NONPOINT SOURCE SUCCESS STORY

Oklahoma

Water Quality Improves in Alabama and Bad Creeks

Waterbody Improved

Alabama and Bad creeks were placed on Oklahoma's Clean Water Act (CWA) section 303(d) list of impaired waters in 2002, 2010, and 2012 for bacteria, salts, and dissolved oxygen (DO). Pollution from grazing lands and historic oil and gas activities contributed to these impairments. Implementing conservation practice systems (CPs) and restoring abandoned petroleum sites decreased chloride, total dissolved solids (TDS) and *Escherichia coli (E. coli)* and improved DO levels. As a result, Oklahoma removed the chloride and TDS impairments in 2006 and 2018, *E. coli* impairments in 2014, and the DO impairment in 2018 from its CWA section 303(d) lists. Alabama Creek and Bad Creek now fully support their agricultural (AG) and partially support their primary body contact (PBC) designated beneficial uses. Bad Creek fully supports and Alabama Creek partially supports the warm water aquatic community (WWAC) beneficial use.

Problem

The Alabama and Bad creek watersheds cover 40,924 acres in Okfuskee and Okmulgee counties in Oklahoma (Figure 1). Land use in the watersheds is mainly grasslands (43 percent) and forest (49 percent). Petroleum production peaked in the early 1900s but has since declined, resulting in numerous abandoned wells and salt-scarred areas. In 2002, challenges with grazing land management and historic oil field activities contributed to listing the streams as impaired by chloride when 25 percent of Alabama Creek samples and 14 percent of Bad Creek samples exceeded the chloride standard. A stream is considered impaired by chloride if more than 10 percent of samples exceed the historic yearly mean concentration of area streams (334 milligrams per liter (mg/L)). Also in 2002, 13 percent of Bad Creek DO readings fell below the criteria. Impairment results if more than 10 percent of samples fall below 6.0 mg/L from April 1 through June 15 or below 5.0 mg/L during the remainder of the year. More than 33 percent of TDS samples in Alabama Creek were above the yearly mean standard in 2002. Streams in this area are considered to violate the TDS standard if more than 10 percent exceed the historic yearly average concentration of 1030 mg/L. Concentrations of *E. coli* exceeded allowable limits in 2010 in Alabama Creek and 2012 in Bad Creek when the geometric mean of recreation season samples were 165 and 158 colony forming units per 100 milliliters (CFU/100 mL). A stream is considered impaired for *E. coli* if the geometric mean is greater than

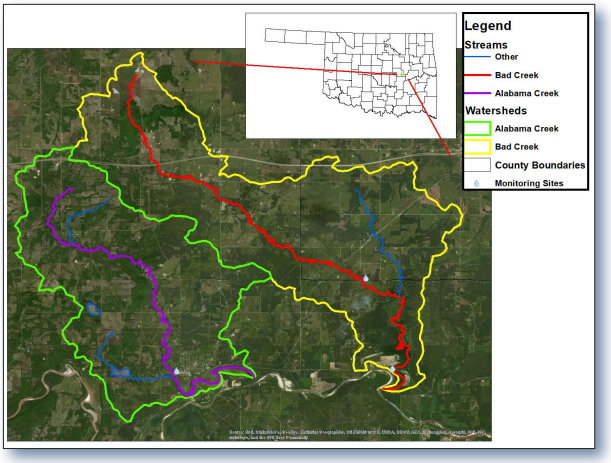

Figure 1. The Alabama and Bad creek watersheds drain to the North Canadian River, approximately 48 river miles upstream of Lake Eufaula.

126 CFU/100 mL. Based on these results, Oklahoma added segments OK520500010200_00 (14.2 miles) and OK520500010170_00 (19.1 miles) to the 2002, 2010, and 2012 CWA section 303(d) lists for nonattainment of the AG, WWAC and PBC designated beneficial uses.

Story Highlights

Landowners in the watershed worked with the Okfuskee and Okmulgee county conservation districts (CCDs), the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS), the Oklahoma Conservation Commission (OCC), and the University of Oklahoma (OU) to implement CPs through NRCS's

Environmental Quality Incentives Program (EQIP), Conservation Stewardship Program, and general conservation technical assistance program; the OCC's Locally Led Cost Share Program (LLCP); and with funding from the U.S. Environmental Protection Agency (EPA) CWA Section 319 Program.

From 1992 to 2018, landowners improved grasslands, which reduced runoff of sediment, salts, bacteria and other pollutants by decreasing erosion and better utilizing available grazing lands. Also, several partners including OU, Okmulgee CCD, NRCS, and OCC completed an EPA CWA section 319 project in the Clearview subwatershed of Alabama Creek in 1999. This project reclaimed a salt-scarred area by removing and remediating soil and establishing more salt-tolerant vegetation. Finally, between 2003 and 2018, the Oklahoma Energy Resources Board (OERB) restored 28 abandoned petroleum production sites in the watershed, removing relic equipment, remediating soils, restoring topography, and revegetating the landscape. Specific CPs included conservation crop rotation (120 acres [ac]), conservation cover (19 ac), upland wildlife habitat management (151 ac), pest management (1,896 ac), brush management (2,139 ac), forage harvest management (1,146 ac), forage and biomass planting (1,010 ac), prescribed grazing (6,947 ac), and nutrient management (3,209 ac). Partners also installed one water well and 36 ponds.

Results

The OCC documented improved water quality in Alabama and Bad creeks through its Rotating Basin Ambient Monitoring Program. Chloride exceedances had dropped to less than 10 percent in Bad Creek by 2006 and less than 5 percent in Alabama Creek by 2018. TDS concentrations dropped below 5 percent by 2006. Also, by 2006 Bad Creek DO levels had improved to less than 10 percent exceedances. Drought conditions captured in the 2016 assessment contributed to relisting for DO; however, data assessed in 2018 shows that it meets standards. By 2014, the geometric mean measurements for *E. coli* had dropped to 93 and 123 CFU/100 mL in Alabama and Bad creeks, respectively (Figure 2). Based on these data, Oklahoma removed Alabama Creek from the CWA section 303(d) list for TDS in 2006, *E. coli* in 2014, and has recommended delisting chloride in 2018. Bad Creek was delisted for chloride in 2006, *E. coli* in 2014, and is recommended for delisting for DO in 2018. Alabama and Bad creeks

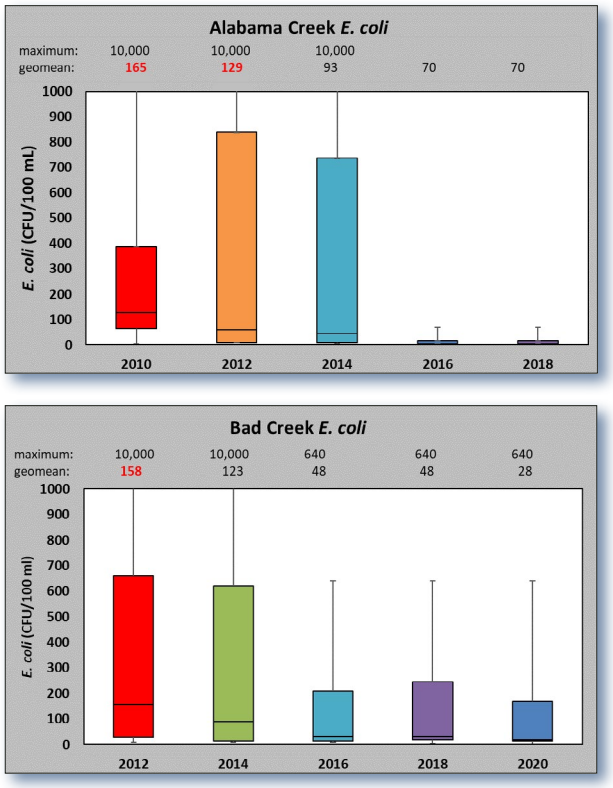

Figure 2. *E. coli* concentrations in Alabama Creek (top) and Bad Creek (bottom) declined as CPs were installed.

now fully support their AG and partially support their PBC beneficial use. Alabama Creek partially supports and Bad Creek fully supports the WWAC beneficial use.

Partners and Funding

The OCC monitoring program is supported by EPA CWA section 319 funding at an average annual cost of $1 million. Approximately $500,000 in EPA 319 funds support statewide water quality educational efforts through Blue Thumb. Approximately $521,766 of these federal and state matching funds have been devoted to Alabama and Bad creeks. From 1992 to 2018, NRCS supplied more than $93,000 for CP implementation through EQIP. The OCC, OU, and Okmulgee CCD utilized $150,000 CWA 319 funds matched by $104,311 of state funds on the Clearview Creek remediation project. OERB devoted more than $479,688 toward abandoned petroleum site remediation. Finally, the OCC, CCDs, and landowners funded more than $13,696 worth of CPs, at least $8,196 of which was funded by landowners through the LLCP.

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