

Chapter 10:

Stormwater Management for People and Wildlife



“Healthy watersheds capture and store water for human and natural needs, but sprawl development creates landscapes that shed water like a raincoat. Water rushing down storm drains when it rains is water that will not come up from your well when it is sunny.”

*Rebecca Wodder, President,
American Rivers*

Stormwater management techniques attempt to reduce the damaging impacts of runoff on water quality, groundwater, flooding, and habitat. Polluted runoff is the leading source of impairment to aquatic systems in the Hudson Valley, and increasingly, groundwater is not being recharged (New York State Department of Environmental Conservation 2000). For this reason, state and federal stormwater management regulations (also known as Phase II regulations) have been implemented. The strategies described in this chapter go beyond the existing Phase II stormwater regulations. Though it may not be immediately obvious, stormwater can also threaten terrestrial plants and animals. Without improved stormwater management, the integrity and quality of the region’s aquatic systems—streams, lakes, wetlands, and groundwater—will continue to be degraded and remaining high-quality examples may be destroyed. Finally, unless stormwater management takes wildlife into consideration, several species may be lost from the Hudson Valley.

How Does Stormwater Affect Natural Areas and Wildlife?

The growing problems of stormwater are related to increases in impervious surface area—streets, parking lots, and buildings—and construction activities that compact the soil. Instead of soaking into the ground, rain that falls on an impervious surface quickly runs off the site via storm drains and drainage ditches, which often send the water directly into streams and rivers. Such runoff cannot effectively recharge groundwater, resulting in more flooding and less available drinking

water. Another result is that streams and wetlands that are naturally dependent on stable groundwater flow may have higher high flows (flooding) and lower low flows, leading to the loss of stream habitat and stresses to fish and other aquatic life. Flooding not only threatens property and the safety of residents, but can cause stream banks to rapidly erode. In addition, stormwater runoff is often contaminated with various water pollutants that are byproducts of urban and suburban activities such as construction, automobile use, and lawn care. Reduced baseflows can cause small streams and lakes to dry up and reduce the stream’s ability to dilute pollutants. If left unchecked, the pollutants can further stress fish and other wildlife species that depend on clean water for food and habitat.

Some common site-development standards may actually worsen stormwater runoff problems. For example, development standards that require wide streets, expansive parking lots, and artificial drainage systems produce even more runoff than residential developments of sixty to seventy years ago. Curbs and catch-basins are commonly used to channel stormwater into storm sewers. In urban areas this may make sense, but in rural and suburban areas, these systems can impede the movement of small animals (See Miller and Klemens 2003 and Calhoun and Klemens 2002). Once in the road, turtles, frogs, and salamanders cannot climb over most curbs, so they travel along the curb—until they reach a storm grate and fall in. The effects of loss of these species can be dramatic, affecting the food availability for many other wildlife. Stormwater ponds and wetlands may act as “decoy” wetlands in areas where high concentrations of frogs, turtles, and salamanders occur. The detention ponds can attract small animals that normally use small wetlands as breeding areas. However, because of pollutant loads and fluctuating water levels breeding is rarely successful (See Miller and Klemens 2003 and Calhoun and Klemens 2002).

Stormwater management needs to accomplish two things: slow the release of stormwater runoff to downstream rivers and make sure runoff water does not degrade surface water quality. Communities in rural and suburban areas may want to consider additional stormwater management guidelines to protect wildlife.

How Can Improved Stormwater Management Be Used to Protect Natural Areas and Wildlife?

Improved stormwater management for people and wildlife can reduce impacts to streams, wetlands, groundwater, and protect small animals. Stormwater management tools that control the quality and quantity of urban runoff will help reduce impacts to streams and wetlands. Using the right techniques in the right places will help reduce impacts of stormwater management on small wildlife. Some of those techniques include: promoting groundwater recharge, locating stormwater ponds away from natural wetlands, and designing curbing and stormwater systems that take local wildlife into consideration.

Smart Growth Strategies

Alternative stormwater drainage and site design approaches can substantially reduce the impacts of stormwater on water quality, groundwater, aquatic habitat, and wildlife. These alternative development techniques, commonly called low-impact development, involve measures that accomplish three basic objectives:

- Reduce the amount of impervious surface area, allowing for groundwater recharge, thereby reducing runoff.
- Use the landscape to naturally filter and absorb runoff before it leaves the development site.
- Provide flexibility to choose and locate stormwater-management practices based on site constraints and natural resources as well as watershed and community factors, which may reduce threats to native wildlife.

Low-impact development designs reflect both old and new design philosophies. Natural drainage and narrow streets mirror a design philosophy that pre-dates the arrival of “modern” subdivision design in the 1950s and 1960s. The use of native landscaping material, is reminiscent of presettlement conditions. Cluster or open space development is a relatively new design approach that reduces impervious area and preserves natural features (See also Chapter 9).

Local governments can ensure that environmentally friendly stormwater designs are implemented in their communities by adopting laws and ordinances to ensure adequate drainage, prevent flooding, protect water quality of streams and lakes, and limit erosion from sites during construction. An additional way to reduce stormwater impacts is to allow for flexibility in local land-use laws that encourage natural drainage, such as vegetated swales and bioretention areas, to minimize impervious surfaces and soil compaction.

Specific recommendations for improved stormwater drainage and site design follow. Because environmental conditions vary, not all of these techniques are appropriate on all development sites. Site-specific design should reflect local conditions. Though some of these techniques may be less expensive to install than conventional development designs, there may be other tradeoffs such as aesthetic perceptions and maintenance needs that should be considered. Detailed discussion of these approaches and tools to help choose the appropriate practices for your situation are provided in the *New York State Stormwater Management Design Manual* (New York State Department of Environmental Conservation 2001) and *Better Site Design: A Handbook for Changing Development Rules in Your Community* (Center for Watershed Protection 1998).

Better Site Design for Conservation of Natural Areas

The following principles related to natural areas conservation for new development sites are adapted from the Center for Watershed Protection and American Rivers. They are intended to help local governments modify their ordinances where appropriate.

- Encourage incentives and flexibility to conserve stream buffers, forests, meadows, and other areas of environmental value. Where it is not possible to conserve natural areas onsite, encourage offsite mitigation. This is particularly important when doing so is consistent with locally adopted watershed or habitat conservation plans of these resources.
- Create along all perennial streams a variable-width, naturally vegetated buffer system that encompasses critical environmental features such as the 100-year floodplain, steep slopes, and freshwater wetlands. Maintain the buffer system through the plan review, delineation, construction, and post-development stages (See Chapter 5 for a discussion on buffer width).
- Limit clearing and grading of a site to the minimum needed to build lots, allow access, and provide fire protection. Manage a consolidated portion of the community open space as protected green space.
- Conserve vegetation at each site by preserving and planting native plants, clustering tree areas, and incorporating trees into community open space, street rights-of-way, parking-lot islands, and other landscaped areas.
- Prevent new discharges of stormwater runoff into wetlands, sole-source aquifers, or sensitive areas.

Natural Absorption

The first step in reducing stormwater impacts is allowing more water to be naturally absorbed into the ground. Natural vegetation—especially trees—help capture and absorb stormwater. Mass grading of development sites strips water-permeable topsoil and compacts underlying soils, further reducing the landscape's ability to absorb precipitation and runoff. Two techniques can be used to promote absorption of rain into the ground. The first is concentrating development in part of a site, conserving community open space that is naturally vegetated. The second is to limit clearing and grading, and mitigate soil compaction.

Reduced Impervious Area

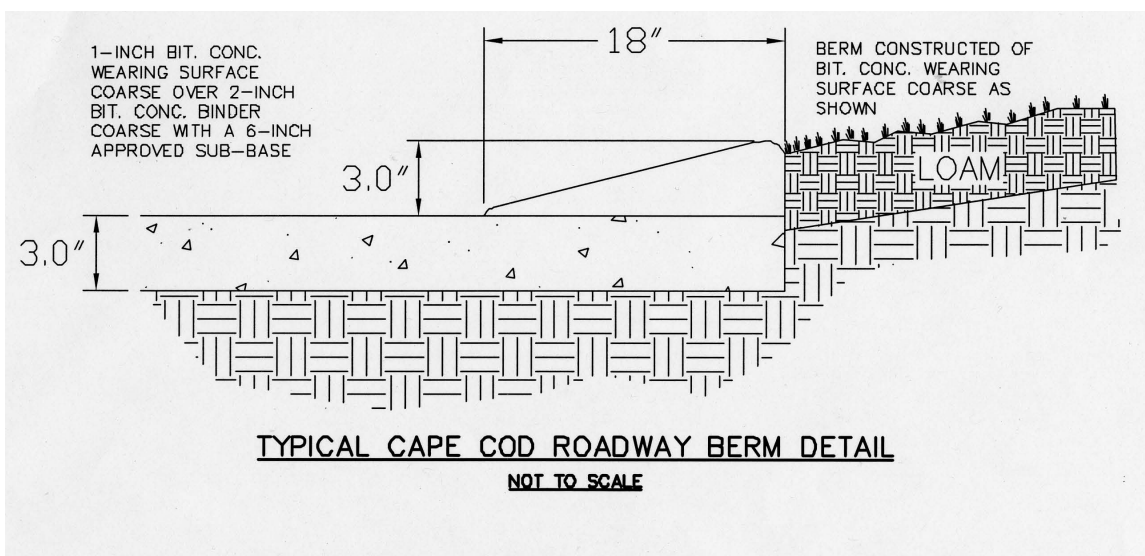
The area of impervious surfaces in a new residential development can be reduced in several ways: reducing building envelopes; allowing narrower streets; eliminating or reducing the size of cul-de-sacs, reducing setbacks between streets and homes, thereby reducing the length of driveways; and encouraging shared driveways, reducing sidewalk widths, or installing sidewalks on only one side of the street. Impervious surfaces also can be reduced in parking lots by downsizing individual parking spaces, installing planting medians, and installing porous pavement in low-maintenance overflow parking areas. Businesses whose patrons park at different times could share parking lots (for example, a bank and a restaurant or a movie theater and a funeral home). Most of these practices require changes to municipal codes.

Vegetated Drainage Swales

Using properly engineered drainage swales and other vegetated channel systems—instead of storm sewers, lined channels, and curbs and gutters—will reduce runoff volumes and increase the removal of damaging pollutants from runoff water. Gently sloped (4:1) vegetated drainage swales will also reduce small wildlife mortality when used instead of storm drains and stormwater devices such as hydrodynamic separators. If curbs are necessary, a Cape Cod-style curb (see below) can be used, which allows small animals to cross roads easily (Calhoun and Klemens 2002). Communities should strive to maintain the natural drainage system, including natural stream channels, wetlands, and floodplains. However, stormwater should not be discharged into a stream, wetland, or tidal wetland without first applying an approved treatment practice to remove pollutants and reduce the surge of water.

Infiltration Practices

Infiltration practices allow stormwater to seep into the ground within 48 hours of a storm event rather than traveling over the surface of the soil, and to recharge groundwater supplies that are essential to the health of many streams and wetlands. Where soils are sufficiently permeable and pollutants from commercial and industrial areas are not a threat, infiltration trenches and basins can reduce surface runoff volumes and naturally recharge groundwater supplies. Unlike stormwater ponds, infiltration practices do not involve a permanent pool of water, so they reduce the chance that amphibians will become trapped in fluctuating water levels.



Bioretention Areas

Bioretention areas use soils and native vegetation to capture and treat stormwater runoff. This technique reduces stormwater impacts by maintaining natural drainage patterns and using vegetation to absorb runoff. Bioretention areas may need to be combined with other stormwater management practices to control runoff volume from larger storms.

Native Landscaping

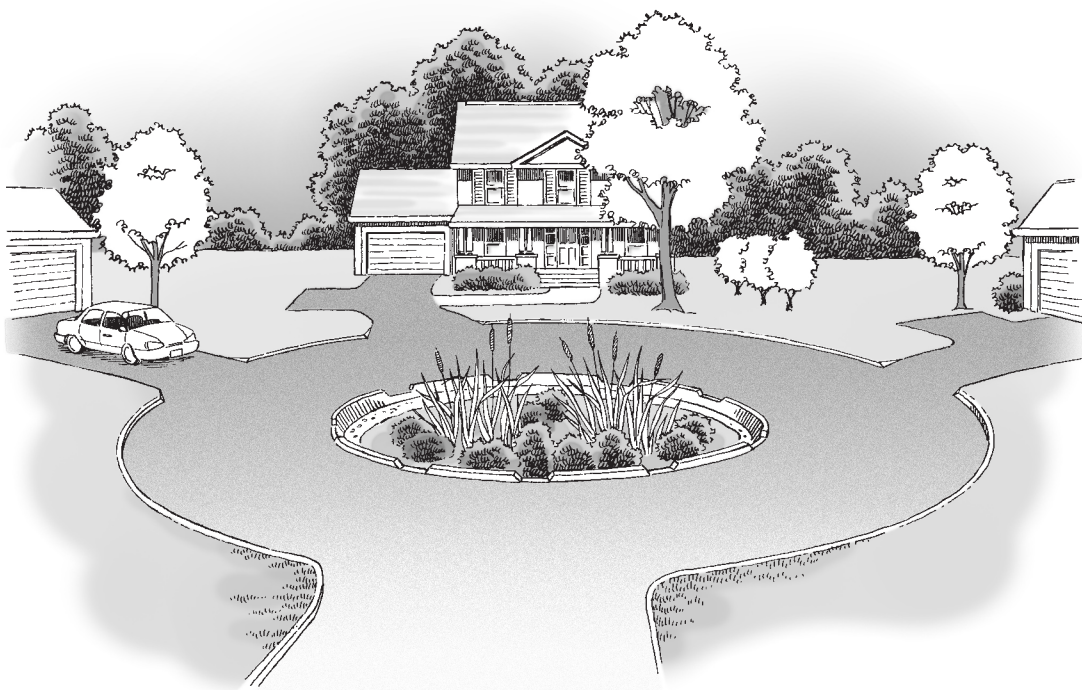
Native landscaping utilizes native plants, particularly native trees, shrubs, and wildflower species, as an alternative to conventional turf grass and ornamental plants. Native landscaping is particularly appropriate in drainage swales, bioretention areas, and rain gardens at the edges of roads, parking lots, and driveways, and can reduce the maintenance needs of conventional turf-grass landscaping such as mowing and irrigation. Native landscaping also provides important localized habitats for birds and butterflies and beneficial insects such as bees. This technique is discussed in greater detail in Chapter 13.

Stormwater Pond and Wetland Design, Management, and Maintenance

The design of stormwater ponds and wetlands incorporates features of natural wetland and lake systems, such as gradual shoreline slopes, a border of wetland vegetation, and areas of open water. In

contrast, conventional designs for stormwater detention basins feature dry bottoms or riprap-edged wet basins. Natural designs remove more stormwater pollutants than conventional wet- and dry-bottom basins, reduce nuisance goose populations, and can provide habitat for waterfowl, water insects, and amphibians. A note of caution is in order here, however. Even well-designed and -constructed stormwater ponds and wetlands can act as “decoy” habitat areas for wildlife that normally breed in vernal pools. To minimize the effect on native salamanders, frogs, and turtles, do not locate stormwater ponds and wetlands within 750 feet of a vernal pool, between vernal pools, or in areas that are primary overland amphibian migration routes, if known (Calhoun and Klemens 2002).

To maximize the benefits of natural basin design, local officials can develop and adopt practices to manage and maintain stormwater basins. Maintenance and management guidelines have been developed by the Environmental Protection Agency and the New York State Department of Environmental Conservation in partnership with the Center for Watershed Protection in Maryland (Center for Watershed Protection 1998, 2005, and New York State Department of Environmental Conservation 2001). Additional guidelines are warranted near vernal pools, as noted above.



A rain garden is a type of bioretention area that is both functional and beautiful.

Road Maintenance

In addition to site design, local governments can implement road maintenance programs to reduce the damaging effects of stormwater on aquatic ecosystems. Regular street sweeping in high traffic areas can substantially reduce runoff pollutants. Reducing the use of road salt can reduce winter runoff impacts on sensitive wetlands, streams, and woodlands. Public and private salt storage can also be designed to reduce damage to aquatic systems (Northeast Illinois Planning Commission 1998).

Summary of Benefits*

When used in combination on a development site, low-impact stormwater management techniques can substantially reduce both impacts and construction costs. Based on case studies, it is estimated that alternative stormwater drainage and site-design approaches can reduce:

- stormwater runoff volumes by 20 to 70 percent (in comparison to conventional development);
- runoff pollutant loads by 60 to 90 percent;
- site development costs by \$1,000 to more than \$4,000 per lot for residential developments, and by \$4,000 to \$10,000 per acre for commercial and industrial developments.

Other documented benefits of these approaches include reduced maintenance and replacement costs, enhanced site aesthetics, improved property values, and greater flexibility of site design. These techniques also will lead to improved protection and enhancement of sensitive natural areas and the region's waterbodies for supporting a diversity of wildlife.

Keeping water clean is almost always cheaper than cleaning it up later.

Local Examples

Progressive Local Laws and Ordinances

Natural drainage has been the standard practice for most low-density residential communities in New York State, with conventional storm sewers, lined channels, and curbs and gutters incorporated as communities become more urbanized. However, with the adoption of new Stormwater Phase II regulations at the federal and state level, many communities in New York State are now required local laws and ordinances to reduce runoff at the source. Construction-site operators and developers in all communities are required to control stormwater runoff from projects that disturb more than one acre.

New York State has developed a Model Local Law for Stormwater Management that communities may use to amend their zoning, site plan, and subdivision laws to minimize impervious surfaces and soil compaction, and to maximize treatment and infiltration of runoff on the development site. Communities may also provide additional natural resource protection by adopting local laws and ordinances that regulate floodplain development or require buffers for streams, lakes, ponds, and wetlands. More information on protection of these habitats can be found in Chapter 5.

Better Site Design

Towns of Clinton and Wappinger, N.Y.

In 2005, recognizing the need to develop code-review tools for local government, two municipalities in the Wappinger Creek watershed participated in a Better Site Design project with help from the Hudson River Estuary grant program. The first phase, code and ordinance worksheet review, was coordinated by the Dutchess County Environmental Management Council using tools and support from the Center for Watershed Protection. The second phase, Better Site Design Roundtables, was coordinated by the staff of the Hudson River Estuary Program.

Through the Wappinger Creek Watershed pilot project the Hudson River Estuary Program gathered considerable background information about how New York State law applies to the Better Site Design principles developed by the Center for Watershed Protection. Two final documents, produced in partnership with the municipalities, provide recommendations for specific local code changes, and at the same time summarize the application of Better Site Design principles in New York State (available from the NYS DEC Hudson River Estuary Program).

* from Schueler and Holland 2000a, 2000b.

Improved Wastewater Management for People and Wildlife

Stormwater management is not the only water pollution control activity that can have an effect on wildlife. Wastewater management is the process by which sanitary sewage is cleaned. How wastewater is managed and sited can have a profound effect on the Hudson Valley's habitats, by determining how and where land is developed and how clean our rivers, streams, and wetlands can be. A municipality's wastewater-management options can impact its ability to allow neo-traditional development, cluster development, and conservation subdivisions.

How Can Wastewater Management Be Used to Protect Natural Areas and Wildlife?

Wastewater planning, including careful selection of technology and management options, can be used to guide land use and support the design of new development to achieve habitat, water quality and quantity, and other conservation goals. Municipal sewer and small community systems can potentially help to guide development to appropriate areas and allow more compact site design. Discharging effluent to fields or forests recycles water back into the local ecosystem.

Management Options

In areas with municipal sewers, developers can often build on smaller lots at a higher density (depending also upon local zoning and other considerations). When the only treatment option is individual onsite septic systems, lot sizes must be larger, which can lead to sprawl and more fragmentation of natural areas. Small community systems are a third option that may allow for higher density at a smaller scale. Each management option has drawbacks, however, and a municipality should research these options carefully. Be sure to work with relevant municipalities, counties, sewer districts, and private utilities. The NYS DEC should also be consulted

when considering wastewater management options, because permits may be required.

Maintenance

Whichever management option is used, maintenance is crucial to maintaining water quality. Municipalities can promote management programs for onsite (septic) systems, work with sewer districts to repair and rehabilitate old sewer lines, and make sure provisions are made for lifetime management of small community systems.

Wastewater Planning

Think about developing a town-wide wastewater management plan to guide decisions on wastewater infrastructure, and link this plan to your local comprehensive plan, open space plan, and other local goals and regulations.

Additional Resources

The National Small Flows Clearinghouse is an education and technical assistance program supported by the U.S. Environmental Protection Agency that offers hundreds of publications, videos, and other resources for local officials, homeowners, engineers, and other audiences, ranging from brochures and fact sheets to detailed design manuals. Many are available free or at low cost (www.nesc.wvu.edu).

The National Decentralized Water Resources Capacity Development Project, funded by U.S. Environmental Protection Agency, has a number of detailed studies on small community/decentralized systems available for download (www.ndwrcdp.org/).

The Rocky Mountain Institute is a research and education organization that has a number of documents available for download regarding wastewater management and water conservation (www.rmi.org).

Resources

Center for Watershed Protection. 1998. *Better Site Design: A Handbook for Changing Development Rules in Your Community*. Center for Watershed Protection. Ellicott City, Md.

New York State Department of Environmental Conservation. 2004. *Stormwater Management Guidance Manual for Local Officials (Includes Model Local Law for Stormwater Management)*. New York State Department of Environmental Conservation. Albany, N.Y.

New York State Department of Environmental Conservation. 2001. *New York State Stormwater Management Design Manual*. New York State Department of Environmental Conservation. Albany, N.Y.

New York State Department of Environmental Conservation. 1993. *Reducing the Impact of Stormwater Runoff from New Development (Second Edition)*. New York State Department of Environmental Conservation. Albany, N.Y.

New York State Soil and Water Conservation Committee. 2004. *New York Standards and Specifications for Erosion and Sediment Control*. New York State Department of Environmental Conservation. Albany, N.Y.