



# NONPOINT SOURCE SUCCESS STORY

Ohio

## Raccoon Creek Mainstem and Watershed Restoration and Recovery

### Waterbody Improved

Coal mining (underground and surface) in the late 1800s to mid-1900s severely degraded the Raccoon Creek watershed. The resulting acid mine drainage (AMD), sedimentation, erosion, and dangerous highwalls left much of the watershed scarred and nearly devoid of life. The Ohio Environmental Protection Agency (Ohio EPA) added multiple Raccoon Creek assessment units (AUs) to the Clean Water Act (CWA) section 303(d) list of impaired waters in 2002. Major watershed restoration efforts are ongoing and address AMD and other issues (e.g., sedimentation, low-head dam removal, riparian restoration). Completed projects have reduced acid and metal loads and resulted in biological improvement and attainment of aquatic life water quality goals through much of the watershed (see the Raccoon Creek [story map](#)). As a result, Ohio EPA removed AMD-related parameters from three AUs on the state's 2018 list of impaired waters: Town of Zaleski–Raccoon Creek, West Branch Raccoon Creek, and Hewett Fork.

### Problem

The Raccoon Creek watershed drains 683.5 square miles in southeast Ohio (Figure 1). The mainstem is 112 miles long and flows to the Ohio River. Approximately 50,000 acres of abandoned underground and surface mines have impacted over 190 miles of Raccoon Creek and its tributaries. AMD forms when coal spoil is exposed to water and oxygen. It has a detrimental impact on aquatic life by increasing acid and metal concentrations (primarily iron and aluminum), clogging the gills of aquatic species, and imbedding substrate. Additionally, sediment eroding from abandoned mine lands reduces available habitat. Many stream segments monitored in the 1980s were unable to support any fish species, and only the most tolerant of macroinvertebrates were found. Ohio EPA placed multiple Raccoon Creek AUs (including Raccoon Creek and its tributaries) on the CWA section 303(d) list in 2002 for sediment, pH, and metals (including zinc, iron, and aluminum).

The U.S. Environmental Protection Agency (USEPA) approved a total maximum daily load (TMDL) report for the upper portion of the Raccoon Creek watershed in 2003. To achieve pH values within water quality standards, the TMDL established a target of 20 milligrams per liter of net alkalinity. Historically, much of the Raccoon Creek watershed was designated as Aquatic Life Use or Limited Resource Water due primarily to impacts from historic coal mining. Most of the stream miles designated Warmwater Habitat were in non- or partial attainment.



Figure 1. Raccoon Creek is in southern Ohio.

### Story Highlights

Concerned citizens in Gallia County formed the Raccoon Creek Improvement Committee in the 1980s. The group garnered support from state water quality agencies in the 1990s, and the first official restoration project was completed in 1998. Since then, 21 abandoned mine land (AML)/AMD projects and a low-head dam removal have been completed in the watershed.

AML/AMD restoration projects consist of active treatment, passive treatment, and reclamation projects. These projects occurred mostly in the headwaters and Little Raccoon Creek. Active treatments, such as the calcium oxide doser at Carbondale, actively add an alkaline substance to an AMD source to neutralize acidity. Passive treatment projects include wetlands, open limestone channels, steel slag leach beds, limestone leach beds and successive alkaline-producing systems. Reclamation projects are extremely effective, though costly, solutions for areas impacted by pre-law (i.e., before the Surface Mining Control and Reclamation Act of 1977) surface mines. Unlike active and passive treatments, which are installed to continuously treat AMD formed from underground and surface mines, reclamation stops (or significantly reduces) the formation of mine drainage.

With the main AMD sources in the Raccoon Creek watershed addressed, partners are researching how to restore the watershed to its full potential. In 2019, a low-head dam in Sandy Run was removed. This dam was a barrier to fish passage and negatively impacted the stream channel morphology. Also, Ohio EPA will develop a new TMDL to address the remaining impairments. Since 2009, the Raccoon Creek Partnership has worked with Rural Action and the AmeriCorps program to conduct outreach and education.

## Results

As a result of the above restoration efforts, the chemical and biological stream health in Raccoon Creek has significantly improved (Figure 2 and Table 1).

- Over 100 stream miles meet/exceed the biological criteria for Warmwater Habitat, and the downstream 40 miles support Exceptional Warmwater Habitat.
- 110 of 116 miles now meet the pH target of 6.5.
- The acid and metal loads declined by over 2,500 pounds per day (lbs/day) and 500 lbs/day, respectively.
- 78 fish species were documented in the Raccoon Creek watershed, including the state threatened paddlefish and the eastern sand darter, compared to 53 species collected in 1995.

Due to the extensive restoration efforts, the data collected by Ohio EPA in 2016, and the results of a follow-up watershed monitoring project, Ohio EPA removed multiple AMD-related pollutants from the following three AUs in the 2018 CWA list of impaired waters: Town of Zaleski–Raccoon Creek (AU 050901010205), West Branch Raccoon Creek (AU 050901010202), and

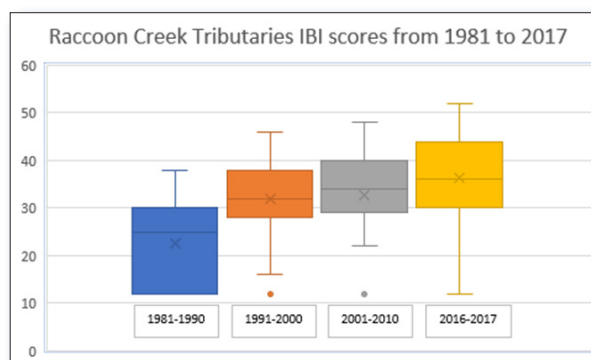


Figure 2. Box and whisker plots of the index of biotic integrity (IBI) scores collected in 1981–2017.

Table 1. Average biological and habitat scores from the Raccoon Creek mainstem in 1995 and 2016.<sup>a</sup>

Segment/ Year Sampled	IBI	MIwb	ICI	QHEI
Upper Raccoon Creek (RM 95.52 to 111.9)				
1995	20.6	4.0	16.6	56.7
2016	44.3	8.2	44.5	63.5
Middle Raccoon Creek (RM 95.52 to 40.3)				
1995	38.8	7.6	40	60.6
2016	49.1	9.2	39	75.4
Lower Raccoon Creek (RM 40.3 to 0.0)				
1995	42	8.72	42	60.6
2016	50.4	10.14	47.6	78

Notes: IBI = Index of Biotic Integrity; ICI = Invertebrate Community Index; MIwb = Modified Index of Well Being; QHEI = Qualitative Habitat Evaluation Index; RM = river mile

<sup>a</sup> Cell colors indicate the narrative evaluation: Blue = Exceptional to very good; green = good; yellow = fair; orange = poor; red = very poor

Hewett Fork (AU OH050901010301). With improved water quality, Raccoon Creek has become a tourist destination for boating, fishing, hunting, and hiking. Two canoe liveries now operate in Raccoon Creek.

## Partners and Funding

Partners have included the Raccoon Creek Partnership; the Ohio University Voinovich School; the Ohio Department of Natural Resources (ODNR), Division of Mineral Resources Management (DMRM); Ohio EPA; and Rural Action. Most project funding comes from the ODNR DMRM through the AML fund, the USEPA CWA section 319 program (\$1.54 million total across five projects), and the Office of Surface Mining Watershed Cooperative Agreement Program.



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