NONPOINT SOURCE SUCCESS STORY

Indiana

Reducing Livestock-Induced Pollution in Emma Creek

Waterbody Improved

Agricultural runoff resulted in impaired biological conditions and failure to attain ammonia standards in a tributary of Indiana's Emma Creek. As a result, the Indiana Department of Environmental Management (IDEM) listed the Emma Creek tributary on the Clean Water Act (CWA) section 303(d) list in 2002. Numerous partners implemented best management practices (BMPs) throughout the Emma Creek watershed, resulting in decreased pollutant runoff. This has resulted in improved water quality in Emma Creek.

Problem

Emma Creek is a tributary to the Little Elkhart River, which flows through southeastern Lagrange County in northeastern Indiana. The 22,000-acre Emma Creek watershed includes 38.2 stream miles. Of these stream miles, 15.5 drain to Emma Lake. From the outlet of Emma Lake, Emma Creek flows another 3.8 miles to its confluence with the Little Elkhart River (Figure 1).

A tributary of Emma Creek was monitored by IDEM's Probabilistic Monitoring program in 2000. Analysis of fish community data showed an Index of Biotic Integrity (IBI) score of 14, which was well below the IBI score of ≥36 that is necessary to be considered supportive of biological integrity. In addition, habitat and chemistry data collected by IDEM in 2000 revealed that siltation, excess nutrients and low dissolved oxygen (particularly during the summer months) contributed to impaired biotic communities in the Emma Creek tributary. In addition, water sample analysis showed an ammonia level of 4.60 milligrams per liter (mg/L), much higher than the 2.1445 mg/L allowed by the water quality standard for the associated temperature and pH results measured concurrently at the site. These results prompted IDEM to add a 2.32-mile segment (Assessment Unit [AU] INJ01E1 _ T1301) to the 2002 CWA section 303(d) list for impaired biotic communities (IBC) and ammonia. Suspected pollutant sources included barnyard runoff, failing septic systems, and livestock accessing streams (and directly depositing waste and causing stream erosion).

Project Highlights

The Lagrange County Soil and Water Conservation District (SWCD) developed a watershed management plan (WMP) for the Little Elkhart River in 2007, using water quality data collected from June 2005 through December 2006 to guide the efforts. As part of the WMP implementation, the SWCD conducted a paired watershed study on the upper and lower Emma Creek subwatersheds from 2009 to 2011 (see Figure 1). In the paired study, the partners implemented BMPs in the upper watershed, which was the treatment watershed. The lower watershed was the control watershed. As part of this project, landowners installed BMPs in the Little Elkhart River watershed between 2009 and 2010, includ-

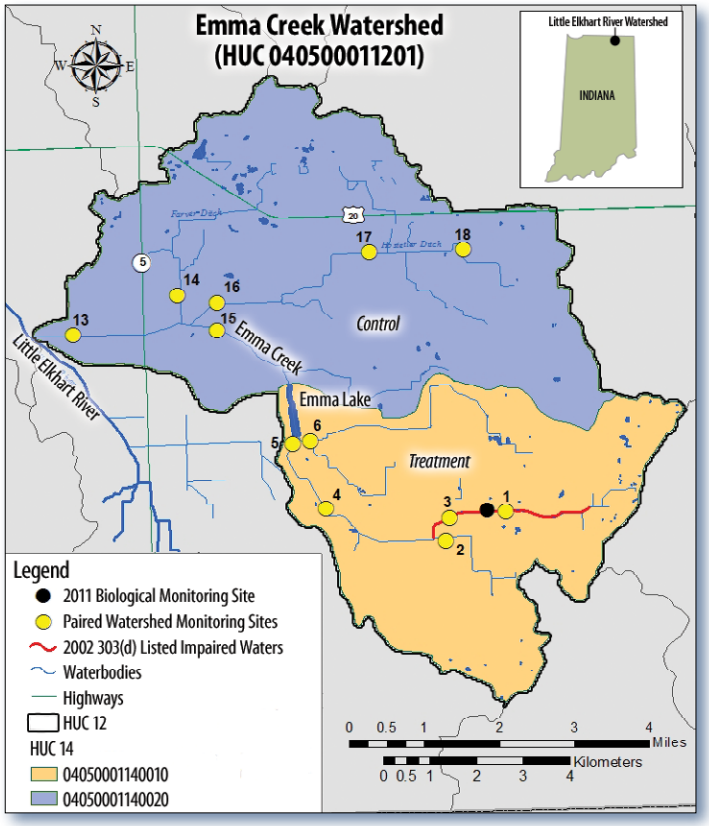

Figure 1. The Emma Creek watershed, in northeastern Indiana, was the subject of a paired watershed study.

ing 12 comprehensive nutrient management plans, two manure management plans, six heavy use area plans, four alternative watering facilities, three water access structures, three stream crossings, two pipe crossings, one livestock stream crossing, two critical area plantings (1.65 acres total), one waste storage facilities, 3.5 acres of filter strips, one waste management diversion and 20,493 feet of fencing (1,400 feet of which were installed upstream of the impaired segment). In a separate effort, the Natural Resources Conservation Service (NRCS) worked with landowners to install 24 acres of pasture and hay planting throughout the watershed between 2000 and 2009.

Key to this restoration effort was the participation of members of the Amish community, who comprise about 75 percent of the agrarian population of the Emma Creek watershed. Participation in cost-share programs by this community has been traditionally low. Outreach and education proved to be a successful strategy in convincing the community to change their management practices to protect water quality, including installing some BMPs without financial assistance.

Results

Thanks to the BMPs implemented in the treatment watershed, water in the Emma Creek Tributary is improving. Data collected along the impaired segment (Site 1 on Figure 1) show that pollutant levels decreased in 2009–2010 as compared to 2007–2008 (Table 1). Data collected by the SWCD at the mouth of Emma Creek showed similar improvements in water quality, indicating that the benefits realized by the BMPs implemented in the upper watershed carry down through the treatment watershed and into the Little Elkhart River. Net load reductions in the Emma Creek 12-digit watershed were 42 percent for *E. coli*, 20 percent for nitrates, 58 percent for total suspended solids, 63 percent for total phosphorus, and 89 percent for ammonia. With the exception of *E. coli*, all of these parameters are associated with watershed-based improvements eventually leading to healthier biological communities.

In 2011 IDEM returned to the 2.32-mile-long impaired stream reach (Emma Creek Tributary) to monitor for change in the fish community. The IBI score remained at 14, indicating that no significant change in biological condition has yet occurred. These data are being interpreted as evidence of a time lag between BMP implementation and habitat recovery.

Table 1. A comparison of means for selected nonpoint source pollution-related parameters at two sites on Emma Creek, before (2007–2008) and after (2009–2010) BMP implementation

Parameter[1]	Site 1 (Tributary of Emma Creek)		Site 13 (Mouth of Emma Creek)	
	2007–2008	2009–2010	2007–2008	2009–2010
Turbidity (ntu)	13	8.8	74	56
TSS	23.4	17.2	107	27
Nitrate	1.1	1.1	3.1	2.8
Total Phosphorus	0.497	0.287	2.01	0.57
Biological Oxygen Demand	1.31	0.72	2.05	1.15
Ammonia	0.15	0.11	0.11	0.09
E. coli (cfu/100 mL)	1,147	750	17,109	16,483

[1] All units are mg/L unless otherwise noted.

Although the SWCD data appear to show that ammonia levels are meeting water quality standards, an ammonia delisting can't occur until a third-party data program to measure the quality of the data is in place. Therefore, the impaired segment will remain listed as impaired for both IBC and ammonia. In 2014, Indiana revised its segmentation methodology. The existing, 2.3-mile-long impaired segment has been incorporated into an 8.69-mile-long segment (AU INJ01C1 _ T1005: Emma Lake Inlet) that begins at the inlet of Emma Lake (not including the lake itself) and includes the upstream portion of Emma Creek and the unnamed tributary.

Partners and Funding

Water quality improvements are the result of collaboration between the Lagrange County SWCD, IDEM, Indiana Department of Natural Resources, the Great Lakes Commission and NRCS. The Lagrange County SWCD sponsored the creation of the WMP, and coordinated the implementation of the paired watershed study. IDEM funded the WMP and BMP implementation with $1,748,604 of CWA section 319 funding. The Indiana Department of Natural Resources and Great Lakes Commission both funded watershed land treatment practices and the implementation of the WMP, with contributions of $75,000 from the former, and $515,000 from the latter, respectively. NRCS provided $5,328 in funding through the Agricultural Water Enhancement Program and was instrumental in providing engineering design and support. Lastly, watershed landowners independently paid $30,000 to install BMPs without cost share.

U.S. Environmental Protection Agency
Office of Water
Washington, DC

EPA 841-F-15-001DD
July 2015

For additional information contact:

Laura Crane, IDEM
lcrane@idem.IN.gov • 317-308-3186

Angela Brown, IDEM
abrown@idem.IN.gov • 317-308-3206