



NONPOINT SOURCE SUCCESS STORY

Tennessee

Acid Mine Drainage Abatement Projects Continue to Improve Water Quality in the Crab Orchard Creek Watershed

Waterbodies Improved

In 1998 Crab Orchard Creek and Laurel Creek were listed as impaired due to acid mine drainage (AMD). Between 2006 and 2011, the Tennessee Department of Environment and Conservation (TDEC) and the Tennessee Department of Agriculture (TDA), with support from a Clean Water Act (CWA) section 319 grant, restored portions of the watershed adversely impacted by legacy mining. In 2010, a 2.3-mile segment of Crab Orchard Creek had improved and was delisted by TDEC. The reclamation activities are still paying dividends, as an additional 7.9 miles portion of Crab Orchard Creek and 3.7 miles of Laurel Creek were delisted by TDEC in 2014. Through the state of Tennessee's Agricultural Resources Conservation Fund (ARCF) support, additional best management practices (BMPs) are being installed throughout the watershed to protect newly restored segments of Crab Orchard Creek and Laurel Creek, and to benefit segments still in need of restoration.

Problem

Crab Orchard Creek (TN06010208020-3000) and Laurel Creek (TN06010208020-0700) are within the Crab Orchard Creek watershed (060102080406) in Morgan County, Tennessee (Figure 1). Laurel Creek flows into Crab Orchard Creek, which flows into the Emory River.

In 1982, 22 miles of Crab Orchard Creek were included on the Nationwide Rivers Inventory for exceptional scenery, recreation, geology, fish and wildlife values. Crab Orchard Creek watershed (including Laurel Creek) was included on Tennessee's 1998 CWA section 303(d) for impairments for pH and siltation due to abandoned mines. Field data collected by TDEC in 1999–2000 indicated that Crab Orchard Creek (TN06010208020-3000) was impaired for pH, metals and manganese, while Laurel Creek was impaired for pH alone. A pH total maximum daily load (TMDL) was developed for the Crab Orchard Creek watershed in 2001, which indicated that resource extraction (i.e., mining activities) were the cause of impairment to both Crab Orchard Creek and Laurel Creek. Tennessee's Fish and Aquatic Life criteria pH range of 6.5 to 9.0 (the most stringent) was chosen as the criteria for the Crab Orchard Creek watershed in the TMDL. Samples tested between October 1999 and June 2000 indicated pH values for Crab Orchard Creek ranged from 4.0 to 6.5; the pH in Laurel Creek ranged from 4.5 to 5.7.

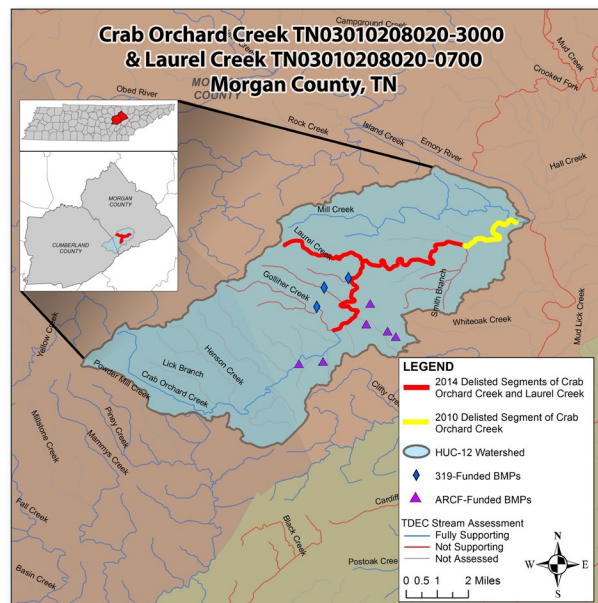


Figure 1. Crab Orchard Creek and Laurel Creek are in central Tennessee.

Project Highlights

Mine reclamation and AMD treatment efforts were initiated by TDEC using a 2005 CWA section 319 grant. Between 2006 and 2010, TDEC installed eight AMD treatment systems/ponds and reclaimed 57 acres of previously mined lands (Figure 2). These restoration efforts contributed to the removal of

Photograph courtesy of TDA and TDEC.



Figure 2. Mining land area before and ten years after reclamation activities were performed.

a downstream segment of Crab Orchard Creek (TN06010208020-2000) from Tennessee's 2010 list of impaired waters.

In addition to addressing pollution from mining lands, partners have been working to control agricultural sources of pollution for many years. As early as 2002, partners began installing agricultural BMPs in the watershed. In total, through the support of ARCF, 37 BMPs to reduce agricultural pollutants were installed in the Crab Orchard Creek watershed in 2002–2016. The practices included exclusion fencing, alternative watering facilities, livestock heavy use areas and cropland conversion.

Results

The pH of Crab Orchard Creek was analyzed in April–June of 2014. The pH levels ranged from 6.10 to 7.24 during the sampling period (meeting the applicable criteria), indicating a considerable improvement from previous observations.

Manganese concentrations varied from 48 micrograms per liter ($\mu\text{g/L}$) to 600 $\mu\text{g/L}$; four of the six observations showed concentrations less than 200 $\mu\text{g/L}$. Previous concentrations of manganese in Crab Orchard Creek, observed in 1999 and 2000 during the development of the Crab Orchard Creek TMDL, were as high as 7,480 $\mu\text{g/L}$. During the 1999–2000 sampling period, only one manganese sample in Crab Orchard Creek had concentrations under 200 $\mu\text{g/L}$.

In addition, benthic invertebrates were sampled in 2012 by TDEC, and a Tennessee Macroinvertebrate Index (TMI) was calculated to determine if the remaining manganese was causing a condition of pollution. The TMI yielded scores of 36 and 32; a score of 32 or higher is considered passing for biocriteria guidelines.

As a result of these data, an additional 7.9 miles of Crab Orchard Creek (TN06010208020-3000; immediately upstream from the segment delisted in 2010) and 3.7 miles of Laurel Creek (TN06010208020-0700) were removed from Tennessee's 2014 impaired waters list. The delisting of these two additional watershed segments illustrates that the installation of the AMD treatment systems and mine reclamation continues to provide water quality benefits.

Partners and Funding

The lead organization on the project was the Land Reclamation Section of TDEC's Division of Water Resources, which was awarded a CWA section 319 grant totaling \$409,200. TDEC provided \$209,800 in matching funds to assist with the construction of the mine reclamation and treatment systems. Additional support was provided by the Crab Orchard Creek Restoration Partnership (COCRP), which consisted of organizations and nongovernmental agencies dedicated to removing Crab Orchard Creek and its tributaries from the impaired waters list. Partners within COCRP included TDEC, Tennessee Valley Authority, Emory River Watershed Association, Morgan County, Oakdale School, U.S. Department of Agriculture–Natural Resources Conservation Service (NRCS), Tennessee Wildlife Resources Agency, University of Tennessee, Tennessee Scenic Rivers Association, and Chota Canoe Club. Members of the COCRP provided technical assistance, community outreach/education, and monitoring.

In addition to the AMD remediation supported by the section 319 grant, Tennessee's ARCF provided \$80,878 to help implement 37 agricultural BMPs. The U.S. Fish and Wildlife Service and NRCS are also currently active in the watershed, supplying cost-share opportunities and technical assistance for additional BMPs protective of water quality. Installing agricultural BMPs is critical in the Crab Orchard Creek watershed to prevent newly restored segments from being overburdened by other pollutant sources.



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For additional information contact:

Sam Marshall
Tennessee Department of Agriculture
Land and Water Stewardship Section
615-837-5306 • Sam.Marshall@tn.gov