Article 144

Technical Note #49 from Watershed Protection Techniques. 1(4): 192-197

Sligo Creek: Comprehensive Stream Restoration

Perhaps the most comprehensive urban stream restoration project yet attempted is Sligo Creek. An urban creek that drains through Maryland's Piedmont, Sligo Creek had become severely degraded over time. An interagency team from Metropolitan Washington Council of Governments, Interstate Commission on the Potomac River Basin, Montgomery County Department of Environmental Protection, Maryland Department of the Environment, and Maryland-National Capitol Park and Planning Commission has worked for a decade to restore the stream. The restoration strategy consisted of comprehensive implementation of stormwater retrofits, instream habitat creation, riparian reforestation, and fish reintroductions (see Table 1). Biomonitoring was conducted before, during, and after each phase of the project. The project was conducted in two phases: first Wheaton Branch and then the Sligo Creek mainstem and Flora Lane tributary. Figure 1 shows the approximate location of the project's components.

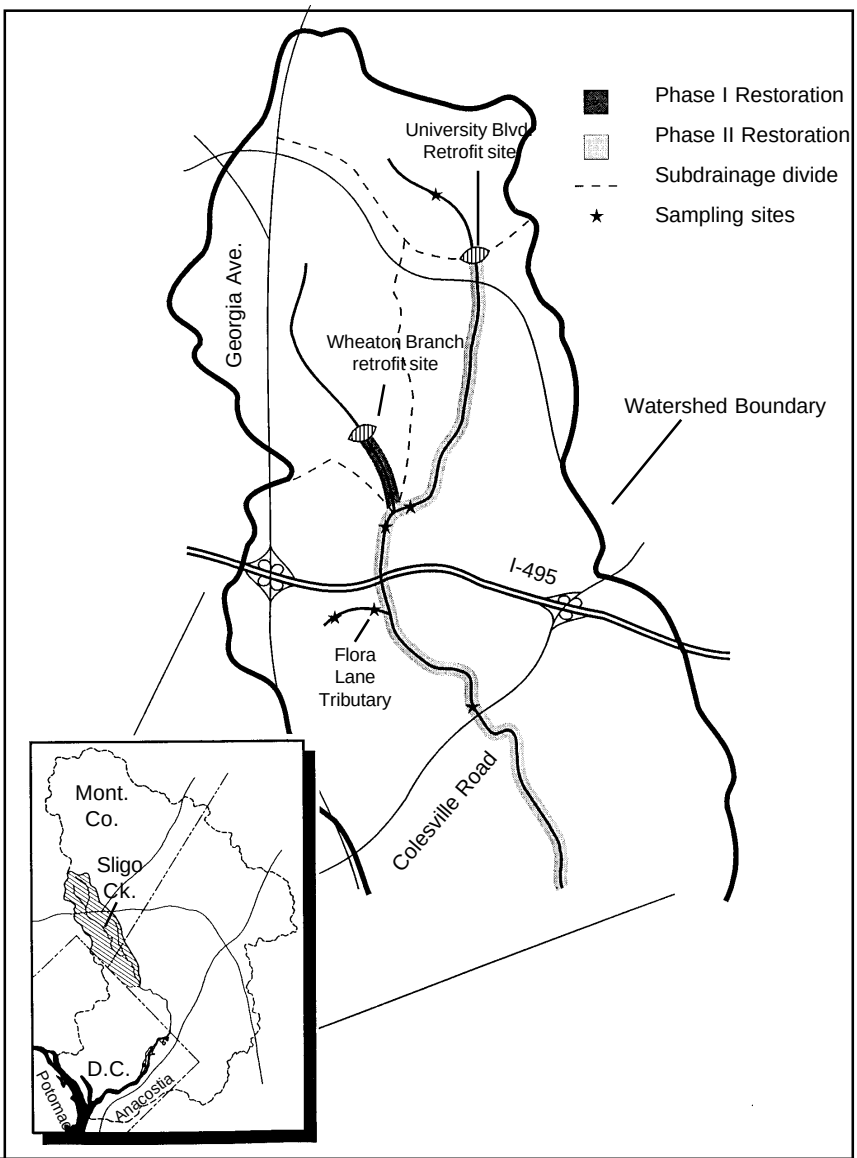

Figure 1: Vicinity Map (Galli, 1992)

Wheaton Branch

Wheaton Branch was a severely degraded urban stream. Its thousand-acre subwatershed is approximately 55% impervious. Frequent flooding had increased the stream channel width from 15 feet to as much as 86 feet (Galli and Schueler, 1992.) The streambed consisted of very large cobbles embedded in silt and clay, much of which was contaminated by petroleum hydrocarbons. Water temperatures averaged 2-7°C warmer than nearby forested streams. The aquatic community was severely degraded, with only two pollution-tolerant species of fish present: blacknose dace (*Rhinichthys atratulus*) and northern creek chub (*Semotilusatro maculatus.*) In comparison, less heavily-impacted reference streams in the Anacostia basin contained 12 to 15 fish species. Indeed, the biological quality of Wheaton Branch, as measured by the Index of Biologic Integrity (IBI), was zero prior to restoration.

The restoration of Wheaton Branch is unique in that it addressed all restoration steps in a single project. To control stormwater flows and improve water quality, an existing flood control structure was converted into a multi-cell pond/marsh system. With three interconnected pools (total surface area 5.9 acres), this retrofit detained runoff for as long as 36 hours (Figure 2). A system of weirs, pipes, and gate valves was then used to gradually release the water. Construction of the pond/marsh system was completed in June 1990.

After the stormwater retrofit pond was completed, the next step called for the replacement of nearly all functional components of the stream ecosystem within a 900-foot reach. Stone wing deflectors and boulders were installed to concentrate stream flow thereby enhancing pool/riffle areas. Notched log drop structures were used to create pools. Brush bundles, rootwads, and imbricated rip-rap were employed to stabilize banks and provide cover (Figures 3 and 4). Debris was

Table 1 (A): The Wheaton Branch "Prescription"

Location: Montgomery Co., MD
Watershed size: 1,000 acres
Degree of Imperviousness: 55 percent

Restoration Step	Application in Wheaton Branch
Control urban hydrologic regime and improve water quality	• Upstream stormwater management pond retrofit
Remove urban pollutants	• Upstream pond retrofit
Restore/create instream habitat structure	• Notched log drop structure • Imbricated rip-rap • Rootwad • Brush bundles • Boulder clusters • Single and double-wing deflectors
Stabilize channel	• Double -wing deflector • Imbricated rip-rap • Rootwad • Brush bundles
Replace/augment riparian cover	• Reforestation
Protect critical stream substrates	• Upstream pond retrofit • Wing deflectors
Recolonize Stream Community	• Fish reintroduced

Table 1 (B): The Sligo Creek "Prescription"

Location: Montgomery Co., MD
Watershed size: 8 acres (in Montgomery Co.)
Degree of Imperviousness: 36 percent

Restoration Step	Application in Sligo Creek
Control urban hydrologic regime	• Upstream stormwater management pond retrofit
Remove urban pollutants	• Upstream pond retrofit • Sewer repairs and reconstruction
Restore/create instream habitat structure	• Log drop structures • Single and double-wing deflectors • Parallel pipe
Stabilize channel	• Rip-rap • Coconut rolls • Parallel pipe
Replace/augment riparian cover	• Reforestation
Protect critical stream substrates	• Upstream pond retrofit • Wing deflectors
Recolonize stream community	• Fish reintroduced

removed from the stream and recycled for root wads and log drop structures. Boulders were carefully stacked to produce underwater crevasses for fish refuge. Beside the stream, two small vernal pool areas were excavated for amphibian habitat, and downed trees and logs were positioned to create cover for small animals. Areas adjacent to the stream were reforested using locally obtained native trees and shrubs to complete the habitat work. Species used for reforestation included red maple (*Acer rubrum*), green ash (*Fraxinus pennsylvanica*), sycamore (*Plantanus occidentalis*), tulip poplar (*Liriondendron tulipifera*), and spicebush (*Lindera benzoin*). A total of 19 different tree and shrub species were used. This work was completed in April 1991.

Once stream habitat had been improved, native fish were incrementally reintroduced (1992). Reintroduction was necessary because of downstream fish barriers. The first phase involved stocking moderately prolific species, such as the bluntnose and silverjaw minnow, white suckers, longnose dace, and the tessellated darter, that were electrofished from nearby streams and transferred to Wheaton Branch. Reintroductions were phased so that less prolific species were given a chance to become established without competition from more prolific species. Subsequent stockings were conducted in 1993 and 1994. Volunteers formed a "bucket brigade" to assist the restocking effort. See Table 2 for a partial list of reintroduced species.

Preliminary monitoring results indicate that Wheaton Branch has responded reasonably well to the project: numbers of both fish species and macroinvertebrates seem to have improved. In particular, some species that are indicators of good water quality have returned (Galli, 1995). The most dramatic improvements, however, appear to be occurring downstream of Wheaton Branch in the Sligo Creek mainstem.

Sligo Creek

Although Sligo Creek is almost entirely bordered by parkland, its 13.3 square mile watershed lies within one of the most densely populated areas in the Washington D.C. region (Bandler 1990b). Extensive development has covered over or dried up all but two of its major tributaries. Over 60% of the forest cover has been lost in the watershed since 1932. From a narrow stream of perhaps 10 to 15 foot width, Sligo had become as wide as 50 feet. While much of the mainstem of Sligo Creek had been armored with rip-rap, it also had very poor aquatic diversity: only three fish species present and an IBI score of zero.

The approach to the restoration of Sligo Creek's mainstem was generally similar to that used at Wheaton Branch. Upstream stormwater retrofits included conversion of a dry pond to a pond/marsh system providing 40 hours of extended detention. Instream habitat struc-

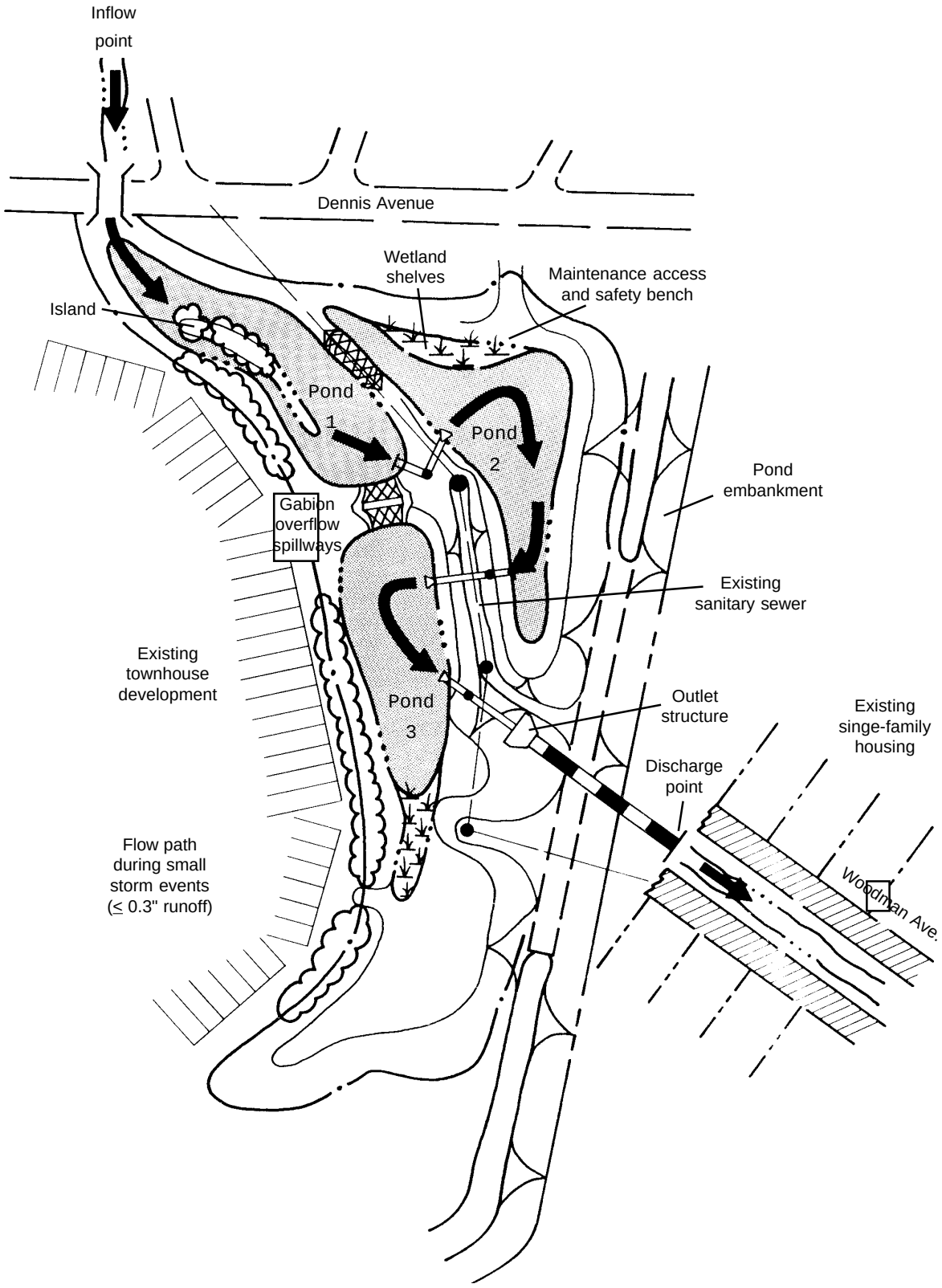

Figure 2 (A): Wheaton Branch retrofit *(Adapted from Loiederman Assoc. Inc.)*

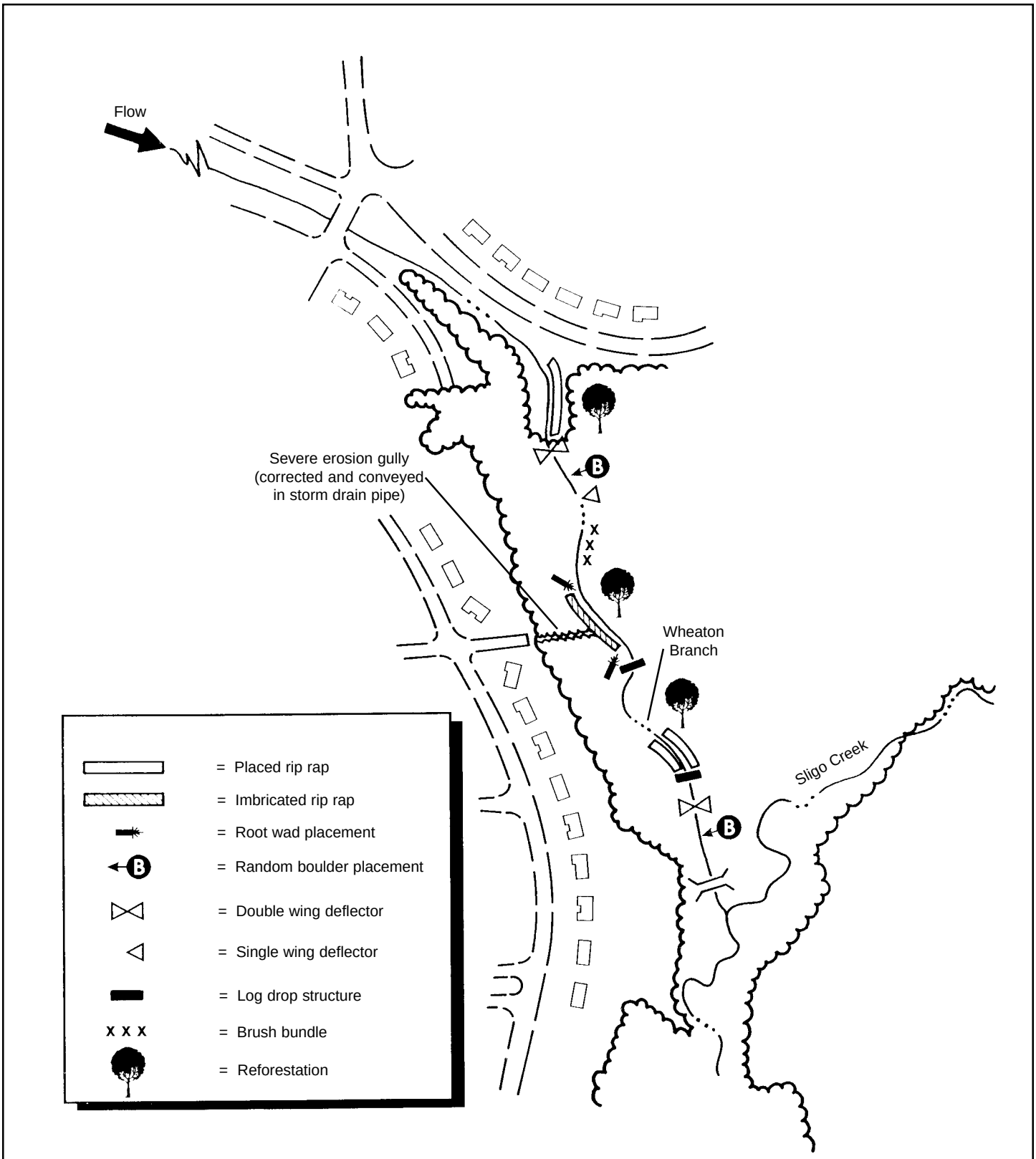

Figure 2 (B): Placement of stream restoration elements

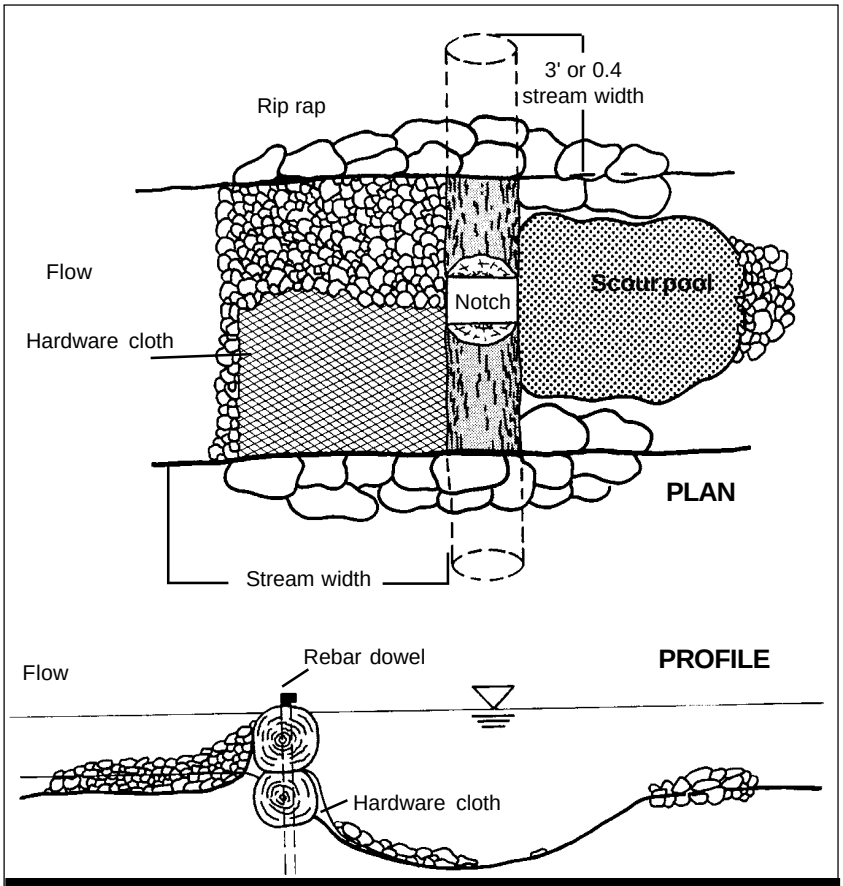

Figure 3: Typical Log Drop Structure (Galli and Schueler, 1992)

tures were installed at 19 key points along a three mile segment of the mainstem. Underutilized wet picnic grounds were considered wetland areas to provide additional habitat. Streamside reforestation is ongoing. As in Wheaton Branch, preliminary monitoring has indicated that the stream has responded well to the project: numbers of fish species seem to have improved and some species that are indicators of good water quality have returned.

Conclusions

Preliminary results at Sligo Creek and Wheaton Branch seem to indicate that by using a comprehensive approach, dramatic improvements are possible even in a highly degraded urban stream. John Galli and his colleagues continue to study the stream's long term physical, chemical, and biological response to the restoration effort. With a unique multi-year dataset covering fish, macroinvertebrates, and habitat quality, analysis of the Sligo Creek restoration will greatly enhance the literature of stream restoration.

—CAB

References

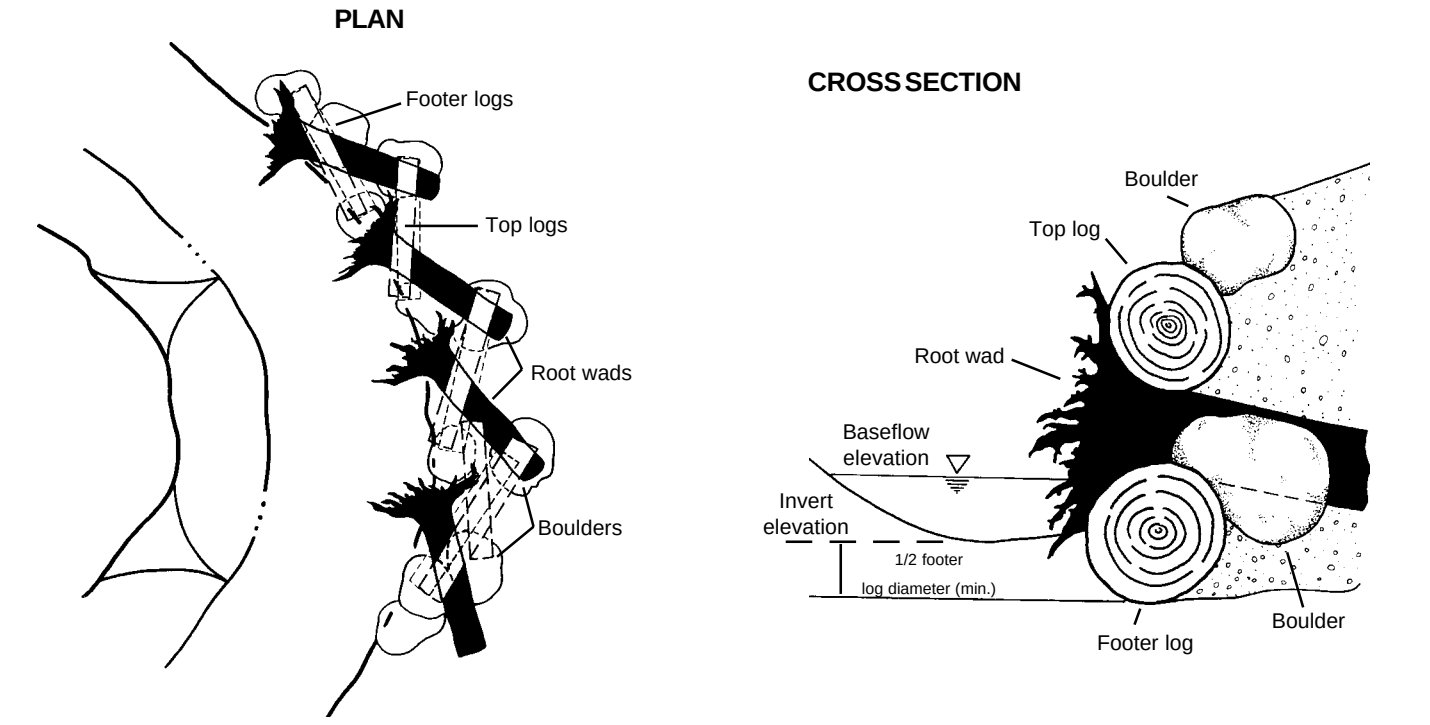

Figure 4: Root Wad Detail (Brightwater, Inc. Environmental Consulting, 1993)

Table 2: Fish Reintroduced Into Wheaton Branch and Sligo Creek

Common name *(Scientific name)*	Wheaton Branch	Sligo Creek
Bluntnose minnows (Pimephales notatus)	✓	✓
Cutlips minnow *(Exoglossum maxillingua)*	✓	✓
Silverjaw minnow *(Ericymbia buccata)*		✓
Common shiner *(Notropis cornutus)*	✓	✓
Satinfin shiner *(Notropis spilopterus)*		✓
Spottailed shiner *(Notropis hudsonius)*		✓
Swallowtail shiner *(Notropis procne)*	✓	✓
Longnose dace *(Rhinichythys cataractae)*	✓	✓
Rosyside dace *(Clinostomus funduloides)*	✓	✓
Tessellated darter *(Etheostoma olmstedi)*	✓	✓
White sucker *(Catostomus commersoni)*	✓	✓
Northern hog sucker *(Hypentelium nigricans)*	✓	✓
Bluegill sunfish *(Lepomis macrochirus)*		✓

Because the project and data analysis are ongoing, this is a partial list of reintroduced fish. *(Cummins and Stribling, 1992)*

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