



Stormwater Problems & Impacts: Why All The Fuss?



Stormwater Fact Sheet No. 1

This fact sheet is No. 1 of an eight-part series focused on stormwater runoff problems and control strategies. The series covers:

- 1) Stormwater Impacts
- 2) Human Health Impacts
- 3) How Citizens Can Help
- 4) Prevention and Control
- 5) Control for Development
- 6) Rules and Regulations
- 7) "How to" for Local Officials
- 8) Municipal Prevention



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Introduction

Controlling stormwater runoff and its impact is a serious issue facing many communities across western North Carolina and the nation. Citizens complain about flooding caused by increased amounts of stormwater runoff and the state and federal governments are mandating local stormwater programs to control stormwater pollution.

This series of fact sheets is designed to help citizens, developers, and local government officials better understand the problems that are caused by stormwater runoff and how these can be addressed.

What is Stormwater Runoff?

Stormwater runoff is rainfall or snowmelt that runs off the ground or impervious surfaces such as buildings, roads, and parking lots, and drains into natural or manmade drainage ways. In most cases, it drains directly into streams, river, lakes, sounds or the ocean.

Stormwater can drain into streets and human made drainage systems consisting of storm drains and underground pipes commonly referred to as "storm sewers." These sewers are not to be confused with sanitary sewers that transport human and industrial wastewaters to a treatment plant before they discharge to the river. Stormwater entering storm sewers does not usually receive any treatment before it enters streams, lakes and other surface waters. The stormwater here drains to the French Broad River, then flows to the Tennessee River, then the Mississippi, and eventually flows to the Gulf of Mexico.

Why is Stormwater a Problem?

Pollution

Stormwater is a leading cause of water pollution. It runs off solid surfaces and collects pollutants such as oil, pesticides, sediments, bacteria, and other chemicals, and then deposits them into our waterways. This runoff can kill aquatic life, and make our waterways an unhealthy place to live, work, and play. Untreated stormwater entering our streams can result in the contamination of our drinking water supplies or shell fishing waters; prohibitions on swimming, fishing or boating uses; injury to aquatic plants and animals; dangers to public health; and increased flooding.

Flooding

Flooding increases as solid surfaces replace natural vegetation, because water is unable to slowly filter into the landscape. Stormwater deposits sediment that decreases the depth of waterways, further increasing flooding.

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Degraded Water Quality

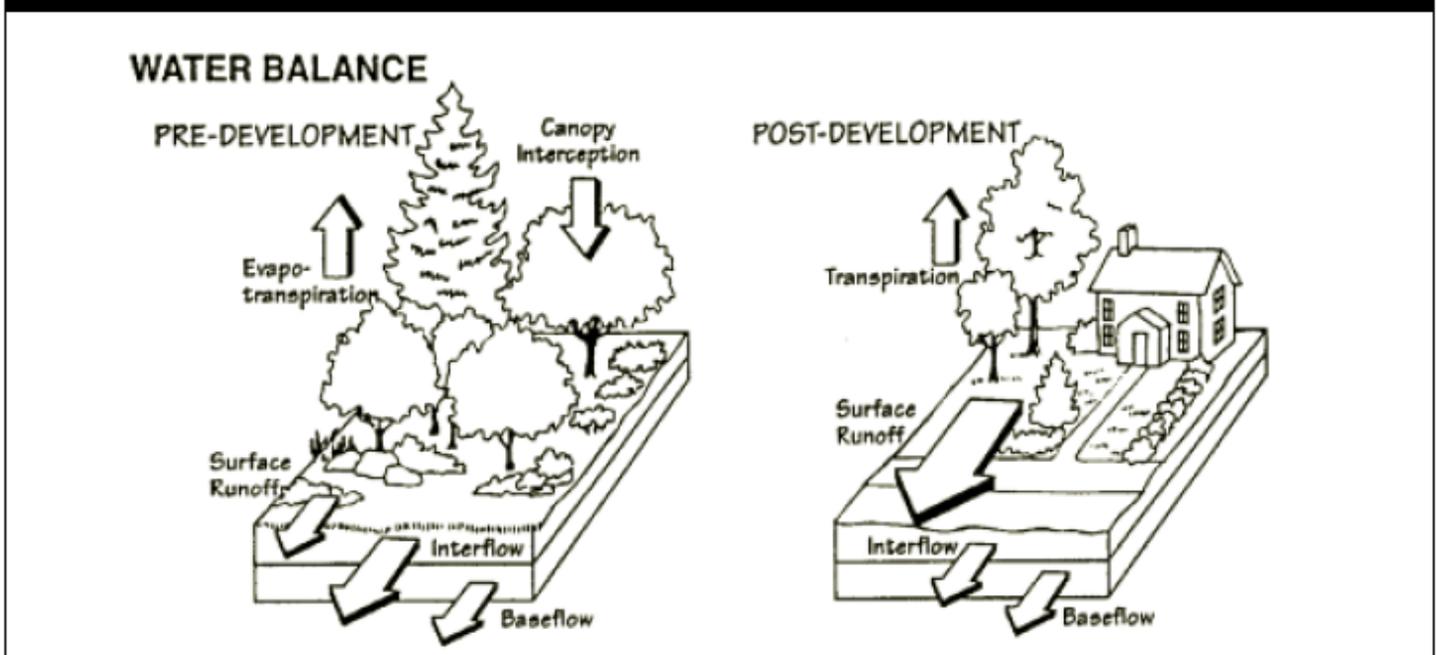
Various pollutants such as oil, fertilizer, pesticides, sediment, and chemicals are deposited on soil and impervious surfaces due to man's activities. During storms into storm these pollutants are washed off and drain to storm drains and then directly into streams, rivers and lakes. Pollutant levels are typically much higher in the first inch of runoff, commonly referred to as the "first flush." Some studies have found that approximately 90% of the pollutant loading is contained in the "first flush" of a one-inch rainfall. Therefore, effective water quality protection requires the treatment of the "first flush" through the use of various preventive and control measures. The Center for Watershed Protection's research has demonstrated that as little as eight percent impervious coverage of a watershed can result in degradation of the water quality. At 25% impervious coverage, the waterways have lost most of their biological diversity and have significant impairments. A two acre single home lot has about 12% impervious cover and a shopping center has over 90% impervious cover.

Although low-density development reduces impervious surfaces in that area it leads to increased impervious surfaces elsewhere, because of more roads and parking that sprawling development requires. Roads and parking lots can account for more than 60% of a low-density development's impervious area. Although large lawns might seem capable of absorbing runoff from adjacent surfaces, they are typically compacted by construction equipment and can generate up to 90% as much runoff as pavement. These facts point to the importance of using the prevention and control measures discussed in Fact Sheet #4 to reduce the impact of impervious surfaces. In addition, some pollutants are dumped or discharged accidentally or illegally into storm sewer systems. Stormwater pollutants and their sources are listed in Figure 3.

Flooding

Stormwater runoff problems and impacts are most evident in areas where urbanization has occurred. Changes in land use have a major effect on both the quantity and quality of stormwater runoff. Urbanization, if not properly planned and managed, can dramatically alter the natural hydrology of an area, because it increases impervious cover. Impervious cover decreases the amount of rainwater that can naturally infiltrate

Figure 1: Water Balance at a Developed and Undeveloped Site



into the soil, and increases the volume and rate of stormwater runoff. These changes lead to more frequent and severe flooding, and therefore potential damage to public and private property.

Under natural conditions, typically 10% of rainwater falling on a piece of property runs off the land surface into streams, rivers, or lakes. The remainder either evaporates into the air or infiltrates into the soil, replenishing groundwater supplies (Figure 1). Development of a site increases the percentage of impervious surfaces. As the percentage of impervious surfaces increases, the percentage of runoff increases because there is less vegetated area to soak up the rainwater.

The rates of runoff and streamflow after a storm event also show dramatic increases under post-versus pre-development conditions (Figure 2). The higher and more rapid peak discharge of runoff and stream flow can overload the capacity of a stream or river, causing downstream flooding and streambank erosion.

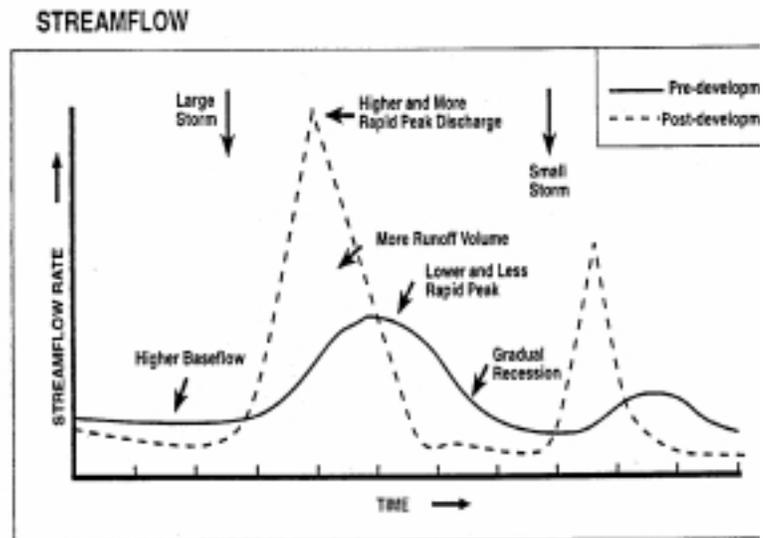


Figure 2: Pre versus Post Development Streamflow Rates

Local governments spend millions of dollars each year for rectifying damage to public and private property caused by uncontrolled stormwater runoff. This damage includes repairs to roads, culverts, water, sewer line washouts, flooded homes and yards, the removal of deposited sediment and debris on properties and roads, and repairs of damage to bridges.

When streambanks erode they clog stream channels, culverts, and pipes with sediment contributing to flooding problems. Sediment is washed into ponds, lakes and other impoundments reducing their capacity to store water and requiring costly removal efforts. The increased volume and velocity of runoff and streamflow can also cause accelerated channel erosion and changes in streambed composition. These changes can destroy fish habitat and disrupt the natural ecology of the stream or river.

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Cumulative Negative Impacts

The cumulative effects of stormwater runoff on water bodies is evident across the state. Streams draining urbanized areas have fair to poor water quality due to stormwater runoff and leaking sewer lines. Some shellfish waters along North Carolina's coast have been contaminated and closed due to stormwater runoff and other pollution sources. Uncontrolled stormwater runoff has many negative impacts on humans and the environment including:

- Floods - Damage to public and private property, including infrastructure
- Eroded Streambanks - Sediment-clogged waterways, filled lakes, reservoirs
- Widened Stream Channels - Loss of valuable property
- Damaged Aesthetics - Dirty water, increased trash and debris, foul odors
- Damaged Fish and Aquatic Life - Impairment/destruction
- Impaired Recreational Uses - Decreased opportunities for swimming, fishing, boating, and other water sports
- Threatened Public Health - Contamination of drinking water, fish/shellfish, increased exposure to harmful pollutants.
- Threatened Public Safety - Increased exposure to drownings in flood waters
- Economic Impacts - Fisheries, shellfish, tourism, recreation related businesses
- Increased Cost of Water and Wastewater Treatment - increased raw water treatment costs and reduced assimilative capacity of waterbodies.



Stormwater Pollutants & Sources

Sediment - Construction sites, disturbed areas, streambank erosion and alterations.

Nutrients - Fertilized lawns, roadsides, leaky sewers & septic tanks

Bacteria - Leaking sewers & septic tanks, pet wastes

Oxygen Demanding Substances - Leaky sewers & septic tanks, organic matter, pet wastes

Trace Metals - Automobile wear and tear, exhaust industrial areas

Road Salt - Applications to snow and ice

Toxic & Synthetic Chemicals - Pesticide applications, automobiles, accidental spills, illegal dumping

Thermal Impacts - Heated landscape/impervious areas, tree removal, shallow ponds

Figure 3.

For more information

- Appropriate Local Government Officials www.seris.info/RiverLink/techinfo.shtml
- Land of Sky Regional Council 251-6622.

- Center for Watershed Protection. www.cwp.org.
- North Carolina Division of Water Quality Stormwater Unit: Manuals and Factsheets
- www.h2o.enr.state.nc.us/su
- North Carolina Division of Water Quality Stormwater Permitting Unit: Stormwater Permitting Unit Home h2o.enr.state.nc.us/su/stormwater.html
- North Carolina Phase II Stormwater www.ncphase2sw.org/
- North Carolina State University www.bae.ncsu.edu/stormwater/
- RiverLink www.seris.info/RiverLink/techinfo.shtml or www.riverlink.org