Restoration of Big Bear Creek (Lycoming County, PA)

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In 1999, the Dunwoody Big Bear Hunting and Fishing Club pulled together a number of partners (including U.S. Fish and Wildlife, PA-DEP Growing Greener, and others) to restore a 3.8 mile section of Big Bear Creek (Lycoming Co., PA) using Natural Stream Channel Design, which incorporates science of fluvial geomorphology. The Big Bear Creek Watershed is 17-square miles and the project occurred in the lower 4 miles of the stream, ending at its confluence with Loyalsock Creek. Over the last half century, instability of Big Bear Creek resulted in a stream with a high width to depth ratio (W/D ratio), large areas of bank erosion (see photos), places where the stream flowed underground (6% of the stream length in 1999), and a depressed fishery dependent on stocking. The scope (plan) of the project was to stabilize the banks, restore the proper sinuosity and W/D ratio, as well as improve habitat for the fishery. Over the next three years, after the appropriate design and permitting, a total of 127 rock "cross veins" or "J hooks" were placed in the stream by contractors (see photos). The veins maintain stream velocity and increase sediment transport by concentrating flow into the center of the stream and prevent erosion by reducing pressure on the channel sides (banks).

Since 2002, when the main phase of the project was completed, the creek has been subjected to several bank-full events including Hurricane Ivan in the fall of 2004. Overall, the project design and implementation has been a success, even though sixteen of the structures have not fully held up. Many of these structures have been repaired or are in the planning stage. A 35 minute video entitled "Successful Construction Practices Applied to Natural Stream Channel Design Projects in the Mid-Atlantic Highlands" (executive producer Mr. Bill Worobec of the Dunwoody Club, filmed by Clark Media and released on December 12, 2004) is being distributed by Canaan Valley Institute (www.CanaanVi.org). The video highlights lessons learned from design, construction, and monitoring of the project. The video has a lot of educational potential for watershed groups considering projects of this type.

Upon completion of the project, permanent cross sections were installed and an "as-built" survey completed for future monitoring. In addition, the Lycoming College Clean Water Institute (CWI) has

been collecting data on water chemistry, suspended sediment, macroinvertebrates, and fish populations (using both electroshocking and snorkeling techniques) since 1999 (starting with baseline data prior to construction). The project has provided ten CWI interns with valuable field experience resulting in three Lycoming College honors projects and one Pennsylvania State University Master's thesis (see citations). Highlights of the project outcome include:

1) Increase in the percentage of riffle and pool sites (from 42% and 7% to 62% and 15%, respectively – see pie diagram). But more importantly, there has been a significant increase in deep pool habitat surface area by over 200%.

2) Improved habitat has led to an increase in macroinvertebrates (org/m^2) to densities two to three times their levels prior to restoration. Significant increases in net spinning caddisflies (Tricoptera - Hydropsychidae) and mayflies (Ephemeroptera – Ephemerellidae and Baetidae) provide a food source for trout.

3) Since 1999, the Dunwoody Club has not stocked trout in the study area. Both brook trout and brown trout are reproducing, however, as evidenced from the range in size classes of fish observed during sampling. Futhermore, trout densities (Fish/200m) have increased in some sections of the stream from 15-20 trout/200m to over 60 trout/200m. In addition, it appears that both brook and brown trout are responding to the improved habitat as documented by increased Redd density (spawning sites), population size, and growth.

Additional information on the Big Bear Creek project can be found at the CWI website under projects – "Big Bear Creek". As soon as the software gets formatted for on-line, the Keystone Stream Team website will post reference reach data for this project.

References

Holmes, N.T. 2004. *The Effects of Rosgen Style Trout Habitat Restoration on Trout Populations and Microhabitat Selection on Big Bear Creek.* Honors Project: Lycoming College Biology Department.

Kratzer, J. 2000. *The Effects of Trout Habitat Restoration and the Cessation of Stocking on Big Bear Creek*. Honors Project: Lycoming College Biology Department.

Patten, K.A. 2005. *Brook Trout and Brown Trout Habitat Use in Two Pennsylvania Streams.* A Thesis in Wildlife and Fisheries Science: The Pennsylvania State University.

Smith, G.D. 2001. *Colonization of Benthic Macroinvertebrates following Construction of Fluvial*

Geomorphologic Structures. Honors Project: Lycoming College Biology Department.

Severe Bank Erosion at Big Bear Creek prior to project

Over widened Channel with Subsurface Flow (this occurred in 6% of project area prior to restoration)

Test Run of log vein structure 1996

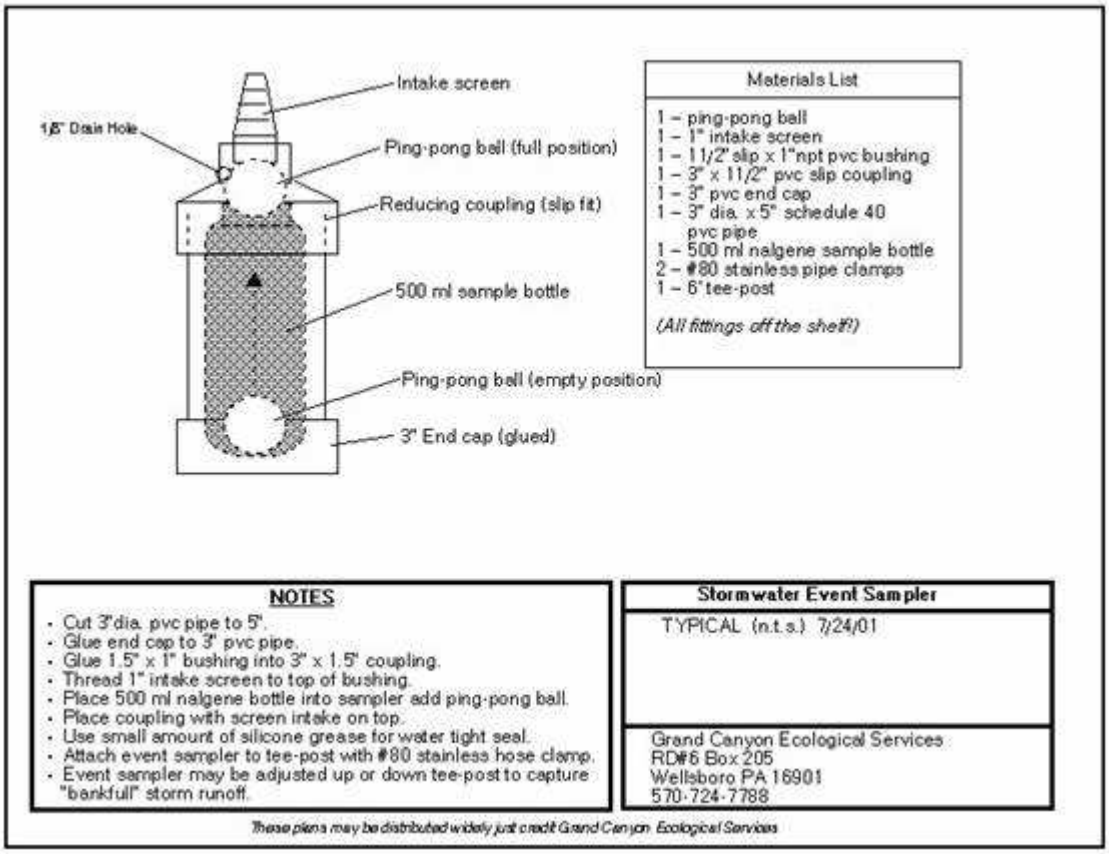
J- Hook Vein

Cross Vein

Tagged Brook Trout

Tagged Trout observed during snorkeling

Sediment samples collected before, during, and after storm event



Event Sampler design (above) and in field operation (below). Collects water for sediment analysis.

Electrofishing in Big Bear Creek