercut earth/embankment; exposed dirt; worn vegetation; "fresh" soil; washed out, disturbed, or damaged soils, rock or vegetation above or around the basin inlet structure?			
4) Tree roots, woody vegetation growing close to or through the inlet structure or a situation impacting structure's integrity?			
5) If the inlet has a pretreatment structure, such as a trash rack or forebay, is it filled with debris or sediment?			
Basin: The basin includes interior side slopes and bottom, vegetation, rock, or berms, inlets and outlets, and exterior side slopes.			
1) Accumulation of debris or litter within basin?			
2) Exposed dirt or earth visible, are there areas of ground without vegetation or where grass is worn or dead?			
3) Excess sediment accumulation in the basin (i.e., is sediment covering vegetation, covering/blocking inlet or outlet pipes)?			
4) Basin walls/embankment eroded, slumping, caved in or being undermined?			
Outlet: The primary structure within a basin that conveys stormwater from within the basin to a location outside the basin. Most basins have a single primary outlet that conveys stormwater from typical storms and a secondary spillway to divert water during large storms. A typical outlet is made of metal or concrete pipe.			
1) Breakage, damage or corrosion or rusting to outlet pipe or conveyance?			
2) Erosion, scour or gullies; undermined or undercut earth/embankment; exposed dirt; worn vegetation; "fresh" soil; washed out, disturbed, or damaged soils, rock or vegetation on or around the outlet structure?			
3) Debris or sediment accumulation in or around the outlet pipe (i.e., is outlet orifice covered with debris/sediment)?			
4) Accumulation of debris or litter in or around outlet?			
5) Tree roots or woody vegetation encroaching or impacting the outlet or causing potential damage to the structure?			
Secondary Overflow Spillway or Emergency Spillway: The location within the basin that conveys high flows safely out of the basin once the basin has reached capacity during large storms or in the event the primary outlet structure is malfunctioning.			
1) Are pipes, conduits, or conveyances free of debris, clogs and in sound condition (i.e., no visible cracks, breakage, slumping, undermined or undercut earth/embankments)			
2) Large tree or root growth close to pipes or conveyances with the potential to crack structure or impede flow?			
3) Erosion, scour or gullies; undermined or undercut earth/embankment; exposed dirt; worn vegetation; "fresh" soil; washed out, disturbed, or damaged soils, rock or vegetation on or around the spillway?			
Basin Outfall Area. The location outside the basin where stormwater is supposed to exit or discharge from the basin including the area in the vicinity of the outfall pipe/conveyance and immediately down slope including but not limited to receiving waterways.			
1) Signs of stormwater exiting the basin in an uncontrolled manner over or through basin outside wall?			
2) Erosion, scour or gullies, undermined or undercut earth/embankment; exposed dirt; worn vegetation; "fresh" soil; washed out, disturbed, or damaged soils, rock or vegetation at or down slope of the outfall?			

*** Items to which inspector responded "yes" require follow-up prior to next inspection.**

FOR MORE INFORMATION

PA Stormwater Best Management Practices Manual (***PA BMP Manual***) published December 30, 2006 by the PA Department of Environmental Protection. Website: **www.depweb.state.pa.us**. (Navigate: "southeast region", choose "stormwater information")

Center for Watershed Protection Ellicott City, MD. Website: **www.cwp.org**.

PA Association of Conservation Districts provides information and contact information for your County Conservation District Office. Website: **www.pacd.org/districts/directory**.

PA Native Plant Society provides information on native plants. Website: **www.pawildflower.org**.

About this Publication

The Pennsylvania Environmental Council is providing this information to help property owners manage stormwater facilities; information provided is intended for the non-engineer and should not be construed as law or legal. Consult with the Conservation District Office or water resource agency in your County and your municipality for more information.

Disclaimer: This publication is intended to educate basin owners and operators to assist with oversight and inspection of stormwater basins. More in-depth technical site assessment information, repair and remediation actions, and input should be sought from municipal officials, County Conservation District staff where basin is located or from the engineer and contractor responsible for basin design and construction. Earthwork (e.g., grading), as well as other repair and retrofit activities in and around your basin may require prior approval or permit from your municipal engineer or the Conservation District.

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MAINTAINING STORMWATER BASINS on Your Property – Fall 2008

A Guide for Stormwater Basin Owners

This pamphlet will help residents, businesses, and other individuals perform routine inspection and maintenance activities to ensure stormwater management basins on private property are in good shape and functioning properly. If there is a stormwater basin on a residential or commercial property you own, either individually or under common ownership, it may be your responsibility, as the property owner, to regularly inspect the basin and perform periodic maintenance. When basins are not maintained, they will fall into disrepair, which can lead to severe flooding and pollution of creeks and streams. This publication is provided to help the non-engineer understand basic inspection procedures, and includes tips for improving basin performance and appearance. Most stormwater basins in Pennsylvania are privately owned; as such, individual property owners are responsible for operation and maintenance. If there is uncertainty about the ownership of a basin on or near your property, contact your municipality to verify ownership and maintenance obligations. If there is uncertainty about basin design or function, if damage or malfunctions are observed, or in the event a more in-depth inspection or assessment is needed, the owner should secure the professional services of a licensed professional engineer. Most stormwater basins in Pennsylvania were designed as **dry detention basins.** This publication focuses on inspection and maintenance only of dry detention basins, or "dry ponds."

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