Amity Creek Geomorphology Survey, August 2004
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In August 2004, staff from the Minnesota Pollution Control Agency performed a stream geomorphology survey on Amity Creek- a designated trout stream and tributary to the Lester River, located on the northeastern border of Duluth. The selected reach started approximately 1200' upstream of the first "Seven Bridges Road" bridge upstream of Superior St. and ended at this bridge (see map).

The Level II Rosgen classification involves measuring channel bed materials and the dimension (cross sections), pattern (plan view and sinuosity), and profile (longitudinal slope and pool / riffle sequence) of the stream and its valley. This work is conducted using standard surveying equipment. The most fundamental information for characterizing stream geomorphology is the bankfull elevation, approximately equal to the 1.5 year flood, which establishes the size and shape of the channel and corresponds to the streamflow most effective at producing and carrying sediment (Leopold, 1993; Rosgen, 1996, Verry et. al, 2000). For more information on these methods see the references at the end of this document and the EPA Watershed Academy website: http://www.epa.gov/watertrain/stream_class/index.htm

The data collected allowed us to place Amity Creek in one of eight fundamental stream types (Rosgen, 1996). Additionally it will allow us to learn more about how the river transports water and sediment, and the impacts of watershed landuse on these fundamental processes.

A spreadsheet designed by Dan Mecklenburg at the Ohio Department of Natural Resources was used for most of the data analysis; it can be downloaded from: http://www.dnr.state.oh.us/soilandwater/streammorphology.htm

Amity Creek fits the typical mold of a North Shore stream: rocky stream bottom; steep slopes, low sinuosity, and deep entrenchment in its valley (or flood-prone area). The study reach had several large pools that showed a definite difference in substrate from the riffles. This reach was also unique because of the predominance of bedrock and rock canyons, which made it difficult to determine some of the features necessarvy for classification at Rosgen Level II. Fortunately, other areas that were not as rocky provided enough information to make judgments about the stream type.

At the time of the survey Amity was at low flow, but remnants of a very large flood were found, likely the July 4th, 1999 storm that caused the catastrophic BWCA blow-down. Rainfall estimates from this storm were about 6 inches in Duluth, somewhere between a 100 to 500 year storm event. According to data from the US Geological Survey, the Knife River (approximately 15 miles NE) reached its highest streamflow on record on July 5, 1999- 9,100 cubic feet per second (cfs). For comparison, the median streamflow at the Knife River over the 30 year period of record is 23 cfs and the previous highest streamflow was 7,440 cfs on May 10, 1979.

Figure 1. Debris from the July 4, 1999 storm well above the 50 year flood elevation The vegetative debris in this tree branch on August 23, 2004, is likely from the July 4th storm and is situated about 4 feet above the water surface level, and about 2 feet above the estimated 50 year flood elevation (the elevation where the photo was taken).

This section of Amity Creek types out to be a B4 stream, a gravel-bedded stream with moderate entrenchment, width/depth ratio and sinuosity. Given the large amount of bedrock in the channel and adjacent floodplain, the river should be considered quite stable *at this particular reach.* This type of work should be done regularly in order to ensure stability in the future and track potential changes.

Figure 2. Low Flow Conditions at time of survey. Bedrock canyon wall, which provides stability and entrenchment, visible in background.

Selected References:

Leopold, L. 1994. *A View of the River*. Cambridge, MA. Harvard University Press. 298 p.

Rosgen, D. 1996. Applied *River Morphology*. Pagosa Springs, CO. Wildland Hydrology Press. 376 p.

Verry, E.S., J.W. Hornbeck and C.A. Dolloff eds. 2000. *Riparian Management in Forests of the Continental Eastern United States*. CRC Press, Boca Raton, FL. 402 p.