



## Section 319

# NONPOINT SOURCE PROGRAM SUCCESS STORY

# Oklahoma

## National NPS Monitoring Project Reduces Nutrient Loads, Decreases Streambank Erosion, and Improves Biological Communities

### Waterbody Improved

Peacheater and Tyner creeks are tributaries to the Illinois River and Lake Tenkiller in northeastern Oklahoma—waterbodies that have exhibited visible problems associated with excessive phosphorus and sediment since at least the early 1990s. Impairments in the watersheds are primarily from animal wastes. Peacheater Creek landowners implemented best management practices (BMPs) such as riparian buffers, alternative livestock water sources and better animal waste management techniques. Nutrient loading to Peacheater Creek declined as compared to Tyner Creek, an adjacent control watershed with no project-specific BMP implementation. In addition, streambank erosion declined and biological communities improved in the Peacheater Creek watershed relative to the Tyner watershed. Implementing additional BMPs should result in continued water quality improvement in Peacheater Creek and the entire Illinois River watershed.

### Problem

Peacheater Creek, a 10.3-mile-long stream, and Tyner Creek, an adjacent stream 15 miles long, are tributaries to the Illinois River (Figure 1). Both creeks are impaired by *Enterococcus*, which caused Oklahoma to list them on its 2006 Clean Water Act (CWA) section 303(d) list. The creeks also contribute to the nutrient impairments present in the larger receiving waterbodies such as the Illinois River, which has been included on the section 303(d) list since 1998 for nutrients, metals, low dissolved oxygen, habitat alteration and siltation. Because of their proximity to each other and their location in the Illinois River watershed, these two creeks were chosen to demonstrate the effectiveness of BMPs to reduce delivery of nutrients, sediment and bacteria to the Illinois River and Lake Tenkiller, using a paired watershed design to assess improvements. The goal for the project is to expand the BMPs to the larger Illinois River watershed and achieve the 0.037 milligram per liter (mg/L) in-stream phosphorus standard (30-day geometric mean) in the Illinois River.

Land use in the 16,209-acre Peacheater Creek watershed is primarily pastureland and forestland, with small amounts of cropland and rangeland. There are approximately 65 poultry houses and 4 dairies in the watershed, as well as about 1,200 beef cattle and 176 private residences. The primary sources of nutrient, bacteria and sediment pollution include poorly managed poultry waste, conversion of forestland

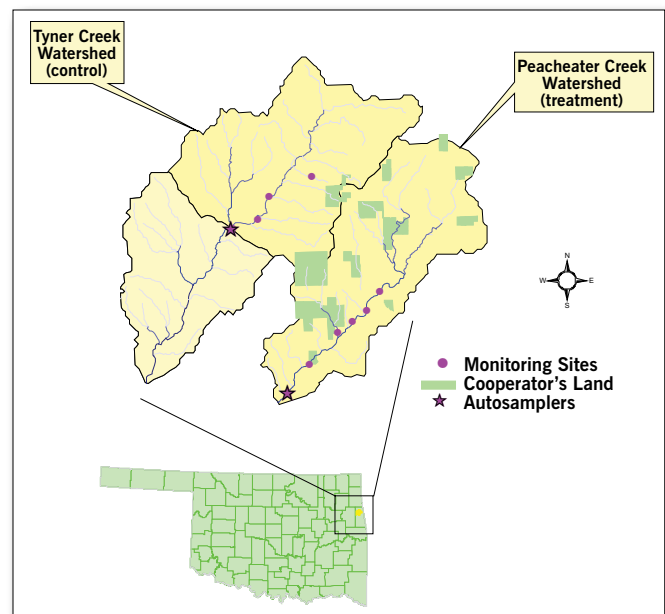


Figure 1. Peacheater Creek (treatment) and Tyner Creek (control) watersheds. Monitoring sites and locations of BMP implementation are shown.

to pastureland and improper pasture and livestock management. These factors contributed to streambank erosion and other impacts downstream, including degraded habitat, nuisance periphyton growth, phytoplankton blooms and summer hypolimnetic anoxia in Lake Tenkiller. In general, the streams have become wider, shallower and loaded with nutrients

and soil, which resulted in loss of fish habitat and increased algae growth. The adjacent Tyner Creek watershed, which was used as the control watershed, is similar in size and land use to Peacheater Creek, with approximately the same amount of agriculture and other nonpoint source impacts.

## Project Highlights

This project is part of the U.S. Environmental Protection Agency's (EPA's) National Nonpoint Source (NPS) Monitoring Program. Landowners implemented BMPs in the Peacheater Creek watershed from 1998 through 2002, and water quality was compared to that of the Tyner Creek watershed, which received no project-specific BMPs. Eleven landowners installed BMPs in the Peacheater Creek watershed, including adding riparian buffers, providing alternative water supplies for cattle, constructing heavy-use areas for feeding livestock and storing wastes, transporting poultry litter out of the watershed, better managing pastures, and repairing or installing septic tanks. Pre-implementation monitoring in both watersheds occurred from 1995 to 1998, with post-implementation monitoring happening from 2003 to 2005.

## Results

Comparison between pre- and post-implementation monitoring periods reveals numerous beneficial changes. Phosphorus concentrations in the Peacheater Creek watershed decreased approximately 9 percent, and phosphorus loading decreased approximately 71 percent over expected values from pre-implementation conditions. Nitrate concentrations decreased approximately 23 percent, total Kjeldahl nitrogen concentrations decreased by approximately 21 percent, and total nitrogen loading decreased by approximately 58 percent.

In addition, Peacheater Creek showed significantly decreased streambank erosion after BMP implementation. The median pre-implementation erosional area was 4.1 square feet versus post-implementation erosional area of 1.7 square feet. Erosional area in Tyner Creek was also reduced, but it was not a significant difference.

The Peacheater Creek watershed also exhibits improved habitat and water quality. Post-implementation fish collections have greater numbers of fish than did pre-implementation collections for both watersheds (Table 1), but

**Table 1. Median total number of individuals collected in fish surveys (over 400-meter reaches) during the pre-implementation versus post-implementation period.**

Stream	Pre-implementation		Post-implementation	
	<i>n</i>	Median	<i>n</i>	Median
Peacheater	3	89	10	275
Tyner	3	293	9	349

Note: *n* represents the number of fish surveys.

Peacheater Creek showed a greater increase in this parameter than did Tyner Creek. There was significant improvement in the index of biological integrity score for the summer index samples of macroinvertebrates for Peacheater Creek (from 29 to 34), while Tyner Creek showed no significant difference.

The observed and predicted water quality improvements that resulted from implementing BMPs in the Peacheater Creek watershed indicate that practices implemented at a similar intensity throughout the larger Illinois River watershed could provide substantial reductions in loading both to the Illinois River and to Lake Tenkiller. The Oklahoma Conservation Commission is overseeing a Conservation Reserve Enhancement Program as well as a current CWA section 319 project in the Illinois River watershed. It is hoped that widespread BMP implementation will allow the Illinois River to achieve the in-stream phosphorus standard of 0.037 mg/L (30-day geometric mean) in the near future.

## Partners and Funding

Funding for the project was a combination of money from EPA's CWA section 319 program and Oklahoma. The total cost was approximately \$800,000. This included \$477,000 in federal dollars from EPA section 319, \$318,000 in state dollars and cost-share funds from landowners. This project demonstrated that in small agricultural watersheds, significant water quality improvement is possible with a relatively low investment in implementation of BMPs. Many different groups participated in the Peacheater Creek project, including the Oklahoma Conservation Commission, Adair County Conservation District, Cherokee County Conservation District, Oklahoma Department of Agriculture, Adair County Extension Service, Oklahoma State University Cooperative Extension Service, Natural Resources Conservation Service, Farm Services Agency, local producers, poultry integrators and animal waste marketers.



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