

UNH T² Center Technical Note

Runoff Pollution: Prevention & Management

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Runoff as Pollution

Water pollution deriving from stormwater runoff is increasingly becoming a problem in municipalities across the country. The New Jersey Department of Environmental Protection found that nearly 60% of drinking water pollution problems is caused by stormwater runoff.

Pollutants, such as chemicals, bacteria, dirt, refuse, and metals are carried with rain or melting snow into municipal stormwater systems, which then carry and deposit the pollutants into waterways. Water in drains is not filtered through a sewage treatment plant before it is released into waterways. The stormwater runoff that empties into storm drains alongside roadways and parking lots flows directly to nearby rivers, lakes, and bays.

The effects of runoff pollution are various and detrimental. First, excess sediment can cloud water, which disrupts aquatic habitats. Second, runoff from lawn fertilizer spreads excess nutrients into the water, causing algae blooms once the overly nutrient-rich runoff reaches bodies of water. When the algae decomposes, it removes oxygen from the water, threatening fish and other aquatic life. Third, bacteria from stormwater runoff can cause health hazards when present in drinking water and swimming areas. Fourth, debris is not only unsightly, but it can suffocate aquatic life, such as ducks, fish, and turtles. Fifth, hazardous waste from household

materials, such as insecticides, pesticides, paints, solvents, and auto fluids, can flow into bodies of water and poison aquatic life. Eating poisoned fish or shellfish can cause illness in people and land animals.

Stormwater pollution is termed “non-point source” pollution because it cannot be traced back to a single source of pollution (such as a chemical spill, for example). Instead it is a combination of many sources of pollution and affects large areas of land and wildlife.

For all of these reasons, stormwater runoff is a large problem in our communities and this article will attempt to outline several best management practices (BMPs) to help prevent and reduce water pollution created through stormwater runoff.



Photo by Jane Thomas, LAN UMCES, <http://ian.umces.edu/imagegallery/displayimage-1438.html>

BMPs to Reduce Water Pollution from Runoff

BMPs for reducing stormwater runoff pollution can be divided into two categories: structural BMPs and non-structural BMPs. According to the Iowa State LTAP, “Structural BMPs include engineered and constructed systems that control the quantity and/or quality of stormwater runoff. Non-structural controls include public education, recycling, and maintenance practices” (“Reducing Water Pollution”).

This article will discuss several structural BMPs, including infiltration systems, detention basins, stormwater ponds, bioswales, rain gardens, and permeable pavements. There is no one “quick fix” that all municipalities can use. Instead, each municipality should research the various types of structural BMPs for managing runoff to discern which BMPs will work best within their environment.

Structural BMPs

Detention Basins

These basins detain stormwater runoff temporarily, and release it into the ground later. The stormwater’s rate of flow is greatly reduced using detention basins, but since all of the runoff is eventually released, it does not reduce the runoff volume. The general purpose for a detention basin is to prevent floods and erosion by detaining the runoff. Rapid erosion can increase levels of stormwater runoff pollution.

Infiltration Systems

Like detention basins, infiltration systems detain stormwater and release it into the ground gradually. However, infiltration systems have a filtering system that uses sand, soil, carbon, or other organic material to remove contaminants from runoff before the stormwater is released into the ground.

Stormwater Ponds

Stormwater ponds retain runoff for between 24 to 48 hours. The pond water dissipates by evaporating or filtering into the ground or the pond water is withdrawn and recycled for other uses, specifically non-potable. Therefore, stormwater ponds prevent large amounts of contaminants from flowing into waterways, reducing non-point source pollution.

Bioswales

Often used in parking lots and other paved areas, bioswales are vegetative systems, the aim of which is to improve the quality of stormwater, and to remove contaminants from the stormwater that flows through them. The open-channel concept of the bioswale allows stormwater to flow along the channel, traveling through the vegetation. The water is slowed, which allows sedimentation, filtering, and/or infiltration into the soil underneath. Once water leaves the bioswale, there are fewer pollutants in the runoff.



<http://www.rivanna-stormwater.org/images/bioswale.jpg>

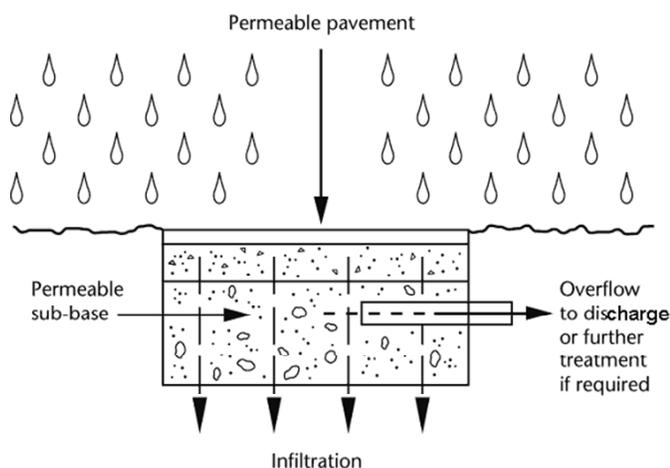
Rain Gardens

Rain gardens are another landscaping solution to stormwater runoff and pollution. These gardens offer on-site treatment options for runoff pollution, and direct the stormwater flow into shallow depressions in the landscape. The water is

then filtered through mulch and a specially prepared soil mix. The filtration process removes pollutants, sediments, and excess nutrients from the water, creating cleaner runoff to flow to waterways.

Permeable Pavements

Permeable pavements allow the stormwater runoff to infiltrate the pavement directly through to the soil underneath. This process filters out many contaminants, and reduces the amount that would normally be flushed to waterways by traditional pavement. Non-permeable pavements do not allow runoff to filter through them, which means that the runoff—including all contaminants and debris—flows directly to waterways, with no filtration.



<http://www.netregs.gov.uk/static/images/NetRegs/pavementAKP.GIF>

Permeable pavements include porous asphalt and pervious concrete. See the diagram above for how permeable pavements allow for filtration of stormwater runoff to reduce non-point source pollution.

Non-Structural BMPs

Public Education

Making citizens aware of the impact that their daily activities have on runoff pollution can be

very effective in reducing stormwater runoff. Citizens often have control over automotive product disposal, pesticide/herbicide use, fertilizer use, hazardous material disposal, lawn debris management, and pet waste disposal. Education on how to recycle these materials, rather than dumping them down storm drains or on lawns, will help citizens understand the effects of their actions. Many municipalities have marked storm drains with plaques that indicate that the drain leads to open waterways. This alerts the average citizen that what they are dumping down their drain could end up in their glass of water or in their cooking pan.

Maintenance Practices

Maintenance practices that public works departments can institute to reduce runoff pollution include proper cleaning and maintenance of catch basins, keeping streets and parking lots clear of debris, maintaining roads and ditches, limiting salting and sanding on roads, removing sediment from structural BMPs, and maintaining vegetation. Maintenance practices should not only reduce runoff pollution, but also ensure that the structural BMPs are properly functioning.

Managing Runoff at Construction Sites

Stormwater runoff can become particularly hazardous at construction sites. This is because construction sites generally have higher rates of erosion, and eroding soil leads to pollutants in nearby waterways. However, there are a few ways that public works departments can control runoff from construction sites before construction begins, during construction projects, and after completing construction work.

Pre-Construction and During Construction

Managing runoff during construction and before construction generally means implementing temporary erosion control measures, to keep runoff

and contaminants from leaving the construction site. These methods of runoff pollution prevention include silt fences, storm drain protection (inlet and outlet), erosion control blankets, sediment traps, and diversion dikes. Any of these methods, or any combination of these methods, can be used, depending on the needs of the construction site.

Road Managers will want to minimize sediment loss before and during construction. Silt fencing, installed around the construction site's perimeter, is the most common method for minimizing sediment loss in construction sites. Used alone, however, silt fences are not nearly as effective at reducing erosion as they could be.

In addition to silt fences, departments can also use temporary mats, netting, or erosion control blankets to protect sloped seeded areas, before the vegetation begins to grow in. Geotextiles and mulches are also useful in protecting sloped areas before vegetation begins to grow. Filters for storm drains are a good alternative during the pre-construction phase of managing runoff pollution. Road Managers can also simply attempt to limit the amount of soil that is disturbed at any given time during the construction process.

Erosion control methods should be installed before construction begins, to minimize erosion. Such preventative measures, while they do take time to install initially, are incredibly cost- and time-effective in the long run.

Post-Construction

The key to post-construction management of stormwater runoff is permanence. These BMPs are permanent structures that are installed to maintain or improve the quality of the runoff and to reduce the quantity of the runoff. Many of the structural BMPs outlined above are useful for post-structural management of stormwater runoff, including rain gardens, permeable pavements, bioswales, basins and ponds for stormwater retention, and other infiltration systems. These permanent, structural

BMPs must be periodically maintained to ensure that they are functioning properly. BMPs designed for post-construction installation and usage remove or reduce pollutants and provide stormwater infiltration. As with the other structural BMPs discussed in this article, municipalities should vary their choices for post-construction BMPs based on the work site.

Making Changes to Improve Water Quality

Runoff from stormwater can be detrimental to habitats, wildlife, and humans, and is a serious source of non-point pollution that needs to be addressed. By following the best management practices outlined in this article—both structural and non-structural—municipal highway departments can reduce pollution that occurs because of stormwater runoff.

Road Managers should provide citizens with information about how stormwater runoff occurs, how it can negatively affect nearby waterbodies, and what can be done to prevent further pollution. Also, Road Managers should ensure they are following BMPs at construction sites. Structural BMPs (such as bioswales and silt fencing) that prevent or reduce erosion will help reduce pollution resulting from stormwater runoff, ensuring better water quality for all.

References

- "After the Storm." EPA.gov. Environmental Protection Agency, January 2004. Web. 14 April 2010.
- Aird, Janet. "Managing Runoff from Start to Finish." *Erosion Control*. July/August 2009: 26-31. Print.
- Johnson, Donald P. "Controlling Stormwater Runoff from Construction Sites." *APWA Reporter*. August 2008: 98-99. Print.
- "Reducing Water Pollution through Stormwater BMPs." *Technology News*. July/August 2008: 1-2. Print.
- Sween, Eric. "Battling Nonpoint-Source Pollution Head-On." *Stormwater*. September 2008: 152-154. Print



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