

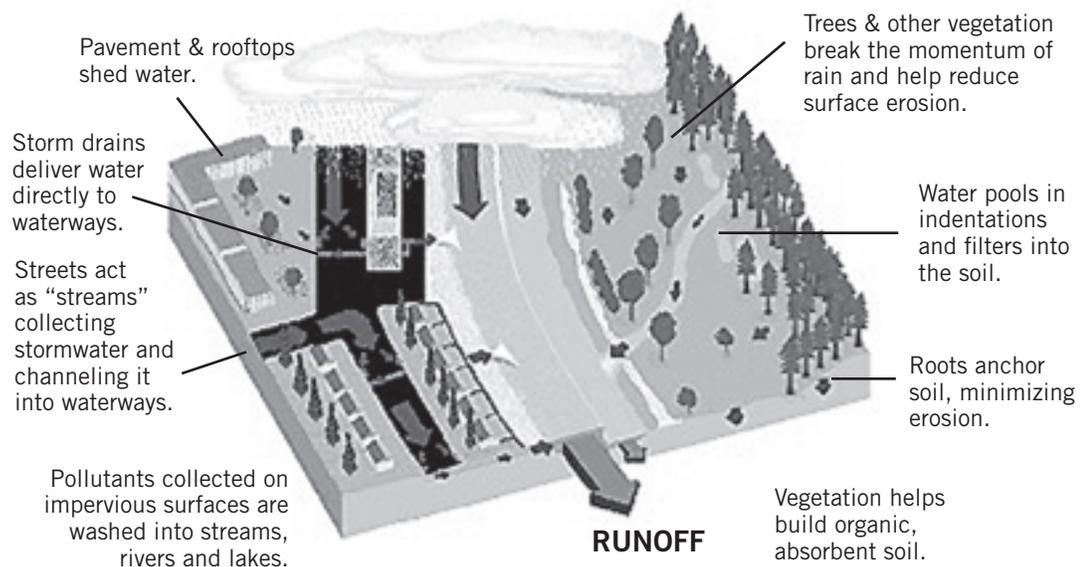
Water is continuously cycling between the Earth and the atmosphere: falling as rain, infiltrating the soil, flowing through streams and rivers towards coastal waters and evaporating. Disruption in this cycle can affect drinking water supplies as well as rivers, streams, estuaries and the aquatic life they contain.

Developed Lands

Rain runs more quickly off of city and suburban landscapes that have significant impervious cover.

Undeveloped Lands

Trees, brush and soil help soak up rain and slow runoff.



How development can affect the hydrologic cycle. (Based on graphic from California Water & Land Use Partnership Fact Sheet. Used with permission.)

More Water Faster

Clearing and grading can change the way rainfall flows off the land because these activities remove vegetation and increase impervious surfaces, allowing rainfall to move off the land quicker and in more concentrated flows. Increased stormwater runoff often begins a chain of events that includes flooding, erosion, stream channel alteration and ecological damage. The way the developed land is used also can result in increased pollution sources carried by stormwater into waterways.

When significant impervious surface is added, the resulting runoff can be to up to 16 times the pre-development amount, based on data from the Center for Watershed Protec-

tion. Development also contributes to erosion during construction when soils are bare and unprotected.

Multiple factors influence the path rainfall takes after reaching the Earth, including:

- intensity and duration of the storm;
- properties of the soil;
- types and amounts of vegetation; and
- presence of impervious surfaces.



The physical and chemical components of water bodies can be altered by stormwater runoff. (photo: Barbara Doll)

Effects on Ecosystems

When the amount of stormwater and sediment flowing into a stream increases beyond pre-development volumes, several detrimental things may occur, including:

Stream Erosion and Widening

The increased force of flowing water erodes streambanks even in small and moderate storms. As erosion intensifies and streams widen, tree roots that once protected the banks may become exposed and are more likely to be uprooted during major storms.

Streambed Changes

Stream bottoms also can be eroded as a result of increased flows. In some areas, sediment may accumulate, covering streambeds with shifting deposits of mud, silt and sand.

Flooding

During a storm, urban streams can flood in a short period of time because of the rush of stormwater runoff from areas dense with parking lots, roofs and roads. Downstream “flash” flooding may occur if storms are long or intense. Localized flooding may occur if streams become clogged with debris and eroded sediment.

Loss of Habitat and Aquatic Life

Erosion, stream widening, flooding and streambed and temperature changes may result in a loss of habitat and aquatic life. Sediment can smother bottom-dwelling organisms and habitat. Highly variable stream flows make it difficult for some species to survive. Very high flows can even wash away entire aquatic communities. In general, erosion and severe flooding result in habitats with fewer and less varied organisms.

Temperature Fluctuations

Loss of waterside habitat because of stream widening can result in fewer trees and other vegetation along the banks to moderate water temperature. This loss can lead to water that is warmer in the summer and cooler in the winter — changes that might not be tolerable to species that normally live there.

Read North Carolina Sea Grant's **Water Quality Fact Sheet 4: Actions and Resources** for potential solutions and more information on addressing these water quality issues.

Information for this document was drawn from:

- Atlanta Regional Commission. (2001). *Georgia stormwater management manual*. Retrieved Mar. 23, 2009, from <http://www.georgiastormwater.com/>
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