



Section 319

NONPOINT SOURCE PROGRAM SUCCESS STORY

Oklahoma

Installing Best Management Practices Improves Clear Creek

Waterbody Improved

Low dissolved oxygen (DO) and high fecal bacteria levels caused Oklahoma to place Clear Creek on the state's Clean Water Act (CWA) section 303(d) list of impaired waters for DO (in 2002) and *Enterococcus* bacteria (in 2008). Impairment was due in part to practices associated with widespread livestock and wheat production. Implementing best management practices (BMPs) to promote better quality grazing land and cropland decreased sediment, nutrient and bacteria runoff into the creek. Water quality improved, prompting Oklahoma to remove Clear Creek from the 2010 CWA section 303(d) list for the DO and *Enterococcus* impairments.

Problem

Clear Creek (Figure 1), in northwestern Oklahoma's Beaver County, is a 24-mile-long tributary to the Beaver/North Canadian River. Land use in the watershed includes mostly cattle and wheat production. Poor grazing land and cropland management, as well as a lack of healthy riparian buffer areas, contributed to excess sediment, nutrient and bacteria runoff in the watershed. Excess nutrients, in turn, can lead to the overgrowth of nuisance algae, and the subsequent breakdown of the algae can cause DO levels to decrease.

Water quality assessments in 2002 showed that 30 percent of samples in Clear Creek fell below (i.e., did not meet) state DO criteria for warm-water aquatic communities. A waterbody is considered impaired if more than 10 percent of samples (based on no more than five years of data before the assessment year) fall below 6.0 milligrams per liter (mg/L) from April 1 through June 15 or below 5.0 mg/L during the remainder of the year. On the basis of these assessment results, Oklahoma added Clear Creek to the 2002 and subsequent CWA section 303(d) lists for failing to support the fish and wildlife propagation designated use due to DO impairment.

In addition, water quality assessments in 2008 showed that the geometric mean for *Enterococcus* bacteria was 60 colony forming units (CFU) per 100 milliliters water. *Enterococcus* species are bacteria common in animal waste and can cause human illness. Waterbodies with a geometric mean above 33 CFU during the recreation season (May 1–Sept. 30) are considered impaired for primary body contact recreation. As a result, Clear Creek was also placed on the CWA section 303(d) list for *Enterococcus* impairment in 2008.



Figure 1. Clear Creek flows through agricultural land in northwestern Oklahoma.

Project Highlights

Landowners implemented BMPs with assistance from Oklahoma's locally led cost-share program and through the local Natural Resources Conservation Service (NRCS) Environmental Quality Incentives Program, No-Till Local Emphasis Area program, Conservation Stewardship Program, Conservation Reserve Program and general technical assistance program. These projects focused on controlling erosion and reducing nutrients and bacteria in runoff. Because Clear Creek is in the Beaver and Cimarron River NRCS Local Emphasis Area, some projects have focused on increasing the amount of water flow in these rivers, primarily through removal of brush species. Increased water flow can lead to increased DO levels.

From 2005–2011, producers in the Clear Creek watershed implemented BMPs to address cropland

erosion, including planting 3,046 acres of cover crops; adding 1,775 acres in conservation crop rotation; installing 60,075 feet of terraces and 155 acres of grassed waterways; and using no-till, strip-till, mulch-till or deep-till on 6,306 acres. Harvest management occurred on 609 acres of cropland, with forage planting on 155 acres. To improve the condition of grazing lands, and thus reduce erosion, producers implemented prescribed grazing on 2,311 acres and developed nutrient management plans for 6,649 acres. Producers planted supplemental range vegetation on 230 acres, improved upland wildlife habitat management on 1,554 acres, conducted brush management on 246 acres and established integrated pest management on 5,592 acres. Five wells and 10 watering facilities were installed to provide alternative water supplies to livestock.

Results

The Oklahoma Conservation Commission's Rotating Basin Monitoring Program, a statewide nonpoint source ambient monitoring program, documented improved water quality in Clear Creek after restoration efforts. Implemented practices and the accompanying education of landowners helped reduce nutrients entering the stream, which in turn improved levels of DO because algae were less likely to be overgrown and die off.

To meet state DO criteria for warm-water aquatic communities, Clear Creek samples may not fall below critical DO levels (5.0 or 6.0 mg/L, depending on the season) more than 10 percent of the time. Data collected for the 2010 and 2012 assessments showed that only five percent of samples fell below the critical DO level, which met state DO criteria (Figure 2). In addition, water quality assessment data showed that the *Enterococcus* geometric mean fell from a high of 60 CFU in 2008 to 28 CFU in 2010, which meets the state criteria of 33 CFU (Figure 3). On the basis of these data, Oklahoma removed Clear Creek from the 2010 CWA section 303(d) list for the DO and *Enterococcus* impairments. Clear Creek fully supports its designated uses.

Partners and Funding

The Rotating Basin Monitoring Program, which includes both fixed and probabilistic components, is supported with U.S. Environmental Protection Agency (EPA) CWA section 319 funds at an average annual cost of \$1 million. Monitoring costs include personnel, supplies and lab analysis for

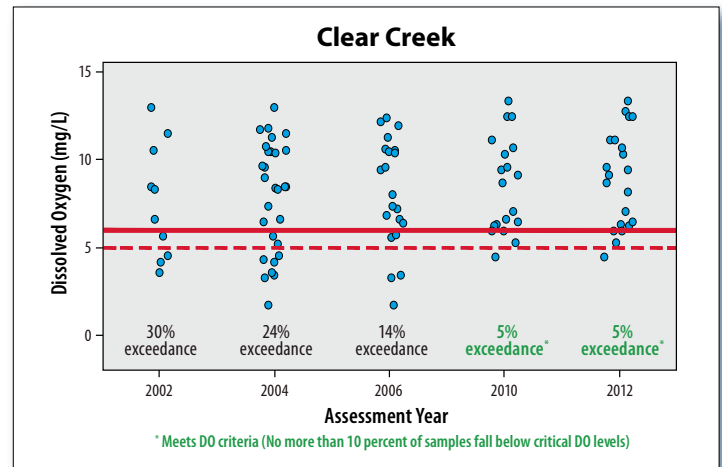


Figure 2. Data show that Clear Creek has met the DO water quality criteria for warm-water aquatic communities since 2010.

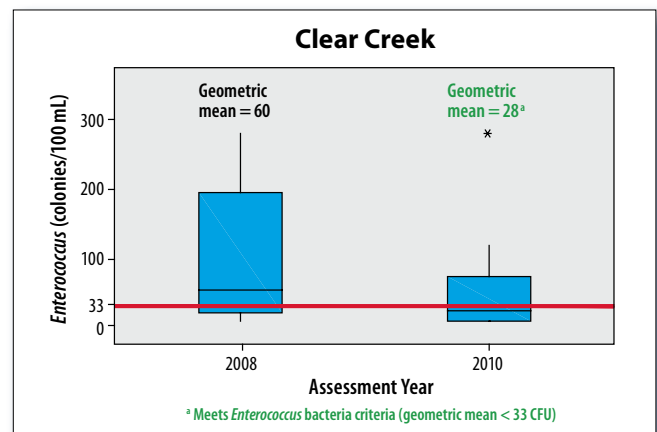


Figure 3. Data show that Clear Creek met the *Enterococcus* water quality criteria in 2010. Boxplots indicate the interquartile range (25th-75th percentile), median of the data (noted as line) and data sample outlier (noted as *).

19 parameters from samples collected every five weeks at about 100 sites. In-stream habitat, fish and macroinvertebrate samples are also collected. Approximately \$600,000 in EPA CWA section 319 funding supports statewide education, outreach and monitoring efforts through the Blue Thumb program. The Oklahoma cost-share program provided \$13,560 for implementation in the Clear Creek watershed through the Beaver County Conservation District. The NRCS spent approximately \$358,825 for implementation of BMPs in the Clear Creek watershed from 2005–2010. Landowners provided a significant percentage of the cost (usually 40–60 percent) toward BMP implementation.



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For additional information contact:

Shanon Phillips, Director
Water Quality Division
Oklahoma Conservation Commission
shanon.phillips@conservation.ok.gov
405-522-4500