NONPOINT SOURCE SUCCESS STORY

Alabama

Addressing Acid Mine Drainage Improves Water Quality in Black Branch and Cane Creek

Waterbodies Improved

High acidity in discharge from abandoned mines led to increased metal levels and low pH in Black Branch and Cane Creek, which in turn degraded aquatic habitat. As a result, Black Branch and Cane Creek were added to Alabama's 1998 Clean Water Act (CWA) section 303(d) list of impaired waters for metals, pH, siltation and other habitat alteration. Cane Creek was added for metals, pH, nutrients, siltation and organic enrichment/dissolved oxygen. Several federal and state agencies collaborated to remediate acid mine drainage in the watershed, partially restoring Black Branch and fully restoring Cane Creek. As a result, Alabama removed Black Branch for siltation and metals, and Cane Creek for metals, nutrients, pH, organic enrichment and siltation, from the 2014 list of impaired waters.

Problem

The 4.11-mile-long Black Branch (segment AL03160109-0404-500) is a tributary to the 18.02-mile-long Cane Creek (three segments: AL03160109-0404-101, -102 and -103) in the Black Warrior River Basin in central Alabama. Cane Creek flows through the town of Oakman in Walker County (Figure 1). The Black Branch–Cane Creek watershed consists of rural, forested land with agriculture and abandoned surface mining areas.

Black Branch has a long history of underground coal mining beginning in 1920. Abandoned mines in the Black Branch–Cane Creek watershed discharged highly acidic water into Black Branch, which created a mixing zone at the confluence of Black Branch and Cane Creek that degraded aquatic habitat and water quality.

In 1997 the Alabama Department of Industrial Relations (ADIR) developed the *Cane Creek Acid Mine Drainage (AMD) Remediation Project, Walker County, Alabama, Environmental Assessment*, which noted the streams were devoid of fish and plants and that the AMD drainage had a corrosive effective on the streams. Because of these conditions, Black Branch and Cane Creek were placed on the state of Alabama's CWA section 303(d) list of impaired waters in 1998 for metals, pH, other habitat alteration and siltation. Remediating Black Branch was essential for fully restoring Cane Creek and improving the water quality in Black Branch itself.

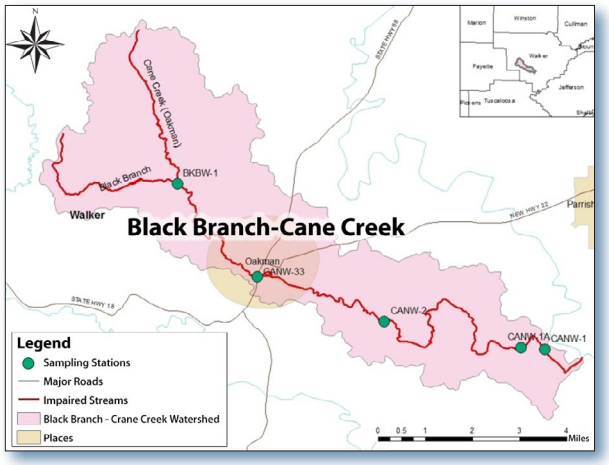

Figure 1. The Black Branch–Cane Creek watershed is in central Alabama.

Project Highlights

The Black Branch Watershed Management Plan (WMP) was written in 2005 to identify ways to reduce the amount of AMD entering the stream. The plan's first objective was to back-fill a collapsed mine subsidence with limestone riprap to protect the safety of site visitors. A secondary objective was to remediate the gob pile (mining overburden) by relocating a portion of the pile and covering the remaining part with one to two feet of soil. Finally, a passive water treatment consisting of a vertical flow system was constructed to improve water quality in Red Branch, a tributary to Black Branch. Restoration occurred from June 2006 to May 2011 (Figure 2).

Figure 2. Watershed sites before (in 2006, top) and after (in 2011, bottom) restoration occurred.

Results

Implementing the recommendations outlined in the Black Branch WMP helped decrease AMD. Water quality data collected in 2012 by ADEM showed increases in pH compared to before restoration. Furthermore, all the pH readings collected in 2012 fell within ADEM's water quality standards criteria requiring pH to be between 6.0 and 8.5 (Table 1). The pH values improved over the course of the project. No violations occurred at any of the three stations in reference to EPA's recommended iron criteria. In addition, all stations showed compliance with the 90th percentile eco-reference guideline for iron. With respect to aluminum, all three stations reported exceedances of EPA's recommended aluminum criteria; however, all three stations median values were below the 90th percentile eco-reference guideline for aluminum (see Table 1). Turbidity data collected in 2012 was below ADEM's water quality criteria of 50 NTU above background. Furthermore, median turbidity and total dissolved solids concentrations are below the eco-reference 90th percentile; therefore, the numeric data meets criteria and indicates low sediment levels. After examining available water quality data and information provided for Cane Creek, ADEM determined that impairment due to metals, nutrients, pH, organic enrichment, and siltation does not currently exist. Black Branch is no longer impaired for siltation and metals. As a result, ADEM removed both Cane Creek and Black Branch from Alabama's 2014 CWA 303(d) list.

Partners and Funding

The Black Branch WMP, written by the Black Warrior Clean Water Partnership for the ADIR, addressed the implementation of the Black Branch Watershed Project. All construction and remediation was done under the supervision of ADIR's Mining and Reclamation Division, Abandoned Mine Lands Program.

EPA and ADEM contributed $255,000 in CWA section 319 funds, which supported safety measures to control erosion through the use of rip-rap, remediation materials for the gob pile, and clearing and reshaping the gob pile. The Abandoned Mine Land Reclamation Program within ADIR's Mining and Reclamation Division contributed $810,152 to remediate the gob pile, construct the passive treatment system for Red Branch, and conduct water quality monitoring of the site before and after construction. They also led educational programs on the site. The Black Warrior Clean Water Partnership compiled the Black Branch WMP for the ADIR as an in-kind service.

Table 1. Before (1988/1996) and after (2012) implementation data collected at Station CANW-33 (CC-1).

	Fe Dissolved		Fe Total		Al Dissolved		Al Total		DO (mg/L)		pH (s.u.)	
	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
Minimum	0.004	0.019	0.04	0.065	0	0.043	0.02	0.043	3.3	6.08	4.2	7.49
Maximum	297	0.04	76.5	0.143	53	0.078	75.4	0.286	7.7	9.08	8.2	8.02
Mean	46.18	0.022	14.57	0.111	9.32	0.054	11.13	0.1159	5.28	7.84	5.86	7.726
Median	0.49	0.019	0.74	0.096	0.06	0.053	0.1	0.098	4.6	7.97	6	7.78
75th %	1.14	0.021	26.6	0.139	0.12	0.058	2.25	0.1123	5.2	8.29	6.5	7.85
90th %	174.7	0.03	42.66	0.179	41.5	0.067	33.16	0.1859	7	8.93	7.22	8.002
Eco Ref 90%	0.588	0.588	0.1046	0.1046	0.1	0.1	0.3055	0.3055	6.79	6.79	7.84	7.84

Note: EPA criteria are Fe < 1 mg/L and AL < 0.0857 mg/L

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