



Why Stormwater Matters

Urban development has a profound influence on the quality of local streams. To start, development dramatically alters the local hydrologic cycle (see Figure 1). The hydrology of a site changes during the initial clearing and grading that occur during construction. Trees that had intercepted rainfall are removed, and natural depressions that had temporarily ponded water are graded to a uniform slope. The spongy humus layer of the forest floor that had absorbed rainfall is scraped off, eroded or severely compacted. Having lost its natural storage capacity, a cleared and graded site can no longer prevent rainfall from being rapidly converted into stormwater runoff.

The situation worsens after construction. Roof tops, roads, parking lots, driveways and other impervious surfaces no longer allow rainfall to soak into the ground. Consequently, most rainfall is directly converted into stormwater runoff. This phenomenon is illustrated in Figure 2, which shows the increase in the volumetric runoff coefficient (R_v) as a function of site imperviousness. The runoff coefficient expresses the fraction of rainfall volume that is converted into stormwater runoff. As can be seen, the volume of stormwater runoff increases sharply with impervious cover. For example, a one acre parking lot can produce 16 times more stormwater runoff than a one acre meadow each year.

The increase in stormwater runoff can be too much for the existing drainage system to handle. As a result, the drainage system is often “improved” to rapidly collect runoff and quickly convey it away (using curb and gutter, enclosed storm sewers, and lined channels). The stormwater runoff is subsequently discharged to downstream waters, such as streams, reservoirs, lakes or estuaries.

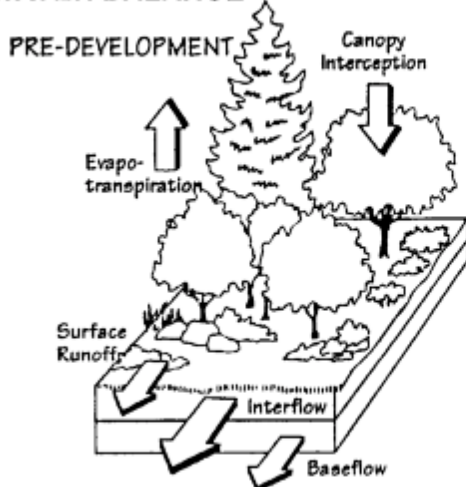
Declining Water Quality

Impervious surfaces accumulate pollutants deposited from the atmosphere, leaked from vehicles, or wind-blown in from adjacent areas. During storm events, these pollutants quickly wash off, and are rapidly delivered to downstream waters. Some common pollutants found in urban stormwater runoff are profiled in Table 1 and include the following:

Nutrients. Urban runoff has elevated concentrations of both phosphorus and nitrogen, which can enrich streams, lakes, reservoirs and estuaries (known as eutrophication). In particular, excess nutrients have been documented to be a major factor in the decline of Chesapeake Bay. Excess nutrients promote algal growth that blocks sunlight from reaching underwater grasses and depletes oxygen in bottom waters. Urban runoff has been identified as a key and controllable source of nutrients.

Figure 1: Water Balance at a Developed and Undeveloped Site

WATER BALANCE



POST-DEVELOPMENT

