Field Tour

PIKE COUNTY, PA | MAY 2018

STORMWATER

BEST MANAGEMENT PRACTICES

A proactive approach to stormwater management helps to prevent water pollution, erosion, and flooding.

Stormwater Solutions

by Ellen Enslin, CPESC
Senior Resource Conservationist
Pike County Conservation District

Stormwater runoff is the portion of rainfall that is not absorbed by the land's surface or evaporated into the air. Instead, it runs overland to storm drains or streams. Natural ground, or soil, allows rain to be absorbed by the earth.

The soil surface is referred to as “pervious” because it allows rain to infiltrate. When rainfall amounts exceed the soil’s ability to absorb all the water, it begins to run over land.

When the natural surface of the land is replaced with hard surfaces such as paved roads, parking lots or roofs, the amount of runoff increases because these “impervious” surfaces do not allow rain to infiltrate.

WHERE DOES THE WATER GO?

Three major changes occur as the amount of runoff increases:

1. More surface water is delivered to streams more frequently.
2. Less water infiltrates the soil to replenish groundwater supply and maintain stream base flow.
3. Runoff washes a wide variety of pollutants into streams. Pollutants such as oil, gas, coolants, heavy metals such as zinc and lead, detergents, bacteria, pesticides, fertilizer and sediment may be picked up by runoff and carried into streams.

MINIMIZE IMPACTS

Better management of runoff will minimize or eliminate the problems. Two of the most effective methods are:

- Rethinking how development is regulated through local ordinances and revising land development ordinances to require and allow improved site design focusing on stormwater management.
- Utilizing Best Management Practices (BMPs) throughout the site design.

RESULTS OF RUNOFF

Increased stormwater runoff can cause serious problems in watersheds and streams including:

- Stream bank erosion and in-stream sediment deposits
- Nuisance flooding and property damage
- Public cost to maintain infrastructure
- Elevated stream temperatures
- Low groundwater levels for supplying streams during dry spells
- Depleted groundwater levels for supplying drinking water
- Damage to aquatic habitat and aquatic life
- Loss of aesthetic value of the stream
- Loss of recreational value for swimming, fishing or boating
- Decreased value as a water source
- Increased costs for water treatment

Best Management Practices

Stormwater Best Management Practices, or BMPs, are actions, structures and techniques that minimize the adverse effects of increased stormwater runoff. Although a variety of BMPs exist, they can generally be categorized as either detention (rate), infiltration (volume), or filtration (water quality). Some fulfill all of these functions; however, most are designed to serve a primary function. BMP selection is based on site conditions and stormwater management goals.

Detention BMPs, such as the detention basin pictured above, provide a delayed and controlled release of runoff. This helps to:

- reduce the rate of runoff by directing it to a holding area and releasing it over time
- minimize stream bank erosion and flooding

Infiltration BMPs, such as the infiltration gallery pictured above, provide an opportunity for runoff to be absorbed into the earth's surface.

Infiltrating rain water reduces the amount of runoff and increases the amount of groundwater recharge.

This is done by:

- directing water to holding areas designed to allow infiltration
- routing stormwater over pervious areas that allow infiltration
- reducing impervious surface and maintaining as much natural cover as possible

Filtration BMPs, such as the rain garden pictured below, help to remove sediment from runoff before it reaches waterways.

Directing runoff to areas where it is slowed down allows:

- suspended particles to settle out
- provides a medium through which runoff drains to filter pollutants

Pike County Training Center

Blooming Grove Township

Constructed in 2011, the Pike County Training Center provides hands-on, realistic training to emergency services professionals. It also houses the 911 Center and the Emergency Management Agency Operations Center.

VEGETATED DIVERSION BERM

These treatments, such as the one pictured at top right, are used in place of a pipe network to convey runoff around the site rather than through it, avoiding erosion of soils disturbed during construction. This reduces the need for larger BMPs and on-site conveyances.

POROUS CONCRETE

Several parking spaces feature porous concrete, a form of permeable paving. Fine particles are removed from the concrete mix to promote pore space, allowing water to pass through. A stone bed beneath the surface serves as a reservoir for water prior to its infiltration into the groundwater supply.

These areas were protected from compaction and sediment during construction and are designed to infiltrate parking lot runoff from 100-year storm events. For Pike County, this is 7.06 inches of rain in a 24-hour period.

Porous concrete's void space is approximately 22%, compared to 3-5% for conventional concrete. To keep the system clean, porous concrete should be vacuumed biannually with a commercial street sweeping truck. Application of anti-skid materials such as sand or cinders should be avoided.

WETLAND FOREBAY and WET POND

A constructed wetland forebay receives the majority of runoff from the site's impervious surfaces and pre-treats runoff by removing sediment and other pollutants prior to discharge to the wet pond.

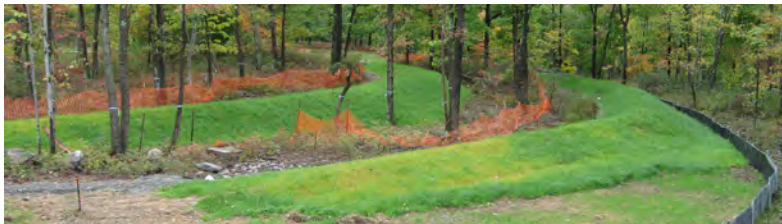
The forebay's impervious liner maintains a constant water level. Graded earthen benches with wetland plantings help to return water to the atmosphere while providing improved water quality and habitat for flora and fauna.

The wet pond, also known as a retention basin, is a substantial permanent pool for water quality treatment. It provides additional capacity for temporary runoff storage, and its contents are used for EMS fire exercises.

INFILTRATION BERM

A mound of compacted earth with sloping sides, pictured below, is located along a contour on a gently sloping area. These berms allow for infiltration of runoff by trapping a pocket of water, which allows it to soak into the ground. Infiltration berms are designed to blend with the natural landscape.

Runoff from the Training Center is directed to two infiltration berms after it has passed through the "treatment train" of stormwater BMPs including the constructed wetland forebay and wet pond.



Delaware Valley High School

Westfall Township

The Delaware Valley High School campus has had several recent improvement projects. The most recent, in 2017, included the addition of a gymnasium, visitor bleachers, athletic field, and parking lot, and demolition of the elementary school and its associated stormwater management facilities. Covered under an Individual National Pollutant Discharge Elimination System (NPDES) permit, the site drains to Rosetown Creek, a tributary to the Delaware River.

SOILS

When designing BMPs, the type and characteristics of soils are explored by a literature review and on-site soils testing to help engineers determine the amount of runoff generated and the infiltration rate.

Soil testing involves test pits where a soil scientist identifies and classifies the layers.

It is important to protect infiltration areas from soil compaction and sediment, which can clog the pore spaces between soil particles.

VEGETATED SWALE

Vegetated swales are broad, shallow channels designed to slow runoff, promote infiltration and filter pollutants and sediment.

Swales may be constructed with a subsoil mix that improves infiltration. Check dams, or perpendicular ditches, are often included within vegetated swales to create small infiltration pools that help to temporarily impound and slow the rate of runoff.

WATER QUALITY INSERT

These structures vary in size and function but they all utilize some form of settling and filtration to remove particulate pollutants, including coarse sediment, oil and grease, litter, and debris, from turbid stormwater flows.

They are ideal for use in “treatment trains” with other BMPs, and usually deal with the “first flush” of stormwater, which is considered to be the most contaminated. Regular maintenance is critical for the performance of this practice.

Delaware Valley Elementary School

Matamoras Borough

Constructed in 2016, the Silver LEED certified Delaware Valley Elementary School drains directly to the Delaware River. Covered under a General National Pollutant Discharge Elimination System (NPDES) permit, most of the 21 acres of earth disturbance was completed within an open meadow.

RAIN GARDEN

Rain gardens are small, vegetated bio-retention areas. A special subsoil mix of stone, aggregate and soil enhances filtration and infiltration.

Runoff is directed to the rain garden, where it is stored while it awaits infiltration into the ground below. Vegetation aids with filtering pollutants and returning water to the atmosphere. Organisms living in the plants' root structures help to break down pollutants.

Rain gardens are well-suited for placement in residential areas due to their small size and aesthetics. They also provide habitat for wildlife, such as birds and butterflies.

INFILTRATION BASIN

This impoundment stores and infiltrates runoff over a large, level, un-compacted, (preferably undisturbed) area with relatively permeable soils and vegetation.

The key is to provide enough surface area for the volume of runoff to be absorbed within a given time (72 hours or less). An engineered overflow structure must be provided for larger storms.

SUBSURFACE INFILTRATION CHAMBERS

Storage media (pipes, etc.) are located under the soccer field to handle overflow from upslope infiltration areas. In this case, the chambers function year-round, as they are located below the frost line.

These chambers maintain aquifer recharge while creating open space for recreation.

SOIL AMENDMENT

This is the process of improving disturbed and low organic soils by restoring porosity and/or adding a soil amendment, such as compost, to re-establish the long-term capacity for infiltration and pollution removal.

Physical loosening of the soil, called subsoiling or tilling, can help to treat compaction.

WATER REUSE

A 10,000-gallon stormwater irrigation tank collects runoff from flat roof areas for use in watering the athletic fields.

The management plan requires soil tests prior to the application of fertilizers in order to minimize overloading of the soils with nitrates.

LITTLE WALKER ROAD

Shohola Township

The Dirt, Gravel and Low Volume Road Program promotes practices that reduce impacts of stormwater runoff and sediment to local streams while minimizing the cost of long-term road maintenance.

The program is a cooperative effort among the State Conservation Commission, Pike County Conservation District, and municipalities.

In fall 2017, improvements on Little Walker Road included a 15-inch culvert pipe with headwall and endwall; a teardrop structure to collect stormwater, seen at top left; and driving surface aggregate, bottom left, which is a mixture of crushed stone with a unique particle size distribution designed to maximize packing density and produce a durable road surface that performs better than conventional aggregates.

This project improved water discharges from Little Walker Road to Walker Creek, a high quality, cold water and migratory fishery.

REFERENCES

EMS Center, Post Construction Stormwater Management Plan Narrative, March 16, 2010

Delaware Valley School District - High School Gym Addition, Post Construction Stormwater Management Narrative, October 24, 2012

Delaware Valley School District - New Elementary School, Post Construction Stormwater Management Narrative, October 2014

Dauphin County Conservation District Best Management Practices Tour Handout

PA DEP Stormwater Manual, December 30, 2006

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556 Route 402, Hawley, PA
570-226-8220
pikecd@pikepa.org
PikeConservation.org

Pike County Conservation District

pennsylvania DEPARTMENT OF ENVIRONMENTAL PROTECTION