Article 39

Feature Article from Watershed Protection Techniques. 1(4): 155-163

The Architecture of Urban Stream Buffers

Headwater streams comprise as much as 75% of the total stream and river mileage in the contiguous United States (Leopold *et al.*, 1964). These critical headwater streams are often severely degraded by the urbanization process (Schueler, 1995a). As a consequence, many communities have adopted stream buffer requirements as one element of an overall urban watershed protection strategy. Up to now, buffer requirements have been relatively simplistic—the "design" of a stream buffer often consists of no more than drawing a line of uniform width on a site plan. As Heraty (1993) notes, buffers designed in this manner often become invisible to contractors, property owners, and even local governments. As a result, many stream buffers fail to perform their intended function, and are subject to disturbance and encroachment.

A buffer network acts as the "right-of-way" for a stream and functions as an integral part of the stream ecosystem. Stream buffers add to the quality of the stream and the community in many diverse ways, as summarized in Table 1. In many regions, these benefits are multiplied when the streamside zone is in a forested condition. While the benefits of urban stream buffers are impressive, their capability to remove pollutants borne in urban stormwater should not be overstated. Although communities frequently cite pollutant removal as the key benefit when justifying the establishment of stream buffers in urbanizing areas (Heraty, 1993), their capability to remove pollutants in urban stormwater is fairly limited. This is a surprising conclusion given the moderate to excellent sediment and nutrients removal reported for forested buffers in rural areas (Desbonnet *et al*., 1994) Much of the pollutant removal observed in rural and agricultural buffers appears to be due to relatively slow transport of pollutants across the buffer in sheetflow or under it in shallow groundwater. In both cases, this relatively slow movement promotes greater removal by soils, roots, and microbes.

Ideal buffer conditions are rarely encountered in urban watersheds. In urban watersheds rainfall is rapidly converted into concentrated flow. Once flow concentrates, it forms a channel that effectively short-circuits a buffer. Unfortunately, stormwater flows quickly concentrate within a short distance in urban areas. It is doubtful, for example, whether sheetflow condition can be maintained over a distance of 150 feet for pervious areas and 75 feet for impervious areas (Figure 1). Consequently, as much as 90% of the surface runoff generated in an urban watershed concentrates before it reaches the buffer, and ultimately crosses it in an open channel or an enclosed stormdrain pipe. As a result, some kind of structural stormwater practice is often needed to remove pollutants from runoff before they enter the stream.

Figure 1: Watershed Geometry and the Concentration of Flow: The Overland Flow Path to the Stream and the Distance Before Flow Concentrates