Surroundings

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NaturalChannel Design

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Mr. Parker is an ecologist and planner with over 17 years of experience. He has participated in a variety of environmental investigations, planning studies, and design projects as well as the preparation of numerous environmental reports. His assignments have included NEPA and environmental documentation, ecological inventories and assessments, socioeconomic inventories, needs and alternatives analysis, environmental permitting, highway and site planning and design, and mitigation/restoration design. Mr. Parker's responsibilities have included contract administration, project management, and quality control.

Streams and rivers are an important part of the natural landscape. They convey water and sediment from higher elevations to downstream locations. However, human-induced changes to streams and watersheds can impair their ability to function and may result in excessive streambank erosion, sediment deposition, degraded aquatic habitats and increased flooding. When the modification of streams is necessary, traditional engineering approaches often call for the creation of wide, straight, smooth channels capable of conveying large volumes of water. However, because of the high velocities and sheer stress in these channels at high flows, they often require expensive armoring of the streambanks and bottom with concrete, gabions, and riprap. Below the limits of the channel armoring, the excessive erosive forces scour the "natural" streambanks producing excess sediment and enlarging the stream channel. At low flows, these channels are shallow, almost devoid of aquatic habitat, and are often incapable of carrying the available sediment load and debris. This can create costly, long-term maintenance problems.

Much of the recent talk about streams and waterways has focused on terms such as natural channel design, fluvial geomorphology, and stream restoration. These terms are all associated with the principal of working with the natural tendencies of streams rather than against them. The principals of natural channel design incorporate the characteristics of stable stream reaches into the channel design modifications. The channel design should incorporate minimal amounts of structural hardening to create a stream that functions properly to convey water, sediment, and debris while still providing maximum biological potential, such as habitat for fish and other aquatic organisms. Natural channel features such as pools, riffles, and undercut banks provide the diversity of habitat needed to support these functions. Natural channels also tend to be self-maintaining and therefore require little or no maintenance.

Detailed field measurements and data are collected at stable, "reference" stream reaches to quantify channel parameters that can be extrapolated to degraded stream sections. The most important channel characteristic is the bankfull discharge and stage. The bankfull discharge is the flow that trans-

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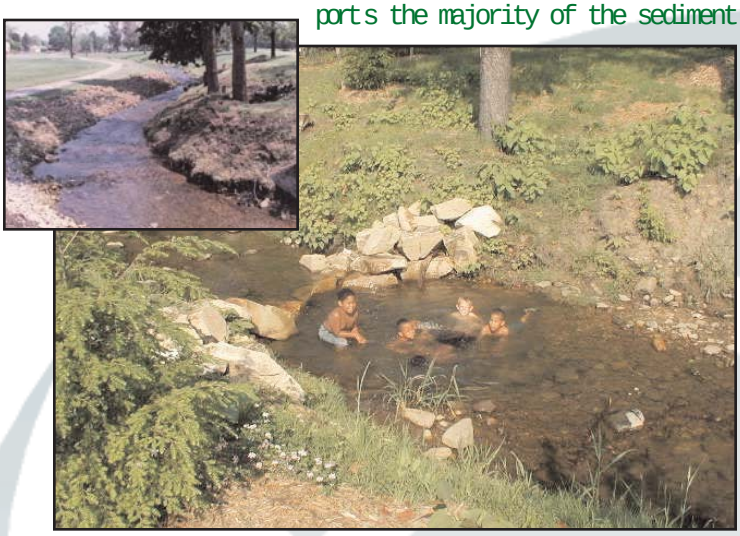
ports the majority of the sediment load over time, and therefore forms and maintains the stream channel. Flows exceeding the bankfull stage will overflow the streambanks and move out onto the floodplain.



The restoration of streams provides enhanced habitat for wildlife as well as recreational possibilities.

When developing plans to restore an impaired stream reach, similar measurements to those taken at the reference reach are made (the reference reach is selected based on similar physiographic conditions as the impaired reach). By converting the measurements taken in the reference and impaired reaches to dimensionless ratios, streams of different sizes can be compared. Areas of departure from the reference condition are noted, and the design is planned to correct these departures.

Other important stream characteristics include the width, depth, and slope of channel features such as riffles, runs, pools, glides, point bars, and other features. The measurement of the stream's geometry (sinuosity, meander wave length, amplitude, belt width, etc.) is also critical to natural channel design. Finally, the analysis of stream substrate, estimation of bankfull discharge and velocity, and the assessment of the general riparian conditions, are completed.

While the natural channel design approach may be more costly in the planning and design phases due to the data requirements of the data collection, they tend to be cheaper to implement than costly engi-

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neering alternatives, save on long-term maintenance costs, are less disruptive to downstream stream environments, and provide improved habitat for a wide variety of aquatic organisms supporting both aquatic and terrestrial ecosystems.