



Section 319

NONPOINT SOURCE PROGRAM SUCCESS STORY

Pennsylvania

Abandoned Mine Drainage Treatment Restores Drinking Water Source

Waterbody Improved

Lloydville Run is the local name for an unnamed tributary (UNT) to Bells Gap Run, which has been subject to historic strip mine and deep mine coal extraction, resulting in impaired water quality because of acid mine drainage (AMD). Pennsylvania's Department of Environmental Protection (PADEP) added Lloydville Run to Pennsylvania's 2002 Clean Water Act (CWA) section 303(d) list of impaired waters for metals, pH and siltation. Water quality improved after PADEP's Bureau of Abandoned Mine Reclamation (BAMR) installed a network of treatment systems designed to remove metals and neutralize the acidity of the inflowing water. As a result, PADEP expects to remove this 2.77-mile segment of Lloydville Run from the state's 2010 CWA section 303(d) list of impaired waters.

Problem

Lloydville Run (Figure 1) flows south near the boundary of Pennsylvania's Cambria and Blair counties before emptying into Bells Gap Run, which flows into the Little Juniata River near Altoona. The headwaters flow through state-owned game lands that contain several abandoned strip and deep coal mines that contribute AMD to Lloydville Run. PADEP added the creek to the 2002 CWA section 303(d) impaired waters list because it was not meeting water quality criteria for metals, pH and siltation and was unable to support its aquatic life designated use.

AMD forms when the iron sulfide mineral pyrite in the mines is exposed to water and air, and a chemical reaction occurs that produces acidic water (low pH). The acidic water can leach various contaminants from rocks in abandoned mines, including metals that can pollute drinking water and endanger aquatic life such as macroinvertebrates and fish. Often, contaminants such as aluminum, iron and manganese are found at toxic levels. Depending on the circumstances, the pollutant that poses the biggest concern at one site might not be an issue at another site, further complicating the problem.

Because AMD contributes to widespread acidic water when it flows into surface water or groundwater, restoring an impaired stream can be challenging.



Photo courtesy of Kay Spyker, PADEP BAMR

Figure 1. Lloydville Run in November 2008.

In general, the goal is to get metals to drop out of solution by neutralizing the water's pH. This is done by adding alkalinity to the source of AMD.

Project Highlights

PADEP BAMR designed three treatment systems and a land-reclamation site to clean up the discharges along Lloydville Run. The agency finished constructing the treatment systems in the fall of 2001. The project included 18 acres of bare earth revegetation above the treatment sites.

The network of treatment systems includes an anoxic limestone drain, a limestone vertical flow pond, sediment ponds, and aerobic and anaerobic wetlands. The treatment system series covers an area of approximately 7 acres. To address specific water chemistry issues, BAMR also implemented passive treatment features to address several acidic seeps from abandoned coal extraction areas. Improved water quality in Lloydville Run and Bells Gap Run benefits Bellwood Reservoir, a downstream water source for the Altoona Water Authority.

Results

Monitoring data collected at a sampling location on Lloydville Run downstream of the treatment systems and land reclamation show that the pH level increased from an average of 4.10 in 2000 to 6.92 in 2007 (Figure 2). Metal concentrations at the location also dropped significantly over the same period. Manganese dropped by 80 percent, aluminum by 67 percent and iron by 59 percent. Monitoring data collected between 2005 and 2007 show that metal concentrations meet water quality standards (Table 1).

In addition, PADEP biologists have documented healthy populations of macroinvertebrates. All sites sampled throughout the Bells Gap Run watershed in 2008 produced Index of Biologic Integrity (IBI) values ranging from 66.4 to 94.4. An IBI value of 63 or greater indicates good water quality and supports removing a stream from the CWA 303(d) list. PADEP expects to remove a 2.77-mile segment of Lloydville Run (UNT to Bells Gap Run) from that list for pH and metals in 2010.

Partners and Funding

Partners involved in restoring the watershed include Environmental Alliance for Senior Involvement (EASI), BAMR, and the Altoona Water Authority. EASI performed the original water quality

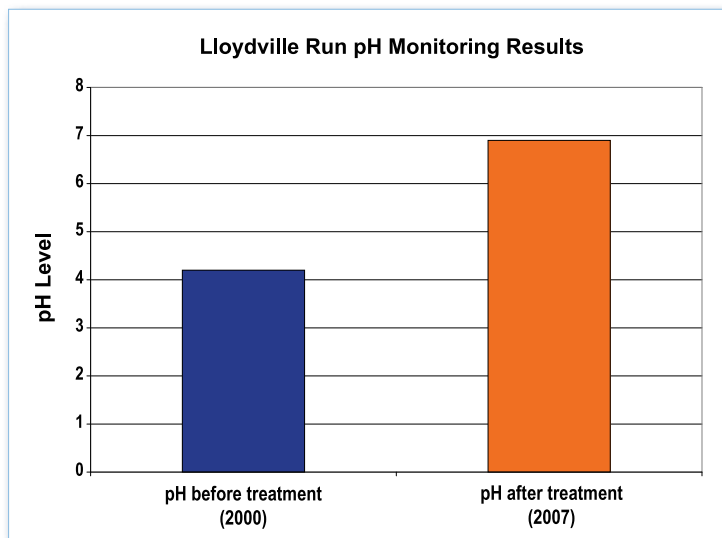


Figure 2. Increase in pH in Lloydville Run from 2000 to 2007 as a result of land treatment.

Table 1. Measured reductions in metal concentrations in Lloydville Run

Metal	2000 average measured concentration (mg/L) ¹	2005–2007 average measured concentration (mg/L)	Water quality criteria maximum (mg/L)
Aluminum	2.7	0.64	0.75
Manganese	2.6	0.48	1.00
Iron	1.5	0.4	1.50

¹ mg/L: milligrams per liter

monitoring. Although the organization disbanded locally, many of the same volunteers continue to monitor the watershed. The project's total cost was \$503,970. PADEP's Growing Greener Program provided \$337,515 and the U.S. Department of Interior Office of Surface Mining's Clean Streams Initiative funded the remaining \$166,455.



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