

# 2010 NPS Report - Raccoon Creek Watershed

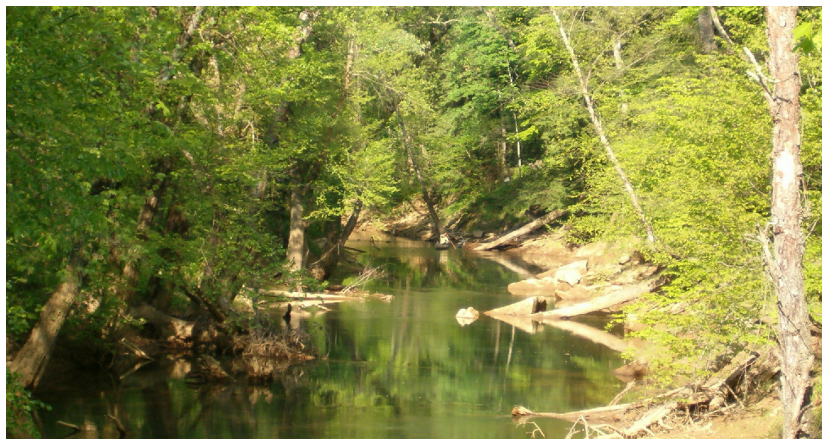
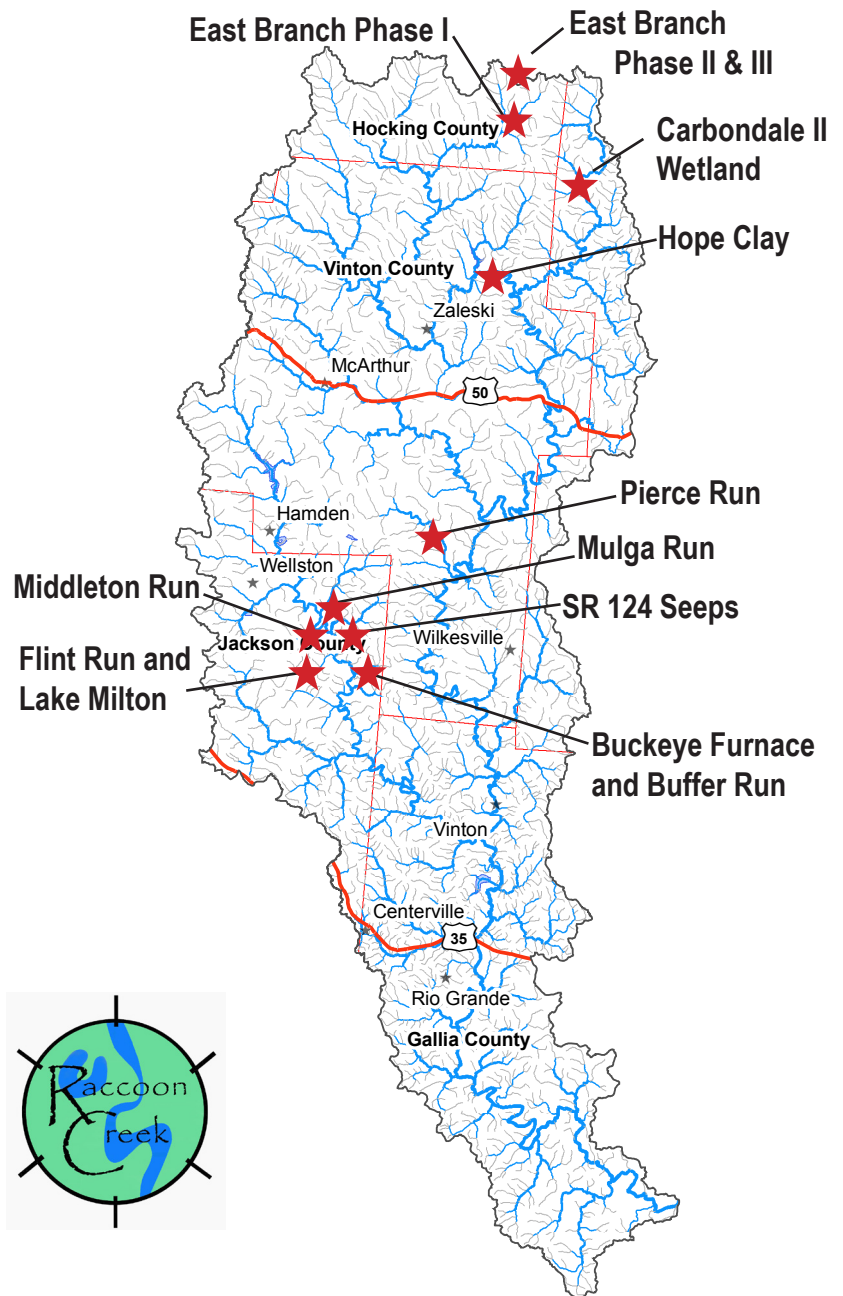
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The Raccoon Creek Partnership is a local partnership working towards conservation, stewardship, and restoration of the watershed for a healthier stream and community. The partnership consists of multiple agencies and individuals working to restore and promote the waters of Raccoon Creek. Encompassing over 683 square miles, the watershed lies in portions of six southeast Ohio Counties (Athens, Hocking, Meigs, Vinton, Jackson and Gallia). Raccoon Creek is one of Ohio's longest streams, measuring 112 miles draining into the Ohio River in Gallia County. Major sources of impairment to the stream include acid mine drainage (AMD), drainage from wastewater treatment facilities, and industrial discharges. By and large, AMD contributes to the vast majority of pollution issues in the watershed.

The watershed currently has over 25,610 acres of underground coal mines and 21,550 acres of surface coal mines within its boundaries. About 110 acres of abandoned coal refuse piles also lie in the watershed. These abandoned mines and refuse piles leach thousands of pounds of sulfuric acid and metals into the creek daily, significantly degrading the water quality of streams. In the late 1990's representatives from several partnering agencies, including the Institute for Local Government and Rural Development (ILGARD), Ohio Department of Natural Resources, Division of Mineral Resource Management, and Ohio EPA, prioritized sites that contributed the most AMD pollution to Raccoon Creek and began to implement restoration strategies on these sites. Because the watershed is so large, three major sub-shed divisions are used to break up the region into more manageable sections. These consist of the Headwaters, Little Raccoon, and the Middle Basin sub-sheds. Each of these sections has priority AMD projects. Some of these projects have been completed, some are in progress, and some are anticipated future projects.

## Headwaters

The major priority sites in the headwaters sub-shed include East Branch and West Branch, where several impacted tributaries contribute to significant acid and metal loadings in Raccoon Creek. Brushy Creek and the Mainstem of Raccoon Creek above Brushy Creek are also priority AMD abatement sites.



Raccoon Creek near Moonville, Photo by Ben McCament

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## Little Raccoon

Flint Run is the largest contributor of AMD in the Little Raccoon Creek watershed. A majority of this (90%) is attributed to a 240-acre site in the headwaters. This site, called Broken Aro, previously housed a coal preparation facility and mine tailings dump. Project was completed in 2006. Major AMD contributors in this basin include Mulga Run, Buffer Run and Goose Run.

## Middle Basin

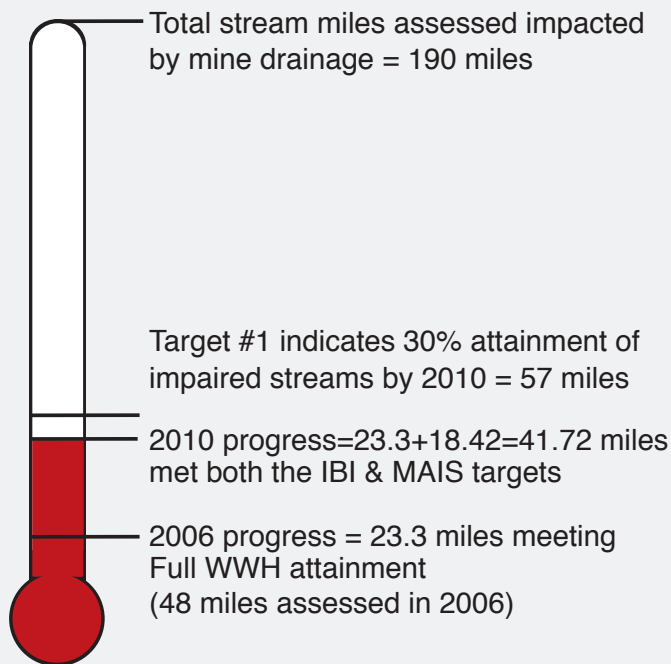
Major acid contributors in the middle basin include Rock Camp and Pierce Run. Rock Camp is the most consistent contributor of AMD, and has net acidic water regardless of flow. Pierce Run has experienced some net alkaline flows; it is thought that this might result from current mining operations in the area.

## Watershed Outreach

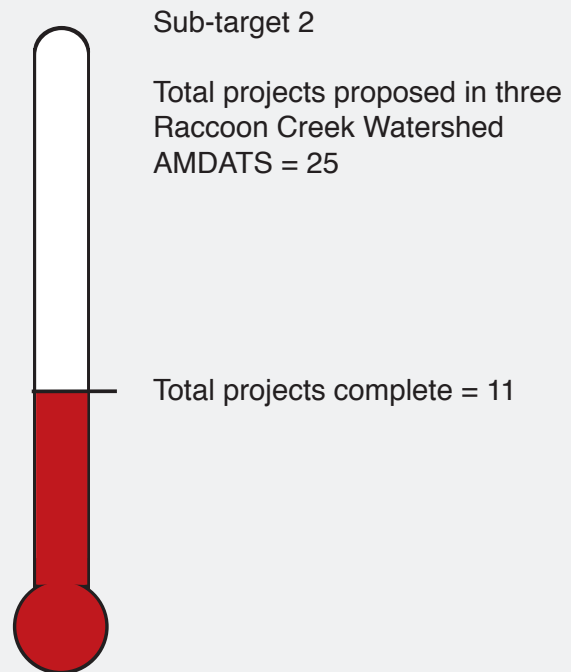
In addition to the technical work of AMD remediation, other activities in the watershed are geared toward meeting goals of stewardship and conservation in the region are coordinated by the Raccoon Creek Partnership. Annual litter pick-ups, and canoe-floats all encourage residents to become stewards of our watershed. The Waterloo Aquatic Education Center is used for school programs for youths to help educate students about water quality, acid mine drainage, and the value of clean water. In addition, a community group has formed to address access issues for canoers and kayakers who wish to paddle on the creek, the Raccoon Creek Water Trail Association.

For further updates on the progress in Raccoon Creek, please visit our webpage at:  
[www.raccooncreek.org](http://www.raccooncreek.org)

## Biological Health Performance



## Completion



## Reductions

Total acid load reduction = 5,438 lbs/day  
Total metal load reduction = 1,057 lbs/day

Data derived using the Mean Annual Load Method (Stoertz, 2004).

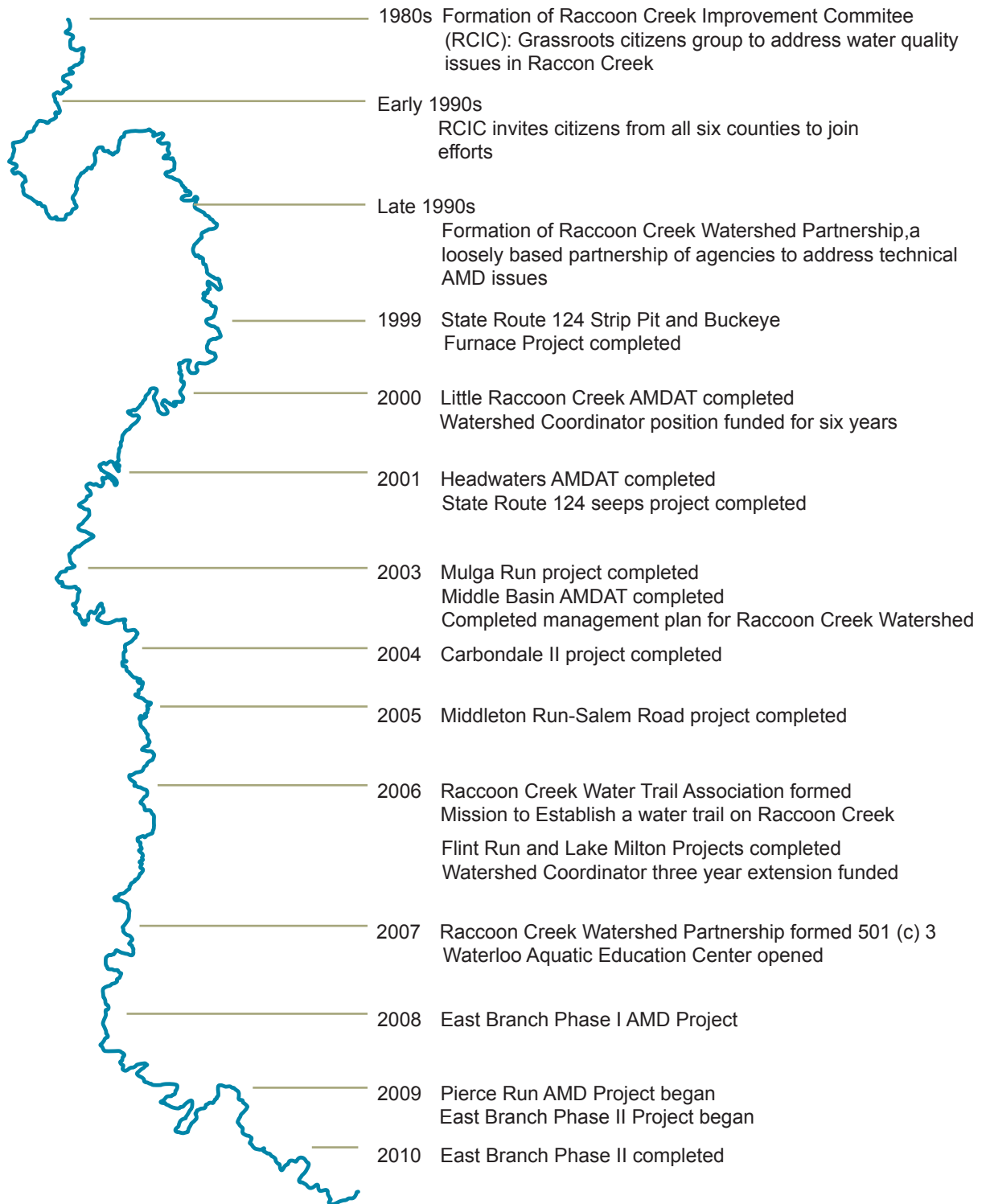
Design = \$1,696,731  
Construction = \$7,555,108

Total Costs through 2010 = \$9,251,839

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## Timeline of the Raccoon Creek Watershed Project Milestones & AMD Projects



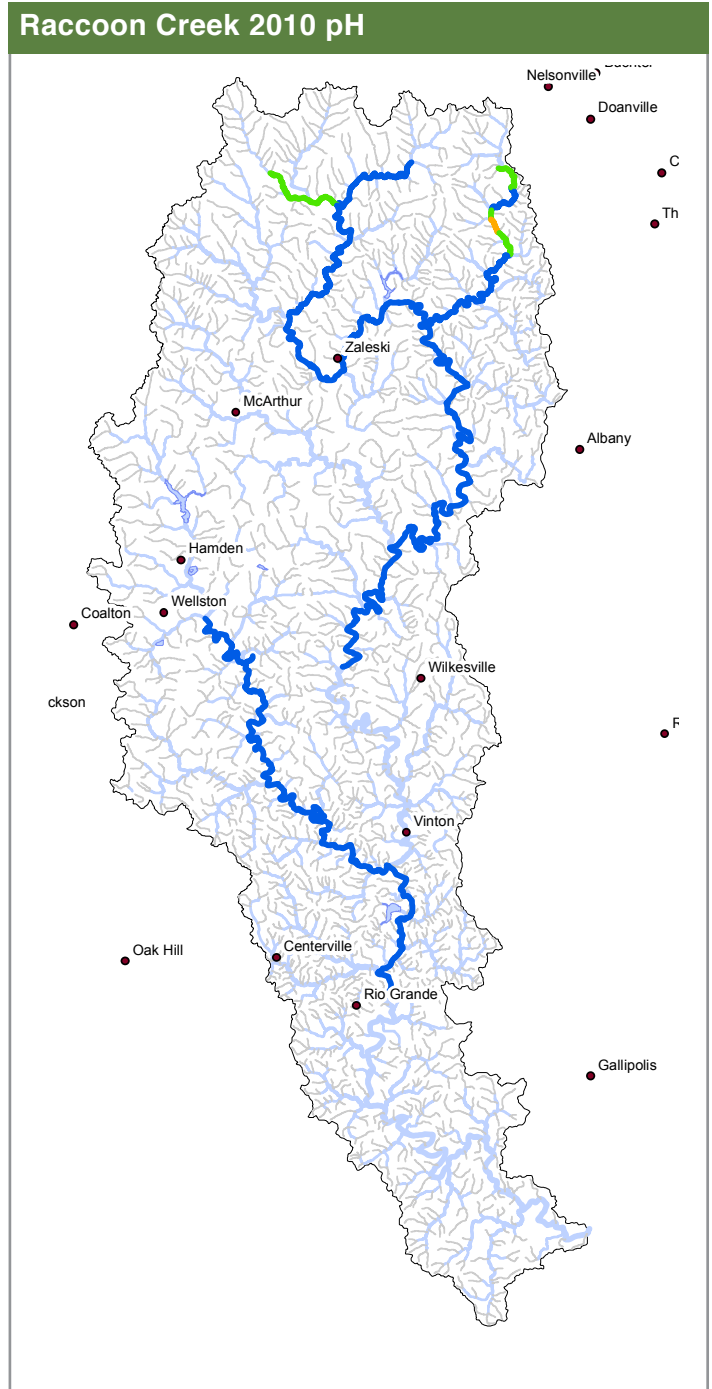
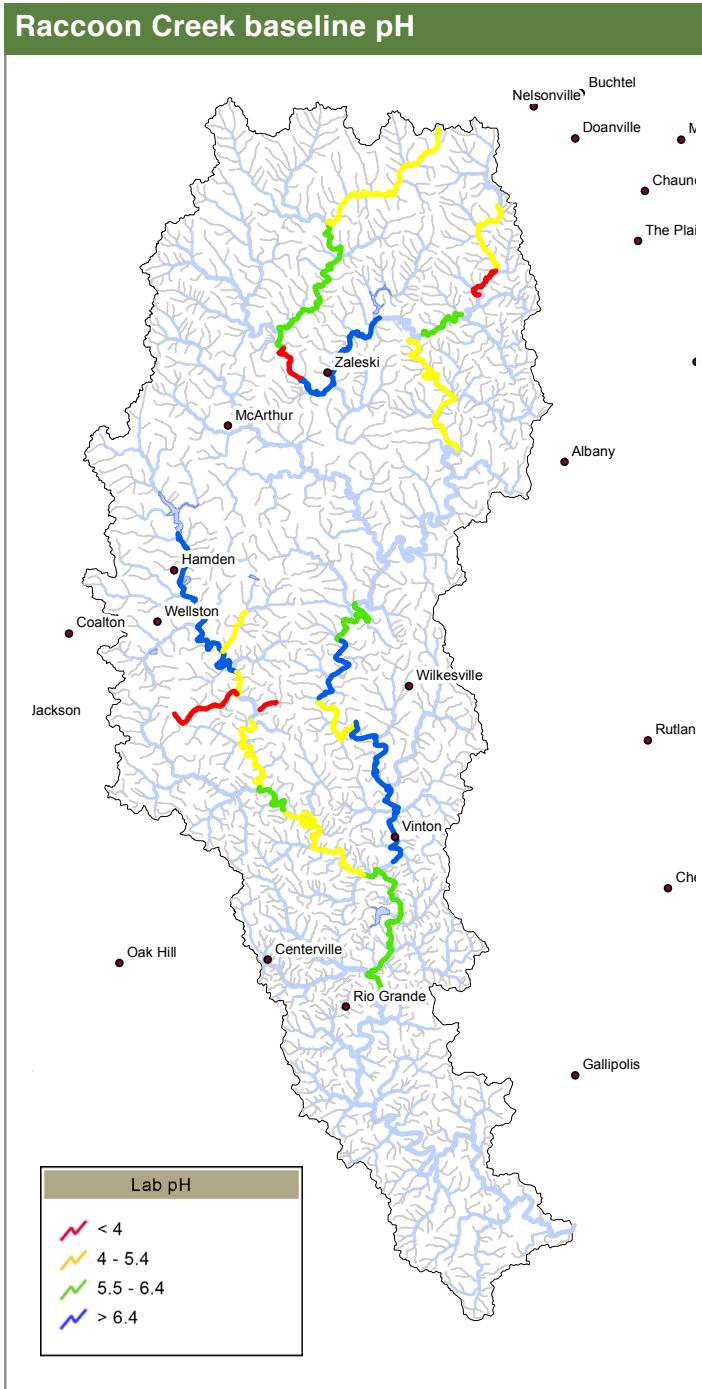
This timeline shows the history of the Raccoon Creek Watershed Partnership, started almost two Decades ago by a group of concerned local citizens. Today, the partnership consists of multiple state and local agencies and private citizens. AMD projects have been administered through the Vinton Soil and

Water Conservation District and Ohio University's Voinovich School (ILGARD), with funding from various state and federal grants but mostly from Ohio EPA's 319 program and ODNR-MRM's AMD program.

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## Chemical Water Quality



In Raccoon Creek pH values have improved throughout the watershed from baseline conditions (1994-2001) to 2010. Raccoon Creek mainstem, Hewett Fork and Little Raccoon Creek average pH values have increased from a range of 4.0-5.4 during baseline to 5.5-8.0 in 2010. (In 2010, 10.7 river miles in Hewett Fork, all 27 river miles in Little Raccoon Creek, and all 58 miles along the mainstem of Raccoon Creek all met the pH standard (pH >6.5)).



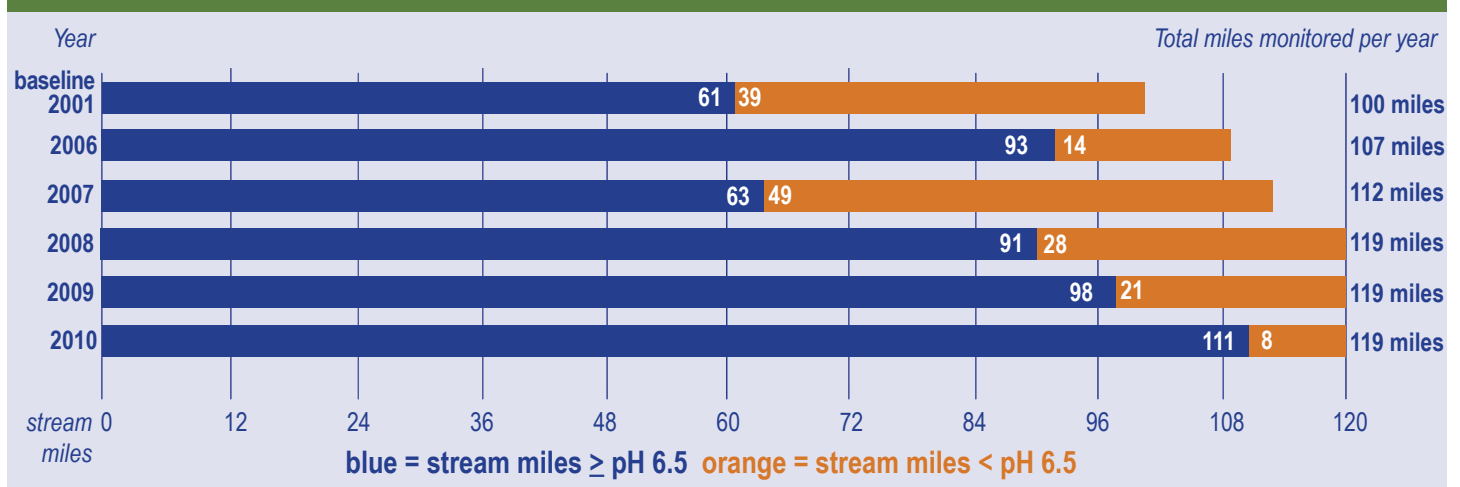
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## Chemical Water Quality

There are approximately 119 stream miles monitored each year along the mainstem of Raccoon Creek (downstream to Rio Grande), Little Raccoon Creek, Hewett Fork, and East and West Branch. A pH target has been set to 6.5. Each year there is an increase in the number of miles that meet this target. In 2007 nearly 64 miles of the 113 monitored met this target. In 2008, there was a large increase (30%) with near 91 stream miles meeting the pH target of 6.5 of the 119 miles monitored. In 2009, 98 of the 119 miles monitored met the target, a 7% increase from 2008. Currently in 2010, 111 of the 119 miles of stream monitored met the pH target, an 11% increase from 2009 (Figure A).

Figure A. Raccoon Creek total stream miles monitored for pH through time

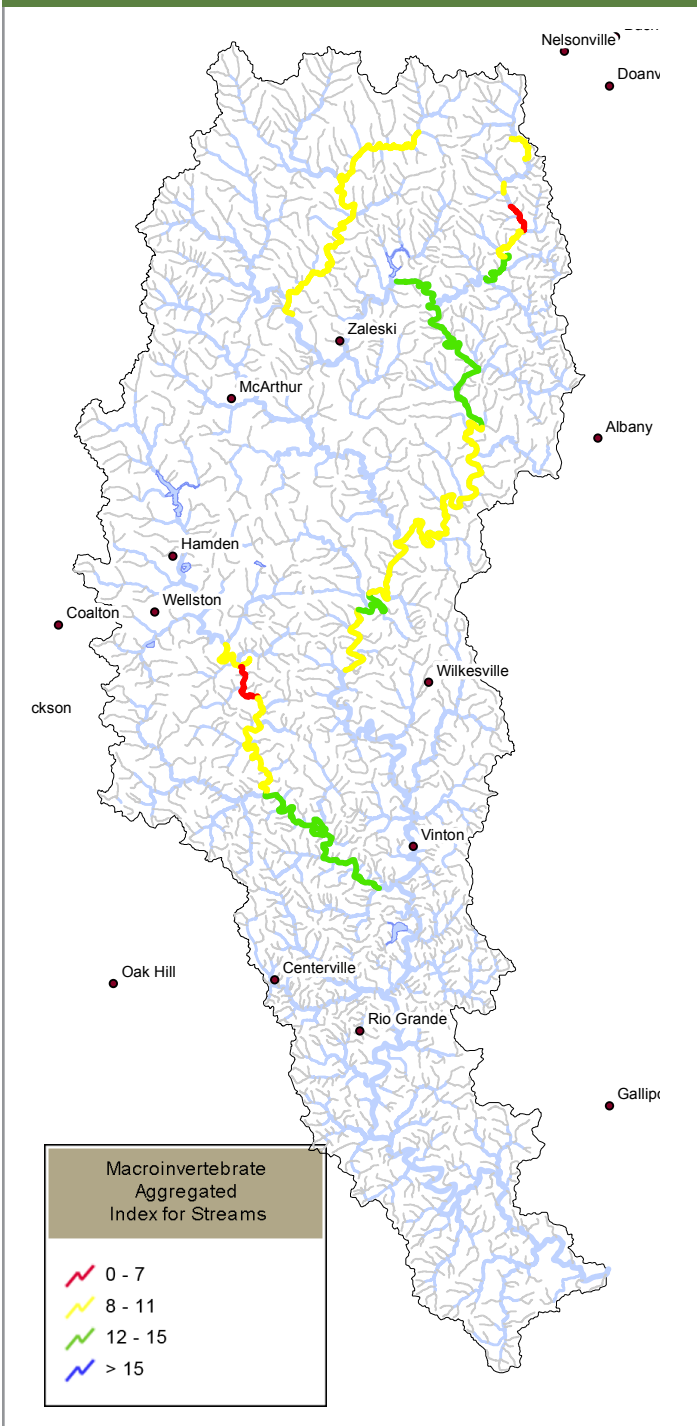


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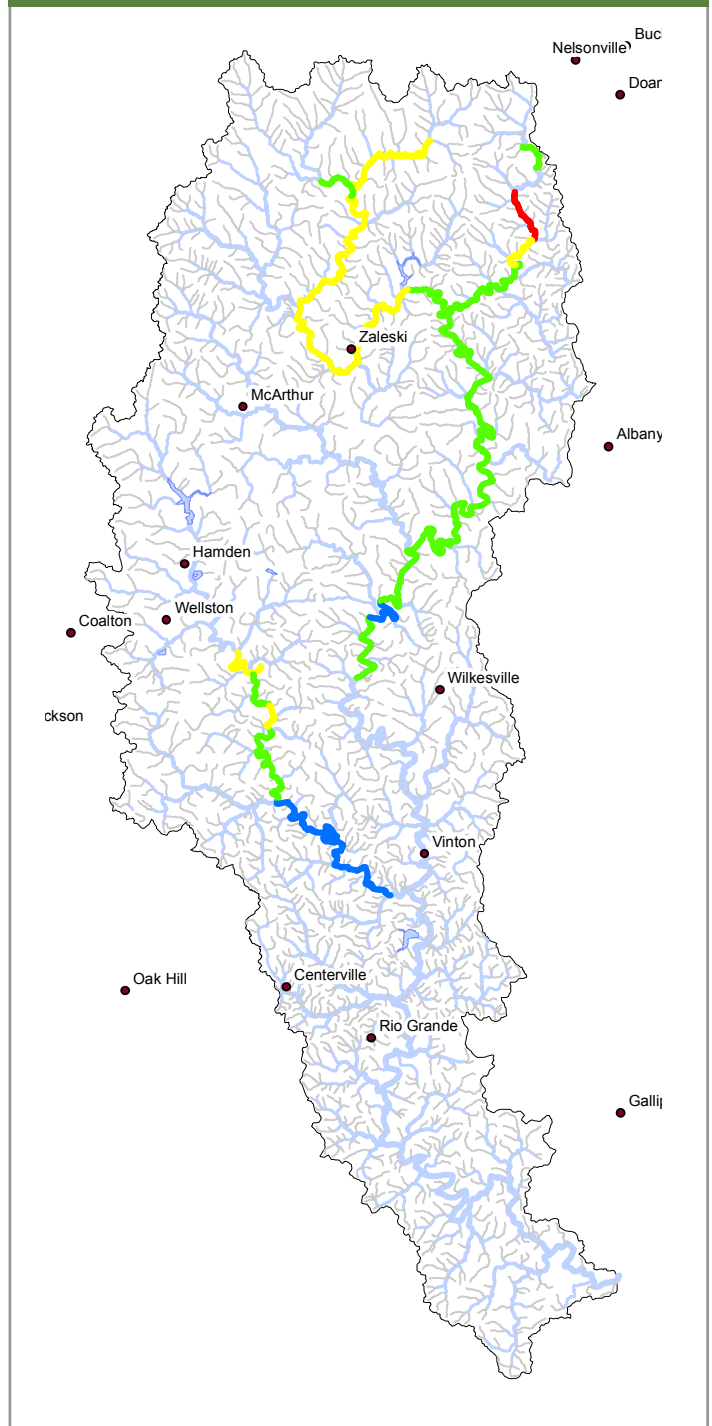
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## Biological Water Quality

### Raccoon Creek baseline MAIS



### Raccoon Creek 2010 MAIS



MAIS samples were collected throughout Raccoon Creek in 2010, these stations has been established as annual monitoring stations for macroinvertebrates. These sites are used to track incremental changes each year, figures 1 and 2.

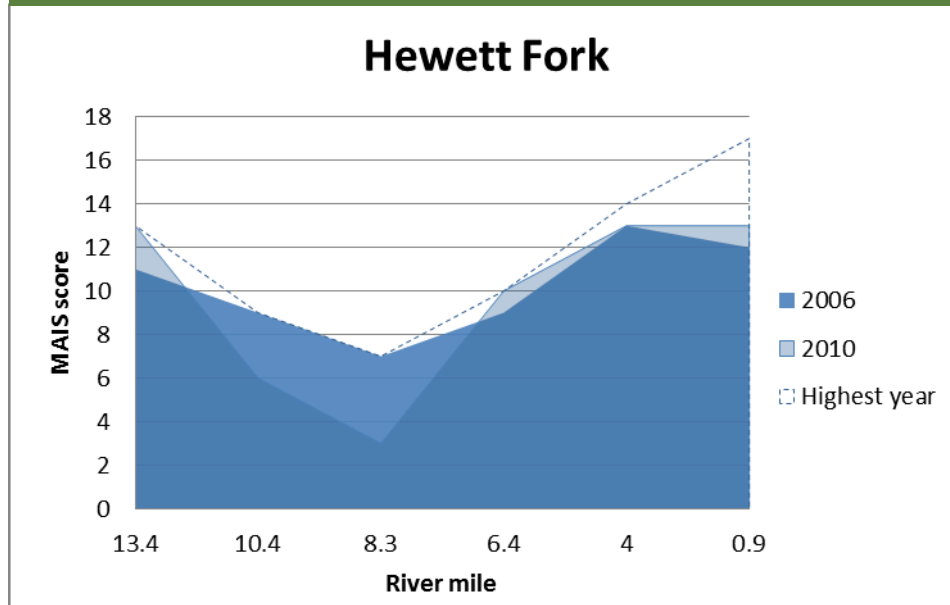
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## Biological Water Quality

Macroinvertebrate scores show an overall reduction in biological quality below the Carbondale doser (RM 11.0) that improves gradually further downstream (Figure B). The macroinvertebrate community at RM 10.4 showed statistically significant improvement after the installation of the doser, but the biological community two miles further downstream consistently remains the most degraded section of the reach. Biological quality between these two sites (in the 3 miles downstream from the doser) exhibits high annual variability that may be related to episodic pulses of acid or metals. Although water chemistry targets are achieved by the site on King Hollow Rd, RM 6.4, approximately five miles downstream of the doser, the macroinvertebrate communities do not reach the target MAIS score of 12 for several more river miles, at RM 4.0. The sampling station at the mouth of Hewett Fork at Moonville (RM 0.9) remains of reasonably good quality in spite of limited riffle habitat and achieved a score of 17 ('Very Good' quality rating) in 2009.

Figure B. Area of degradation for MAIS scores in Hewett Fork from 2006 to 2010.



The blue dashed line identifies the highest MAIS score ever achieved at that site throughout the monitoring time period.

### Hewett Fork MAIS Regressions

| RM   | MAIS scores |      |      |      |      |      |      |      |      | Linear trends           | P-value      | No. of years |
|------|-------------|------|------|------|------|------|------|------|------|-------------------------|--------------|--------------|
|      | 2001        | 2002 | 2003 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |                         |              |              |
| 13.4 |             |      |      |      | 11   | 8    | 9    | 12   | 13   | no change               | 0.274        | 5            |
| 10.4 | 2           | 3    | 3    | 5    | 9    | 3    | 7    | 6    | 6    | <b>some improvement</b> | <b>0.062</b> | 9            |
| 8.3  |             |      |      |      | 7    | 3    | 5    | 6    | 3    | no change               | 0.456        | 5            |
| 6.4  |             |      |      |      | 9    | 9    | 8    | 10   | 10   | no change               | 0.319        | 5            |
| 4    |             |      |      |      | 13   | 13   | 14   | 13   | 13   | no change               | 1.001        | 5            |
| 0.9  |             |      |      |      | 12   | 12   | 15   | 17   | 13   | no change               | 0.379        | 5            |

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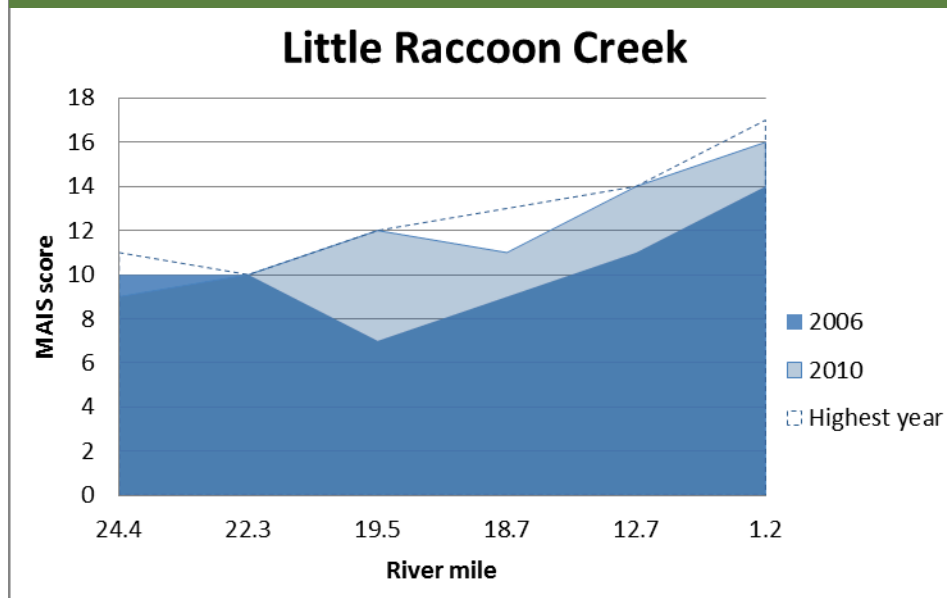
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## Biological Water Quality

### Raccoon Creek - Little Raccoon Creek

Little Raccoon Creek showed solid trends of improved biological quality since 2006, particularly at RM 19.5 and sample stations further downstream (Figure C). Much of the improvements followed the completion of the six major reclamation projects upstream of RM 19.5 (Mulga Run, Salem Road/Middleton Run, State Rte. 124 seeps, Flint Run East, Lake Milton, and Buckeye Furnace).

Figure C. Area of degradation for MAIS scores in Little Raccoon Creek from 2006 to 2010.



### Little Raccoon Creek MAIS Regressions

| RM   | MAIS scores |      |      |      |      |      | Linear trends           | P-value      | No. of years |
|------|-------------|------|------|------|------|------|-------------------------|--------------|--------------|
|      | 2005        | 2006 | 2007 | 2008 | 2009 | 2010 |                         |              |              |
| 24.4 | 8           | 10   | 11   | 11   | 9    | 9    | no change               | 0.868        | 6            |
| 22.3 | 8           | 10   | 10   | 9    | 10   | 10   | no change               | 0.233        | 6            |
| 19.5 |             | 7    |      | 9    | 11   | 12   | <b>improved</b>         | <b>0.001</b> | 4            |
| 18.7 | 14          | 9    | 12   | 9    | 13   | 11   | no change               | 0.769        | 6            |
| 12.7 | 3           | 11   | 13   | 13   | 14   | 14   | <b>improved</b>         | <b>0.051</b> | 6            |
| 1.2  | 14          | 14   | 13   | 15   | 17   | 16   | <b>some improvement</b> | <b>0.078</b> | 6            |



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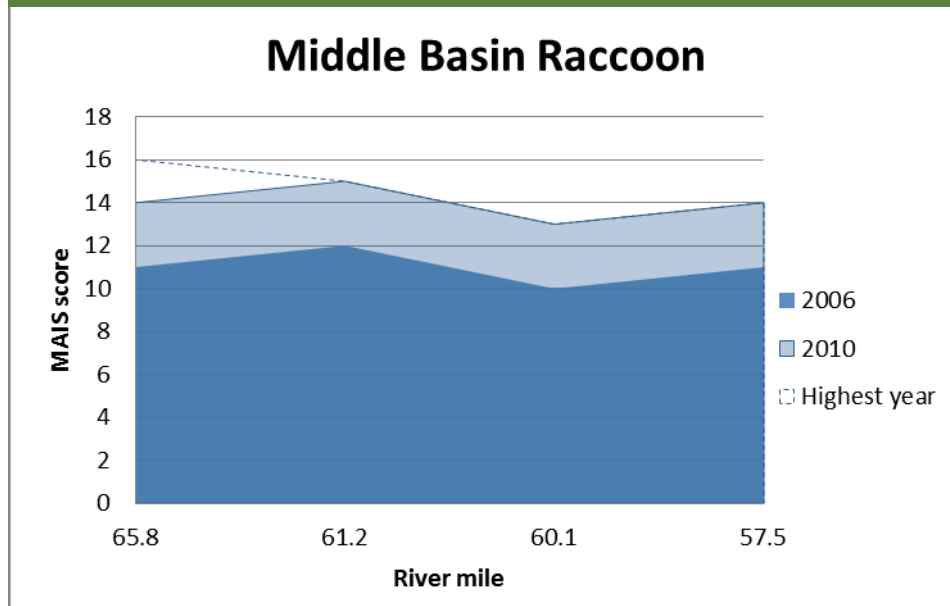
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## Biological Water Quality

### Raccoon Creek – Middle Basin

The four sample sites along the twelve river miles of the Middle Basin of Raccoon Creek all show modest, but important improvements in biological quality since 2006. Although the statistical significance of the trend is not fully apparent with only four annual samples, all the sites surpassed the MAIS target score of 12 in 2010 (Figure D).

Figure D. Area of degradation for MAIS scores in Middle Basin from 2006 to 2010.



### Middle Basin MAIS Regressions

| RM   | MAIS scores |      |      |      |      | Linear trends    | P-value | No. of years |
|------|-------------|------|------|------|------|------------------|---------|--------------|
|      | 2006        | 2007 | 2008 | 2009 | 2010 |                  |         |              |
| 65.8 | 11          |      | 16   | 16   | 14   | no change        | 0.508   | 4            |
| 61.2 | 12          |      | 12   | 13   | 15   | some improvement | 0.087   | 4            |
| 60.1 | 10          |      | 13   | 10   | 13   | no change        | 0.436   | 4            |
| 57.5 | 11          |      | 13   | 10   | 14   | no change        | 0.576   | 4            |

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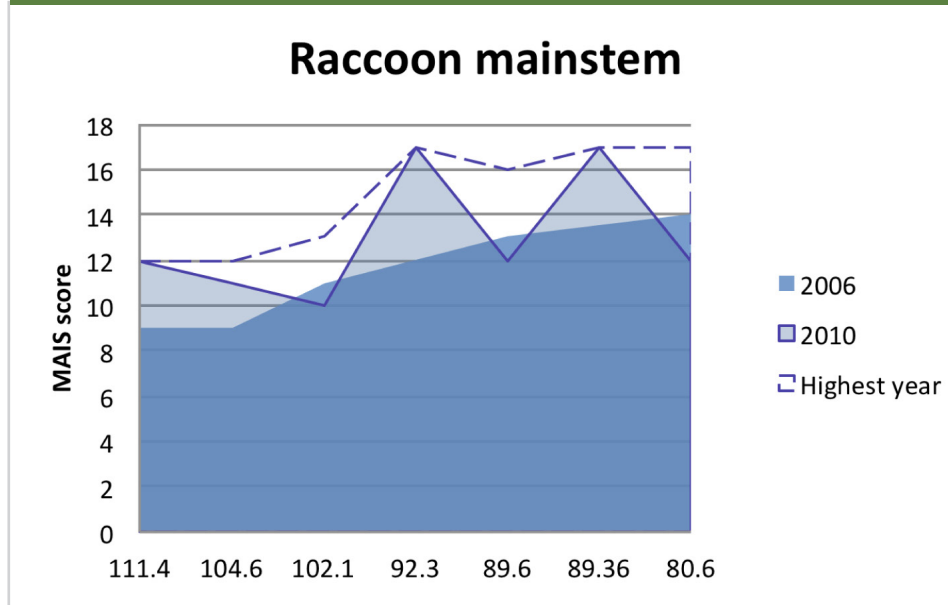
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## Biological Water Quality

### Raccoon Creek Mainstem

The thirty or more miles of the Raccoon Creek Mainstem have shown transient years of improved quality, some achieving MAIS scores of 17 ('Very Good' quality rating) in the past two years 2008- 2010. Biological quality at most of the sample sites in this section was already reasonably good when consistent MAIS monitoring began (in 2007 for most sites) (Figure E).

Figure E. Area of degradation for MAIS scores in Raccoon Creek Mainstem from 2006 to 2010.



The blue dashed line identifies the highest MAIS score ever achieved at that site throughout the monitoring time period.

### Raccoon Creek Mainstem MAIS Regressions

| RM    | MAIS scores |      |      |      |      |      | Linear trends | P-value | No. of years |
|-------|-------------|------|------|------|------|------|---------------|---------|--------------|
|       | 2005        | 2006 | 2007 | 2008 | 2009 | 2010 |               |         |              |
| 111.4 | 8           | 9    | 12   | 9    | 10   | 12   | no change     | 0.172   | 6            |
| 104.6 |             | 9    | 11   | 12   | 9    | 11   | no change     | 0.702   | 5            |
| 102.1 |             | 11   | 11   | 10   | 13   | 10   | no change     | 1.000   | 5            |
| 92.3  |             |      |      | 10   | 10   | 17   |               |         |              |
| 89.6  |             | 13   | 14   | 11   | 16   | 12   | no change     | 1.000   | 5            |
| 89.36 |             |      | 12   | 16   | 14   | 17   | no change     | 0.243   | 4            |
| 80.6  |             | 14   | 14   | 17   | 16   | 12   | no change     | 0.794   | 5            |