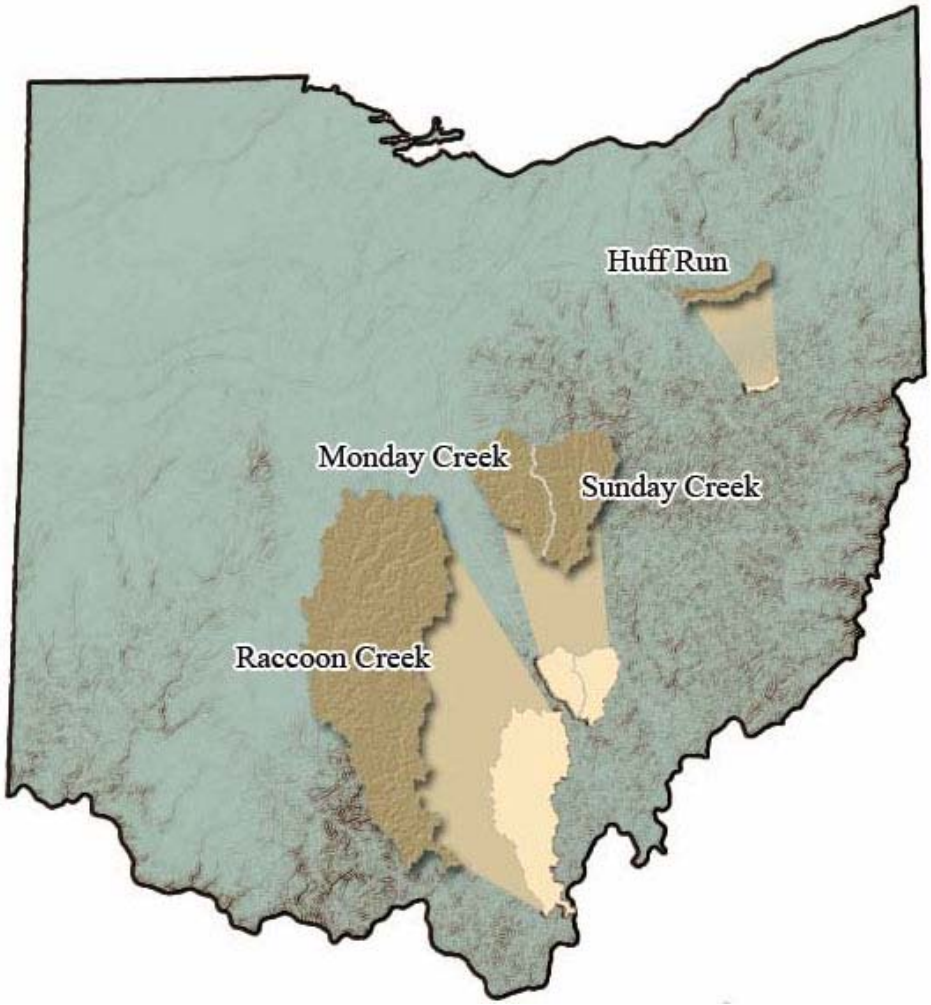
2009 Nonpoint Source (NPS) Monitoring Project
for
Acid Mine Drainage

An Evaluation of Water Quality, Biology, and Acid Mine Drainage Reclamation in Four Watersheds: Raccoon Creek, Monday Creek, Sunday Creek, and Huff Run.



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7-30-10

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Abstract

The Voinovich School of Leadership and Public Affairs at Ohio University has created an evaluation system to track changes in chemical and biological data for the following watersheds: Monday Creek, Sunday Creek, Raccoon Creek, and Huff Run. The annual monitoring and reporting system was developed for Ohio Department of Natural Resources Division of Mineral Resources Management (ODNR-DMRM) in 2005 to track progress towards the targets of the state's 2005 Non Point Source (NPS) management plan for acid mine drainage (AMD). The overall goal of the NPS management plan for AMD is, by 2010, 30% of known acid mine impaired streams are in attainment with Warmwater Habitat (WWH).

The NPS annual reporting website (www.watersheddata.com) integrates water quality and biology data from watershed groups' online ArcIMS database with project status details including: maps, graphs, charts, photos, and printable reports to address the progress with respect to AMD treatment and reclamation. Water-quality and biology trends are compared through time at long-term monitoring stations and acid load reductions are measured at AMD reclamation project discharges. Incremental changes in pH, acidity, fish abundance and diversity are reported downstream of AMD reclamation projects at identified river mile markers.

Total number of stream miles impaired by acid mine drainage at baseline condition (1994 -2001) is 341. To reach the NPS goal for mining issues, 102 (30% of 341) stream miles need to meet Full Warmwater Habitat status by 2010. As of 2005, 23.3 stream miles of the 175 miles accessed met Full attainment of the Warmwater Habitat Status. In addition to tracking the overall NPS goal, smaller incremental water-quality changes were also tracked, pH values show 85 miles of stream improved from not meeting the pH 6.5 water quality standard during the baseline time period to meeting in 2005.

Continual tracking of pH, acidity, and biological indicator MAIS were evaluated annually from 2005-2009. Incremental changes from year to year can be tracked using these

indicators. Net acidity and pH values have improved from 2005 to 2009. Values of pH show 159 miles of stream met the pH 6.5 water quality target in 2006, 114 miles in 2007, 130 miles in 2008, and 162 miles in 2009 (207 miles monitored). The family-level biological indicator, Macroinvertebrate Aggregated Index for Streams (MAIS), were measured annually from 2005 to 2009, there have been slight increases and decreases seen within each watershed. Over the past five years the most notable improvement is seen in Little Raccoon Creek. There has been a steady improvement documented in the biological community as well as water quality. The mainstem of Monday Creek also has steadily improved since 2003.

Introduction

The Nonpoint Source (NPS) Monitoring Project was created by the Voinovich School of Leadership and Public Affairs at Ohio University in 2005 and funded by the Ohio Department of Natural Resources Division of Mineral Resources Management (ODNR-MRM). This project was developed to address the targets set forth for Abandoned Mine Drainage in the State of Ohio's Non Point Source (NPS) Management Plan 2005-2010. www.epa.state.oh.us/dsw/nps/NPSMP/ET/amdjumppage.html
Abandoned Mine Drainage is one of the six NPS pollutants listed as a key issue to address in Ohio to improve water quality.

The number one existing target in Ohio's NPS management plan for AMD is, "By 2010, 30% of known acid mine impaired streams are in attainment with Warm water Habitat (WWH) aquatic life uses through increasing pH, decreasing metals and sediment loading, and minimizing degradation of primary headwater habitat." Three sub-targets have been developed to aid in addressing the overarching existing target:

1. By 2010, 20 completed and federally approved Abandoned Mine Drainage Abatement and Treatment (AMDAT) Plans for acid mine drainage (AMD) impaired watersheds.
2. By 2010, 10 AMD impaired watersheds have implemented some or all of the reclamation actions recommended in the endorsed AMDAT.

3. By 2006, report annually on a comparison between acidity and pH concentrations upstream and downstream of AMD project sites and long-term monitoring stations, as compared to acidity and pH reference sites within the Western Allegheny Plateau Ecoregion.

As a result of the NPS Monitoring Project funded by ODNR-MRM, an on-line reporting system, www.watersheddata.com, has been created to track environmental changes in four watersheds: Raccoon Creek, Monday Creek, Sunday Creek, and Huff Run (Leading Creek will be added in 2010). These four watersheds represent where active AMD reclamation is occurring. Chemical water quality and biological data trends have been evaluated at the AMD project level, watershed level, and collectively to address the targets described above for the State's NPS management plan.

This website provides a center repository of information relating to the AMD targets listed in the State's NPS Management Plan 2005-2010, entry forms for AMD reclamation projects, downloadable reports for: individual AMD projects, watersheds water quality trends, and NPS management plan targets, and ArcIMS database systems; where water quality and biology data can be viewed, entered, edited, mapped and downloaded for each watershed.

Reports

The NPS monitoring reporting system (www.watersheddata.com) provides four levels of reports: Section I, reports on progress toward the State's NPS management plan target goals, Section II, provides a comprehensive watershed level report showing accumulative chemical and biological effects from abandoned mining reclamation, Section III, lists a summary report of each individual acid mine drainage reclamation project detailing project specifics (i.e. load reductions, costs, etc…), and Section IV, shows the AMD project form report showing the raw data collected from watershed groups from the ArcIMS database on the website using the NPS entry form report for 2009.

Section I – NPS target and goals

Section I contains an evaluation of four watersheds: Raccoon Creek, Monday Creek, Sunday Creek and Huff Run with respect to meeting the State's NPS management target and goals.

To address the overarching number one target of the State's Nonpoint Source Pollution management plan relating to acid mine drainage, the following activities were conducted. Baseline condition for water quality and biology were established for four watersheds where active reclamation projects are occurring; Raccoon Creek, Monday Creek, Sunday Creek, and Huff Run. Each of these watersheds has had extensive biological and chemical evaluations conducted by the Ohio EPA during different years. Sunday and Monday Creek's baseline conditions were derived from the 2001 TMDL biological data collected. Huff Run's baseline condition was taken from the Ohio EPA 1997 sampling event. Raccoon Creek's baseline condition, being the largest of the four watersheds, was derived from various sources (Ohio EPA and USGS) during the period of 1994- 2000. From the baseline biological data, stream miles were tallied for mining impaired streams to estimate a number of streams that are impacted by abandoned mining. Of the 763 named streams in these four watersheds, 569 miles were assessed during the baseline period (1994-2001) and was determined that 341 miles are impacted by abandoned mining practices. Therefore to set a numeric stream mile attainment goal according to the Target #1 described in the State's NPS management plan, 102 stream miles (30% of 341 stream miles) is the goal for these four watersheds to restore to full WWH.

Over the past five years, pH along the mainstems and major tributaries of each watershed has been monitored quarterly to twice a year. The average pH values were compared through time to the state target for pH of greater than 6.5. In 2009, 162 of the 207 miles monitored met this target, which is nearly 78% of the total miles monitored.

2009 NPS Target and Goals Report

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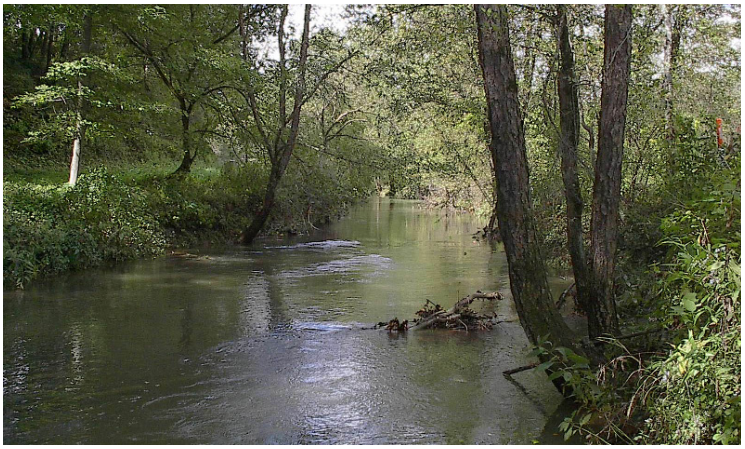
Huff Run

Raccoon Creek



Monday Creek

Sunday Creek

Target #1: "By 2010, 30% of known acid mine impaired streams are in attainment with Warm Water Habitat (WWH) aquatic life uses through increasing pH, decreasing metals and sediment loading, and minimizing degradation of primary headwater habitat."

Water quality stations were analyzed in 2005 and 2006 for biology in Sunday Creek, Monday Creek, Raccoon Creek, and Huff Run watersheds. The total number of AMD stream miles evaluated was 175 in 2005 and 72 in 2006. Comparing the same stream segments from baseline to 2005–2006 shows the change in stream use attainment and narrative conditions, from a biologists' perspective (these changes are not official use attainment status changes made by the Ohio EPA). The biological condition of 23.3 stream miles changed from Non-supportive and Partial attainment to Full WWH use attainment. Although, this number is the ultimate number that is tracked in terms of the NPS management plan Target #1, there are many other significant incremental changes. These changes are tracked and described in this report; for example, attainment use changes from Non-supportive to Partial attainment, narrative description changes, acid and metal loading reductions, pH and acidity improvements, and increases in number of fish and diversity. These incremental changes may not allow a stream segment to change use attainment status, but they do track progress toward the overarching goal and therefore have been tracked at the acid mine drainage project level reports and at the watershed level reports. Biologicial attainment status based on macroinvertebrate (ICI) and fish (IBI) data at the 60 sampling stations within these four watersheds, will be collected in 2010.

Family-level biological (MAIS) data collected annually since 2006 have begun to provide a baseline from which to measure trends in water quality. These results are shown in Section II for each watershed.

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Table 1. Summary of the NPS targets for each of the four watersheds evaluated in 2005 to 2009: Raccoon Creek, Monday Creek, Sunday Creek, and Huff Run.

Watershed	Total number of completed projects	Total costs	Total acid load reduction lbs/day	Total stream miles improved in 2005 to meet WWH Full attainment	Goal of number of stream miles to meet WWH Full attainment by 2010	Stream miles that met the pH target	Total stream miles monitored
Raccoon Creek	10	$8,489,613	5,570 **	23.3	57.0	98	119
Monday Creek	10 (plus 5 subsidence projects, costs are not included)	$3,962,906	3,563	0	25.0	24	39
Sunday Creek	6 (4 of 6 are subsidence projects)	$1,213,646	18	0	18.0	32	39
Huff Run	10	$4,439,685	240	0	2.97	8	10
Total	36	$18,105,850	9,291	23.3	102.97	162	207

**excludes Fern Hill project design costs.*
*** Salem Rd/Middleton Project evaluated at the three separate treatment components*

Reductions

Total acid load reductions = 9,291 lbs/day

Costs

Total reclamation costs = $18,105,850

Attainment Miles

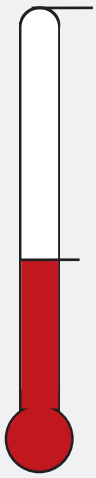
Total AMD impaired stream miles (RC, MC, SC, Huff Run) = **341 stream miles**

Target #1 indicates 30% attainment of impaired streams by 2010 = **102 miles**

Number of stream miles changed from Non-attainment or Partial attainment to Full WWH attainment for 2006 is = **23.3 miles**

(175 miles assessed in 2005)
(72 miles assessed 2006)

Completion



Sub-target 2
Total projects proposed in these four Watersheds AMDATS = **72**

Total projects complete = 36

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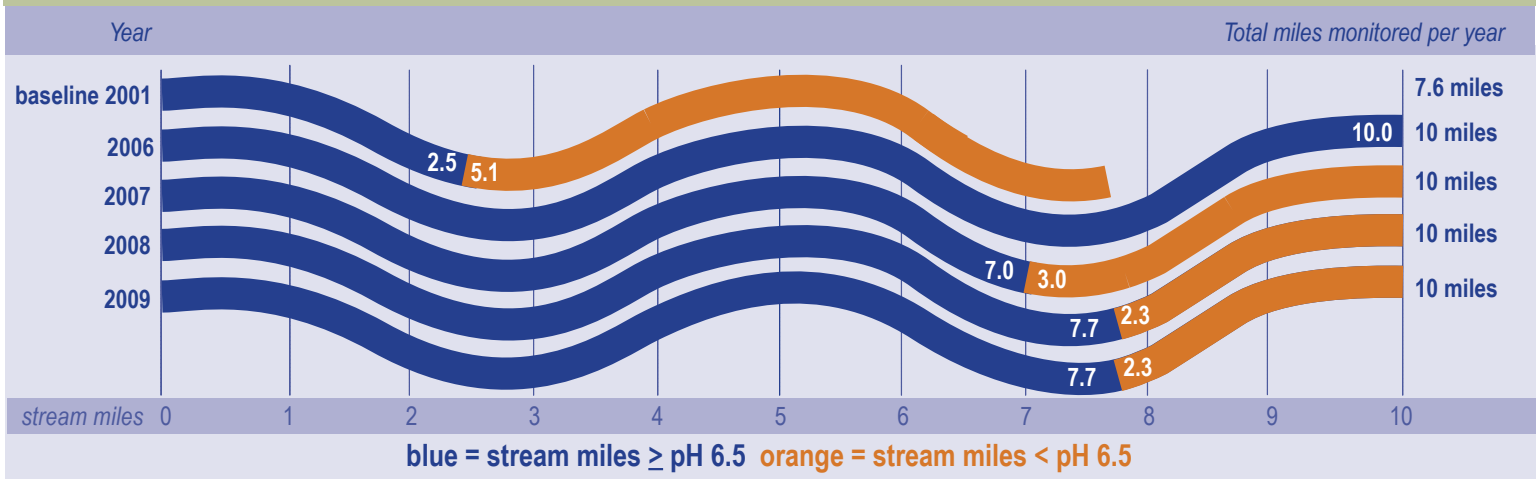
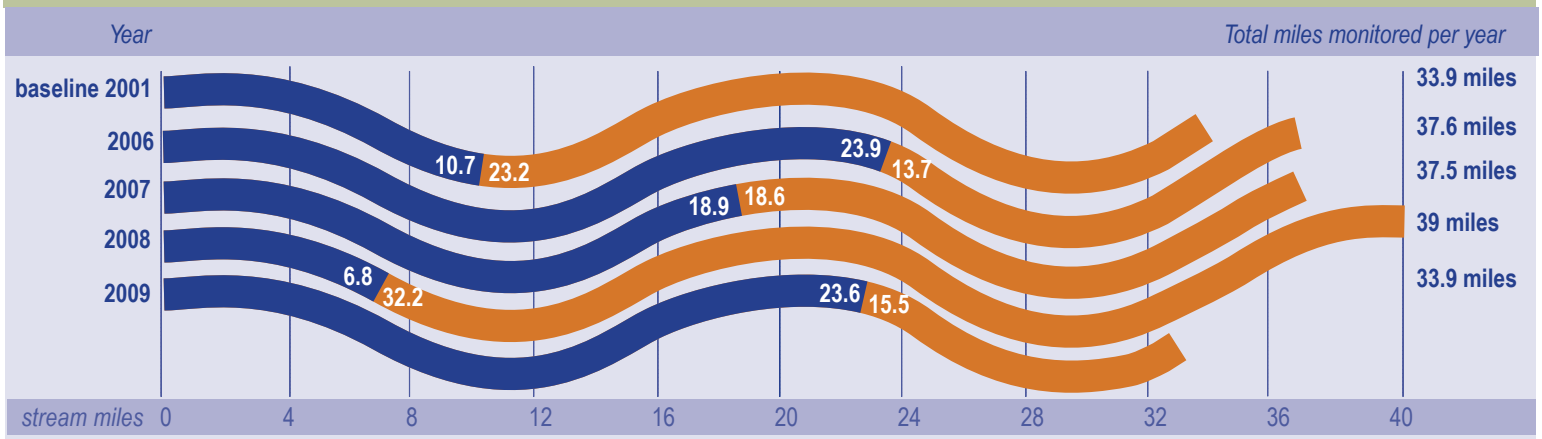
Over the past four years pH has been monitored along the mainstem of each of the four watersheds. The previous four figures show a total number of stream miles that meet the pH target of 6.5 and the total number of stream miles monitored each year. Collectively, pH values showed 159 miles of stream met the pH 6.5 water quality target in 2006, 114 miles in 2007, 130 miles in 2008, and 162 miles in 2009. These variations in pH can be attributed to the changes in the environment due to: reclamation efforts, seasonal changes, and hydrologic conditions.

Huff Run total stream miles monitored for pH through time



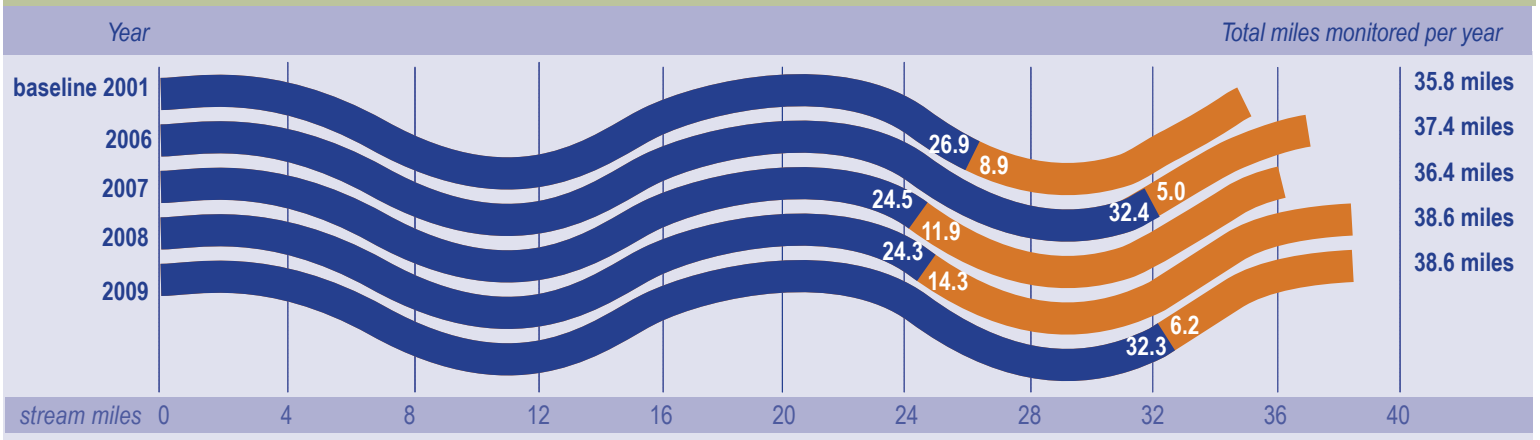
blue = stream miles ≥ pH 6.5 orange = stream miles < pH 6.5

Monday Creek total stream miles monitored for pH through time



blue = stream miles ≥ pH 6.5 orange = stream miles < pH 6.5

Sunday Creek total stream miles monitored for pH through time



blue = stream miles ≥ pH 6.5 orange = stream miles < pH 6.5

Raccoon Creek total stream miles monitored for pH through time

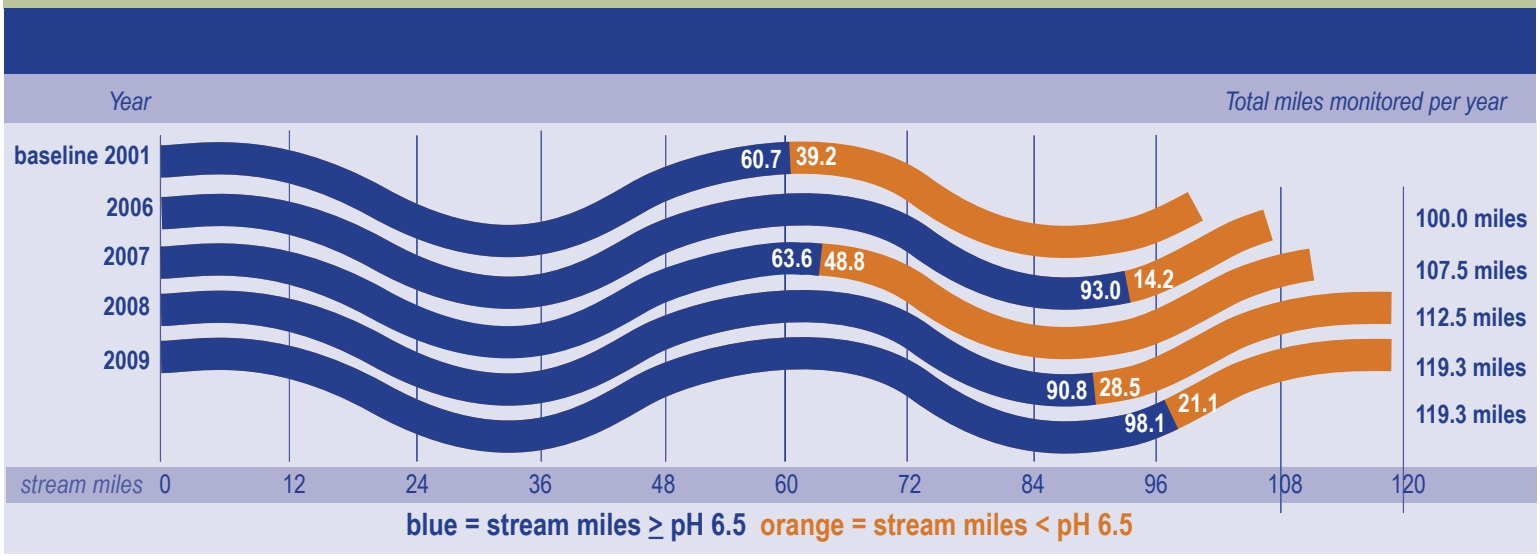
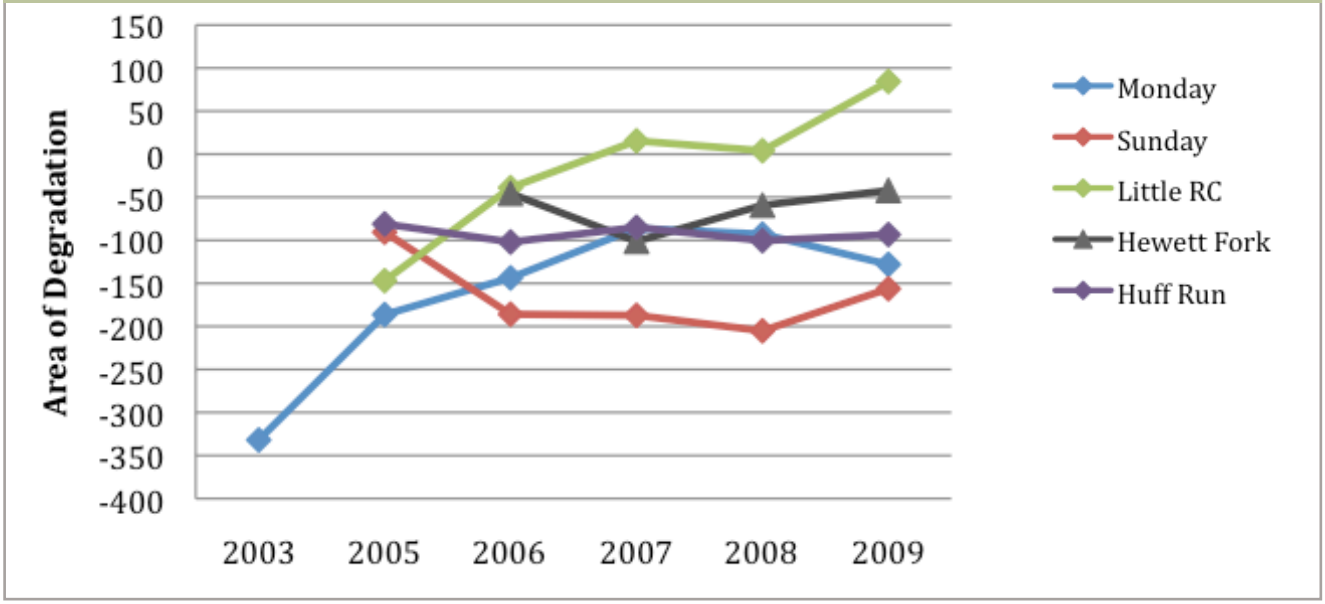


Table 1. Summary of the biological area of degradation from 2003 to 2009.

	2003	2005	2006	2007	2008	2009
Monday	-331.91	-186.39	-143.69	-86.05	-92.91	-128.05
Sunday		-90.6	-185.9	-187.2	-205.2	-156.3
Little RC		-147	-38.9	15.5	4	84.4
Hewett Fork			-45.7	-101.3	-59.4	-42.2
Huff Run		-81.05	-102.0	-85.0	-100.5	-93.4

The area of degradation calculations for Monday Creek, Sunday Creek, Little Raccoon Creek, Hewett Fork, and Huff Run are shown in Table 1. The more positive numbers represent better biological data. For Example, in Little Raccoon Creek there has been a steady increase since 2005 in the biological data, Figure 1.

Figure 1. Change in Area of Degradation 2003-2009 in five watersheds



2009 NPS Target and Goals Report

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Sub-Target 1: "By 2010, 20 completed and federally approved Abandoned Mine Drainage Abatement and Treatment (AMDAT) Plans for AMD impaired watersheds".

- Twelve Acid Mine Drainage Abatement and Treatment (AMDAT) plans have been completed (Map 1): Huff Run, Moxahala Creek, Sunday Creek, Monday Creek, Federal Creek, Raccoon Creek Headwaters, Middle Basin Raccoon Creek, Little Raccoon Creek, Leading Creek, Robinson Run, Yellow Creek, and Upper Rush Creek.

- To address sub-target 1, "complete 20 AMDAT plans by the year 2010", The Ohio Department of Natural Resources Division of Mineral Resources Management (MRM) AMD program is evaluating the degree and impact of AMD on streams and rivers in the coal bearing region of Ohio. This region falls within the Western Allegheny Plataeu (WAP) eco-region, which covers most of unglaciated Appalachian Ohio. The ultimate goal of this undertaking is to better understand the extent of the AMD problem in Ohio, develop restoration plans (AMDATs) where applicable, and to implement AMD remediation or treatment projects where streams or rivers can be expected to improve to meet state biological water quality standards. A committee of ODNR-DMRM staff has developed a four phase process to accomplish this task.

The first phase is to determine if AMD is present in watersheds that are potentially impaired by abandoned coal mines based on previous water quality data or MRM staff recommendations (Map 1 tan areas and Appendix 1). The second phase involves a more detailed investigation of those streams where AMD was documented in the first phase to determine the degree and extent of impact on water quality and on the aquatic biology (fish and macroinvertebrates). The third phase consists of developing a priority-ranking scheme and schedule for AMDAT development for watersheds impaired by AMD. This step involves determining which watersheds/streams are most likely to recover biologically if AMD abatement and treatment is initiated. The fourth and final phase is to develop AMDAT plans for priority watersheds determined in phase III. The AMDAT plan will identify and outline projects, develop a restoration strategy, and determine a cost estimate for implementation. Once an AMDAT is developed for a particular watershed, it will become eligible for AMD program funds to implement the plan. However, development of an AMDAT does not guarantee funding for implementation projects (Kinney et al. 2010).

Two new AMDAT watersheds currently underway investigation include a tributary to the Muskingum River, Brush Creek in Muskingum County and a tributary to the Tuscarawas River, Mud Run in Tuscarawas County.

Sub-Target 2: "By 2010, 10 AMD impaired watersheds have implemented some or all of the reclamation actions recommended in the endorsed AMDAT".

As of 2009, the following nine watersheds are implementing reclamation actions endorsed in their AMDAT plan: Little Raccoon Creek, Headwaters of Raccoon Creek, Middle Basin of Raccoon Creek, Monday Creek, Sunday Creek, Huff Run, Leading Creek, Moxahala and Yellow Creek.

Sub-Target 3: "By 2006, report annually on a comparison between acidity and pH concentrations upstream and downstream of AMD project sites and long-term monitoring stations, as compared to acidity and pH reference sites within the Western Allegheny Plateau Eco-region".

This report and website (www.watersheddata.com) were created in 2005 to provide ODNR-DMRM, watershed groups, watershed professionals, Ohio EPA, USEPA and all of Ohio's citizens an annual report of the reclamation efforts resulting in water quality and biological changes in Ohio's streams due to abandoned mine reclamation. This report is available on the website under the reports tab and updated annually.

2009 NPS Target and Goals Report

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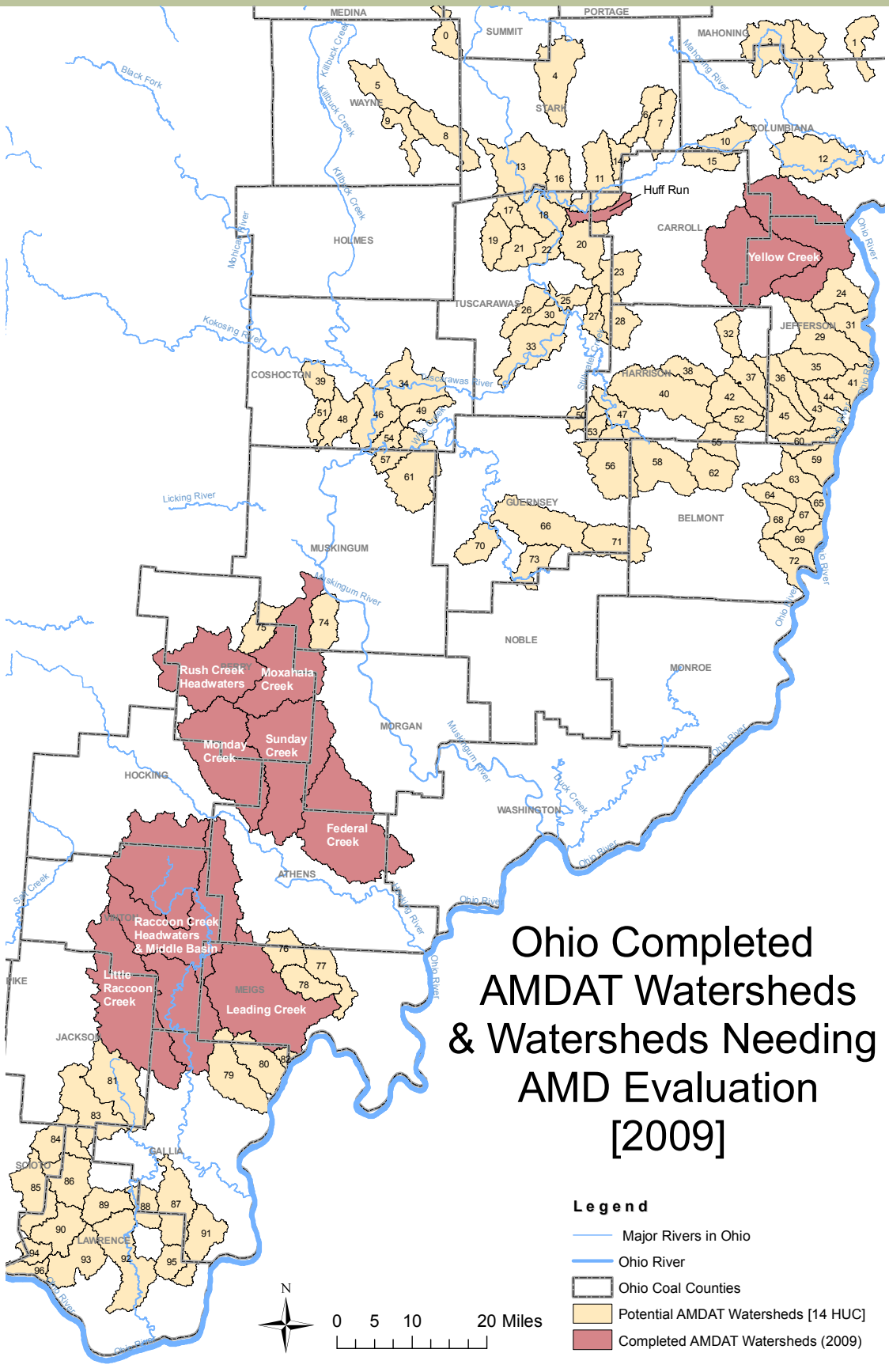
Map 1. Ohio completed AMDAT Watersheds and Watersheds Needing AMD Evaluation 2009



See attached key for watershed HUC codes and narrative descriptions

Map prepared by Ben McCament, ODNR-DMRM 11-23-2009

Section II – Watershed reports

Section II contains four watershed level NPS reports detailing the chemical and biological data trends from baseline condition to 2009.

1. Raccoon Creek Watershed
2. Monday Creek Watershed
3. Sunday Creek Watershed
4. Huff Run Watershed

2009 NPS Report - Raccoon Creek Watershed

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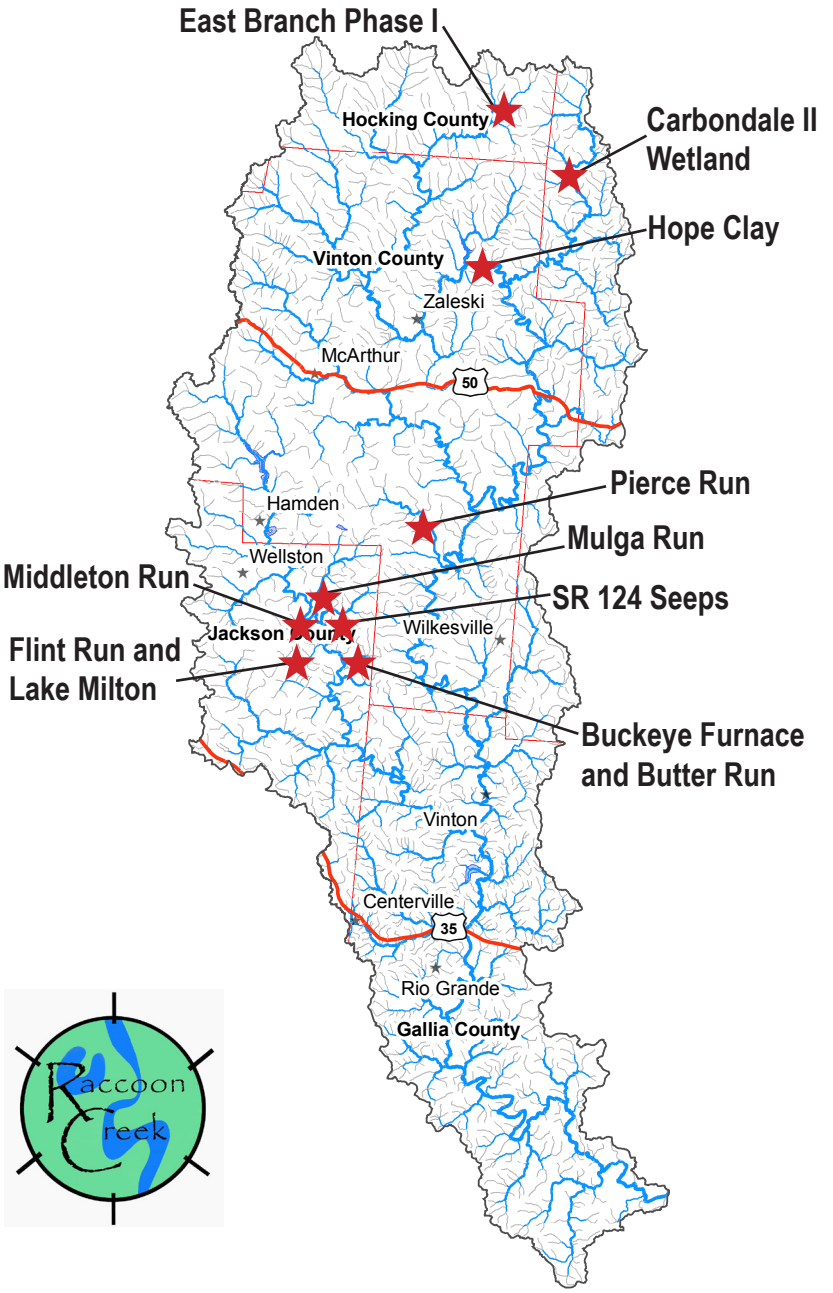
www.watersheddata.com

The Raccoon Creek Watershed Project 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, 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. Other 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, tree-plantings 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

Attainment Miles

Total stream miles assessed impacted by mine drainage = 190 miles

Target #1 indicates 30% attainment of impaired streams by 2010 = 57 miles

2006 progress = 23.3 miles meeting Full WWH attainment

(48 miles assessed in 2006)

Completion

Sub-target 2

Total projects proposed in three Raccoon Creek Watershed AMDATS = 25

Total projects complete = 10

Reductions

Total acid load reduction = 5,570 lbs/day
Total metal load reduction = 1,022 lbs/day

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

Design = $1,647,388
Construction = $6,842,225

Total Costs through 2009 = $8,489,613

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.

1980s Formation of Raccoon Creek Improvement Commitee (RCIC): Grassroots citizens group to address water quality issues in Raccon Creek

Early 1990s
RCIC invites citizens from all six counties to join efforts

Late 1990s
Formation of Raccoon Creek Watershed Partnership,a loosely based partnership of agencies to address technical AMD issues

1999 State Route 124 Strip Pit and Buckeye Furnace Project completed

2000 Little Raccoon Creek AMDAT completed
Watershed Coordinator position funded for six years

2001 Headwaters AMDAT completed
State Route 124 seeps project completed

2003 Mulga Run project completed
Middle Basin AMDAT completed
Completed management plan for Raccoon Creek Watershed

2004 Carbondale II project completed

2005 Middleton Run-Salem Road project completed

2006 Raccoon Creek Water Trail Association formed
Mission to Establish a water trail on Raccoon Creek

Flint Run and Lake Milton Projects completed
Watershed Coordinator three year extension funded

2007 Raccoon Creek Watershed Partnership formed 501 (c) 3
Waterloo Aquatic Education Center opened

2008 East Branch Phase I AMD Project

2009 Pierce Run AMD Project began
East Branch Phase II Project began

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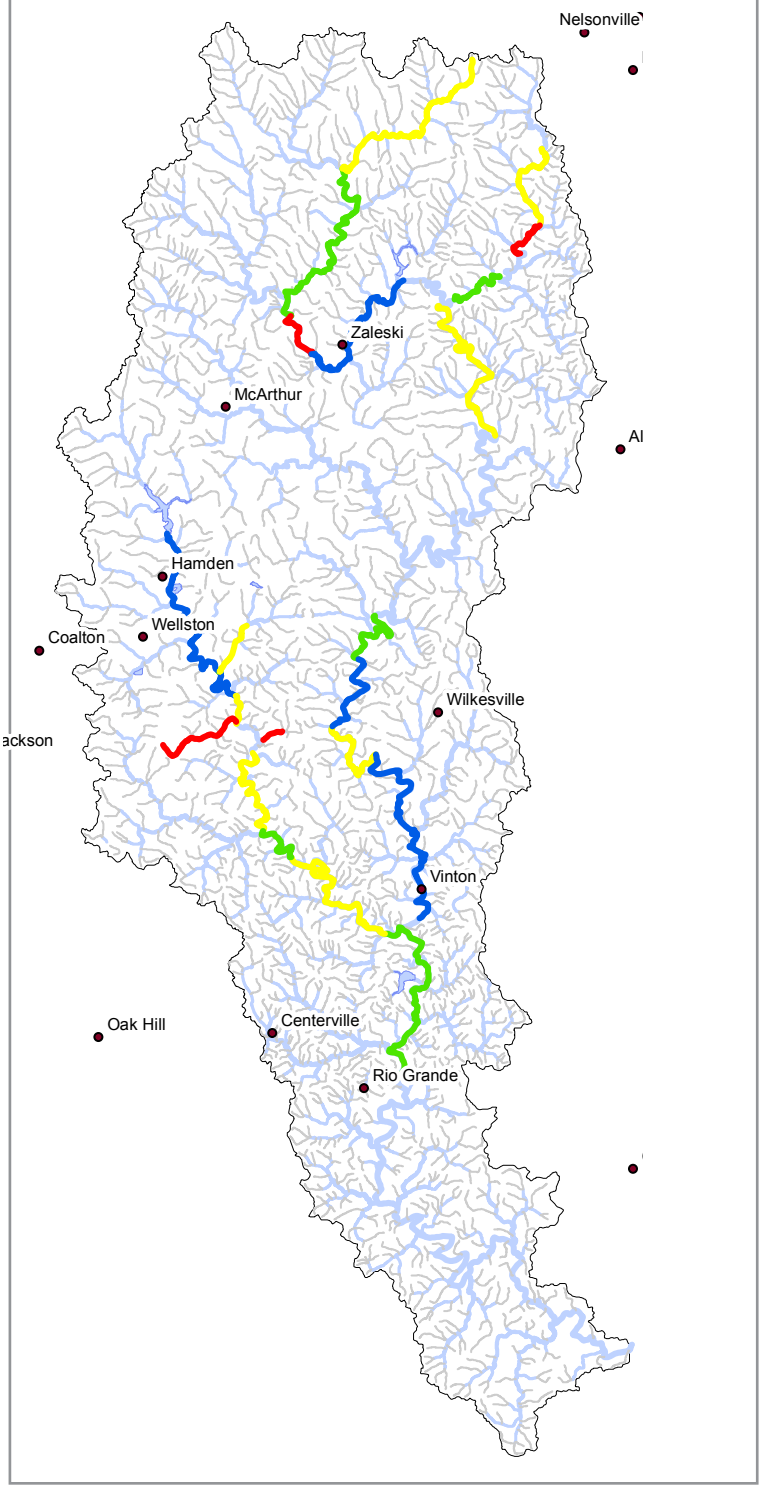
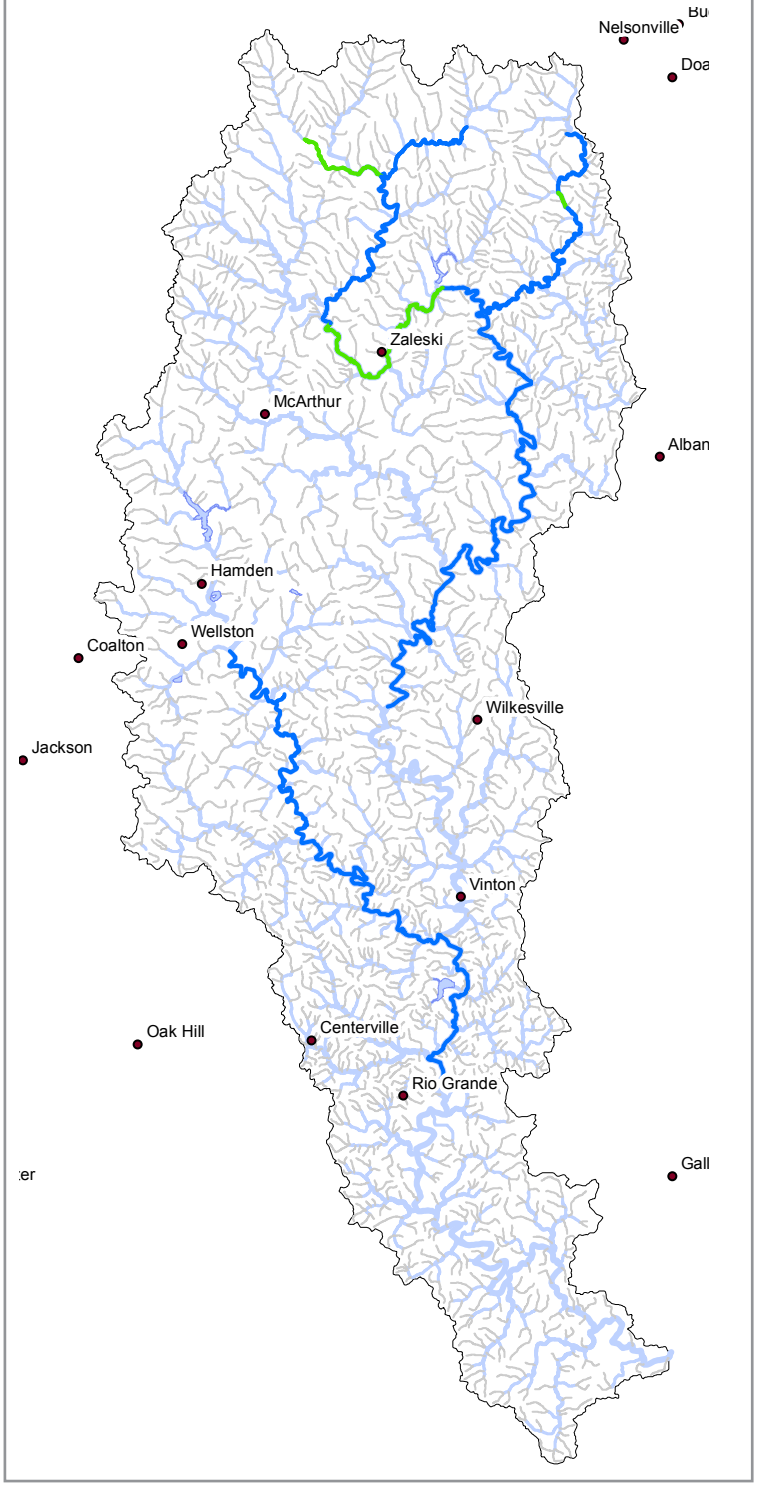
Chemical Water Quality

Raccoon Creek baseline pH



Raccoon Creek 2009 pH



In Raccoon Creek pH values have improved throughout the watershed from baseline conditions (1994-2001) to 2009. 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 6.1-8.8 in 2009. (In 2009, 14.4 river miles in Hewett Fork, 27 river miles in Little Raccoon Creek, and 57 miles along the mainstem of Raccoon Creek all met the pH standard (pH >6.5)).

2009 NPS Report - Raccoon Creek Watershed

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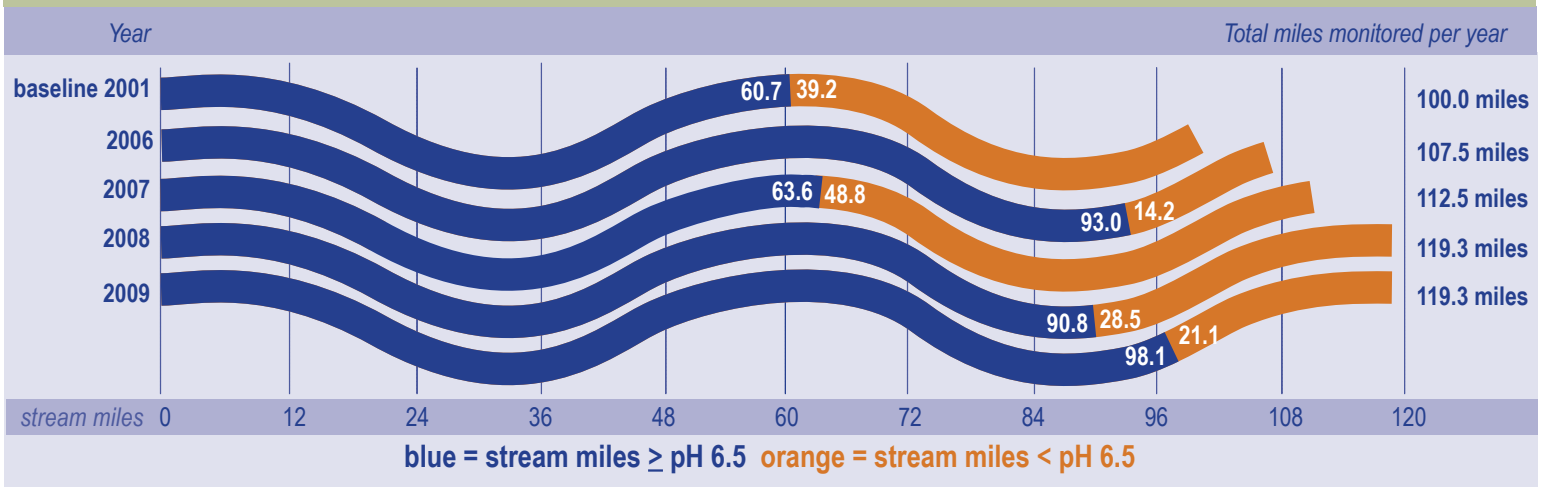
Chemical Water Quality

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 (Figure A).

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



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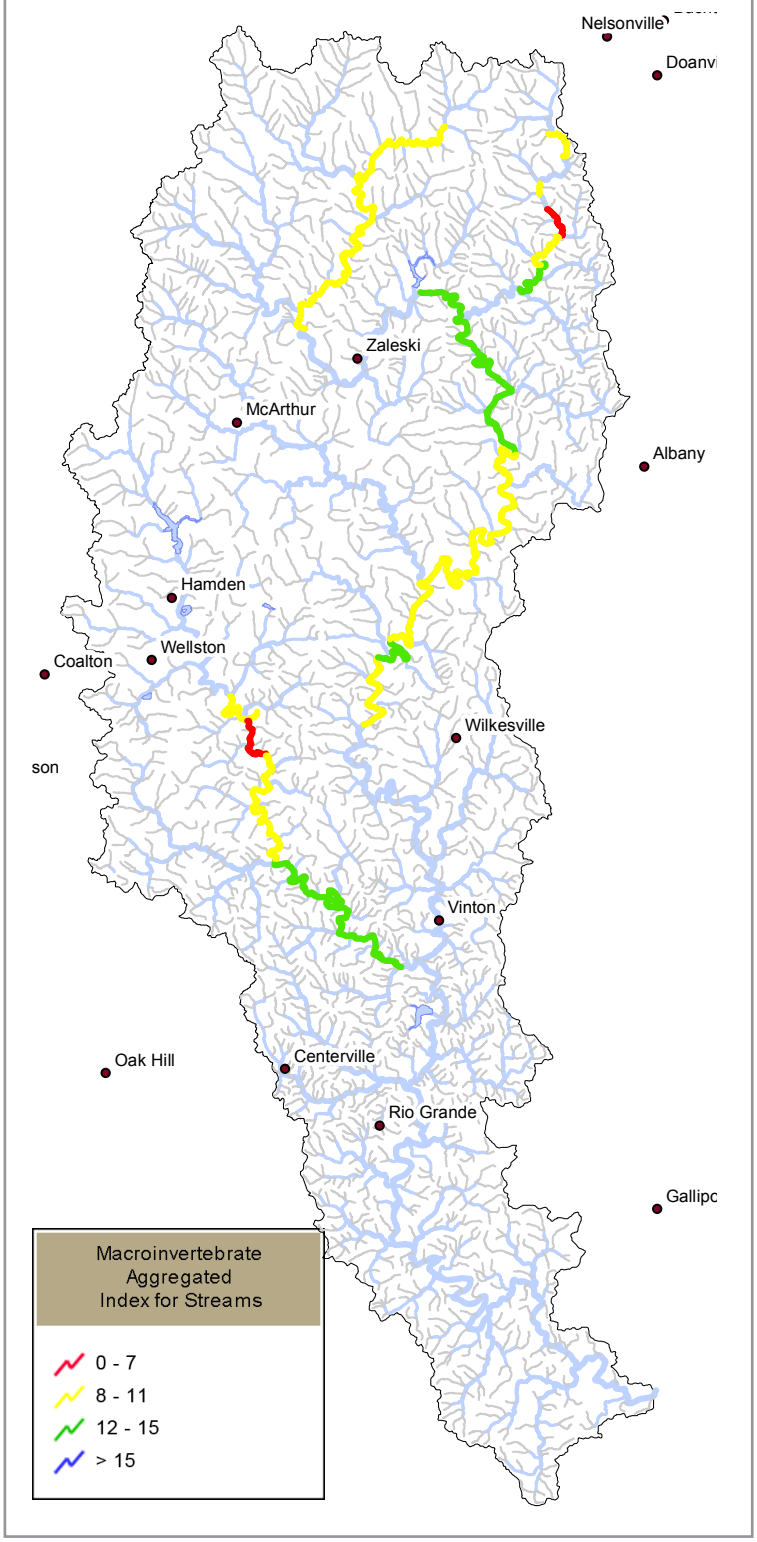
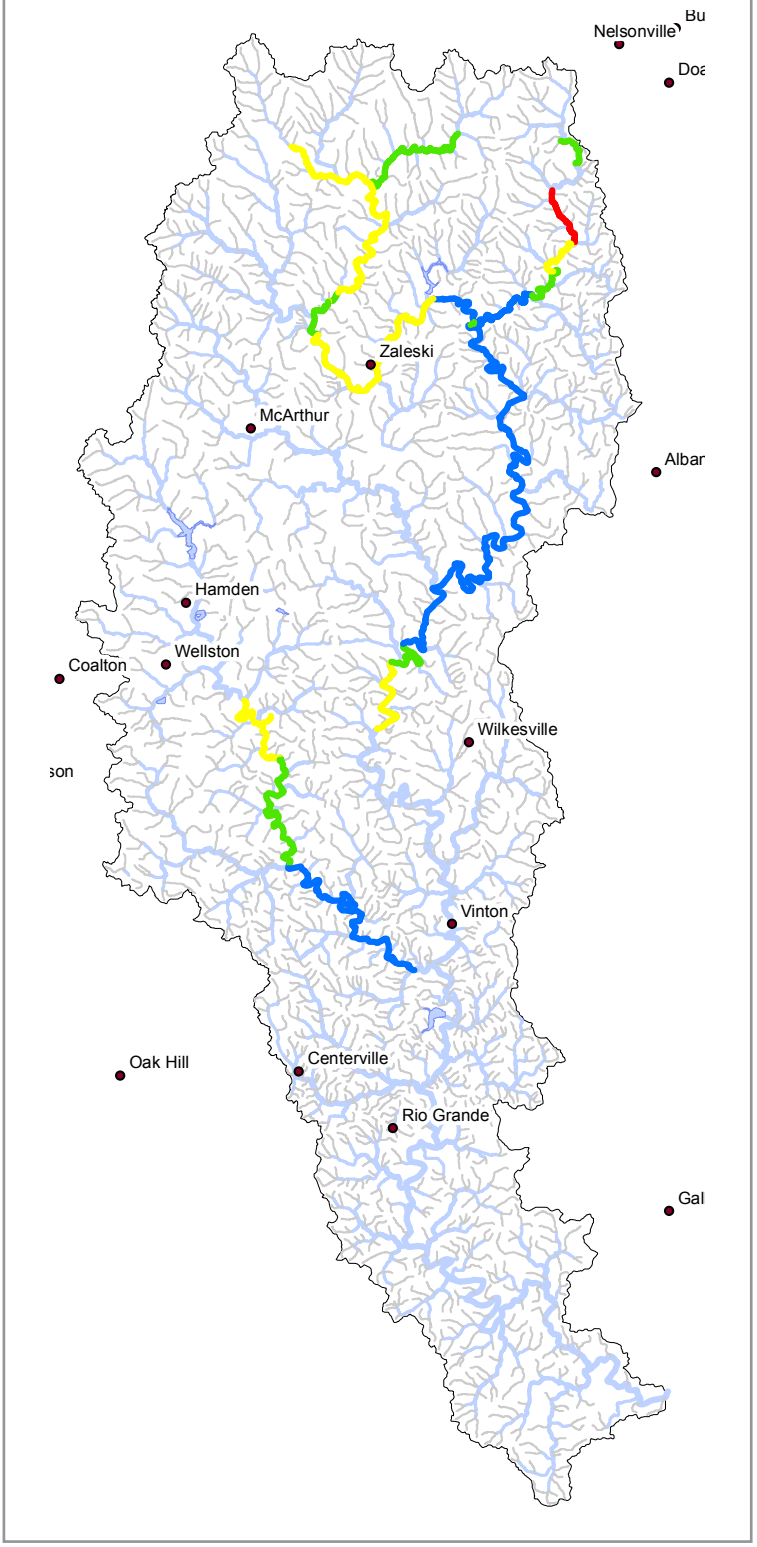
Biological Water Quality

Raccoon Creek baseline MAIS



Raccoon Creek 2009 MAIS



MAIS samples were collected throughout Raccoon Creek in 2009, 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

MAIS samples were collected throughout Raccoon Creek from 2006 through 2009. These stations have been established as annual monitoring stations for macroinvertebrates they will be used to track incremental changes in future years. After each station amasses five samples (five years of data) a regression analysis can be used to determine changes.

Figure B. Area of degradation for MAIS scores in Hewett Fork from 2008 to 2009.

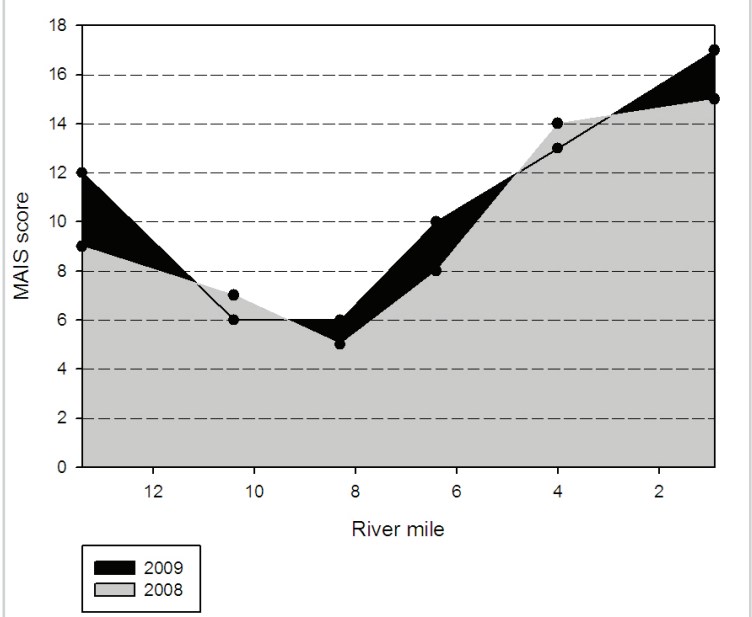
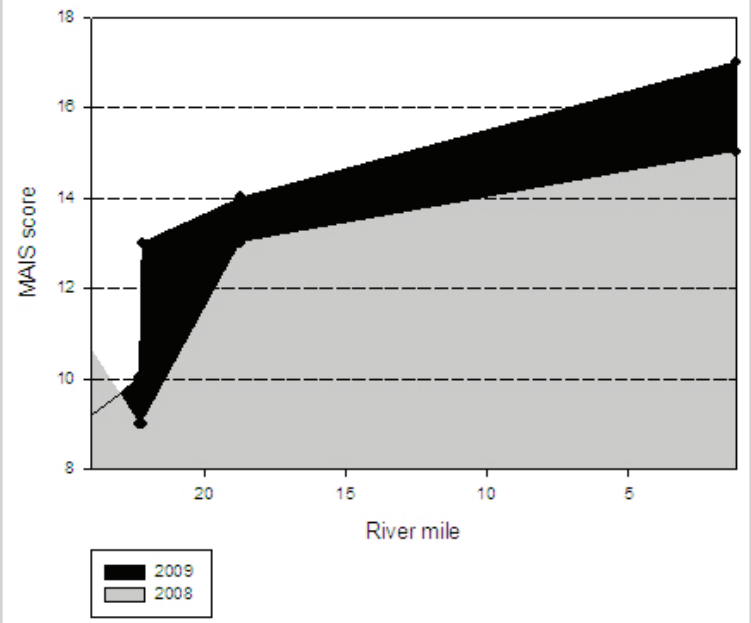


Figure C. Area of degradation for MAIS scores in Little Raccoon Creek from 2008 to 2009.



Area of Degredation Hewett Fork

RM	2006	2007	2008	2009
13.4				
10.4	-12	-39	-24	-18
8.3	-16.8	-37.8	-25.2	-25.2
6.4	-15.2	-22.8	-20.9	-15.2
4	-4.8	-4.8	-4.8	-2.4
0.9	3.1	3.1	15.5	18.6
Total area of degradation	-45.7	-101.3	-59.4	-42.2
		Improved relative to 3 prior years		

The 2009 measures of biological quality (macroinvertebrate scores) showed an overall reduction in the area of degradation, with the greatest improvements being seen in the mid-lower parts of the mainstem (from Kings Hollow Rd, RM 6.4 downstream). The sampling station at the mouth of Hewett Fork at Moonville achieved a MAIS score of 17 and rating of Very Good quality.

Area of Degredation Little Raccoon Creek

RM	2006	2007	2008	2009
24.4				
22.3	-8.4	-6.3	-8.4	-10.5
18.7	-18	-7.2	-21.6	-3.6
12.7	-24	6.0	-12.0	18.0
1.2	11.5	23.0	46.0	80.5
Total area of degradation	-38.9	15.5	4.0	84.4
		Improved relative to 3 prior years		

Little Raccoon Creek showed a solid trend of improved biological quality in 2009, compared to the three preceding years.

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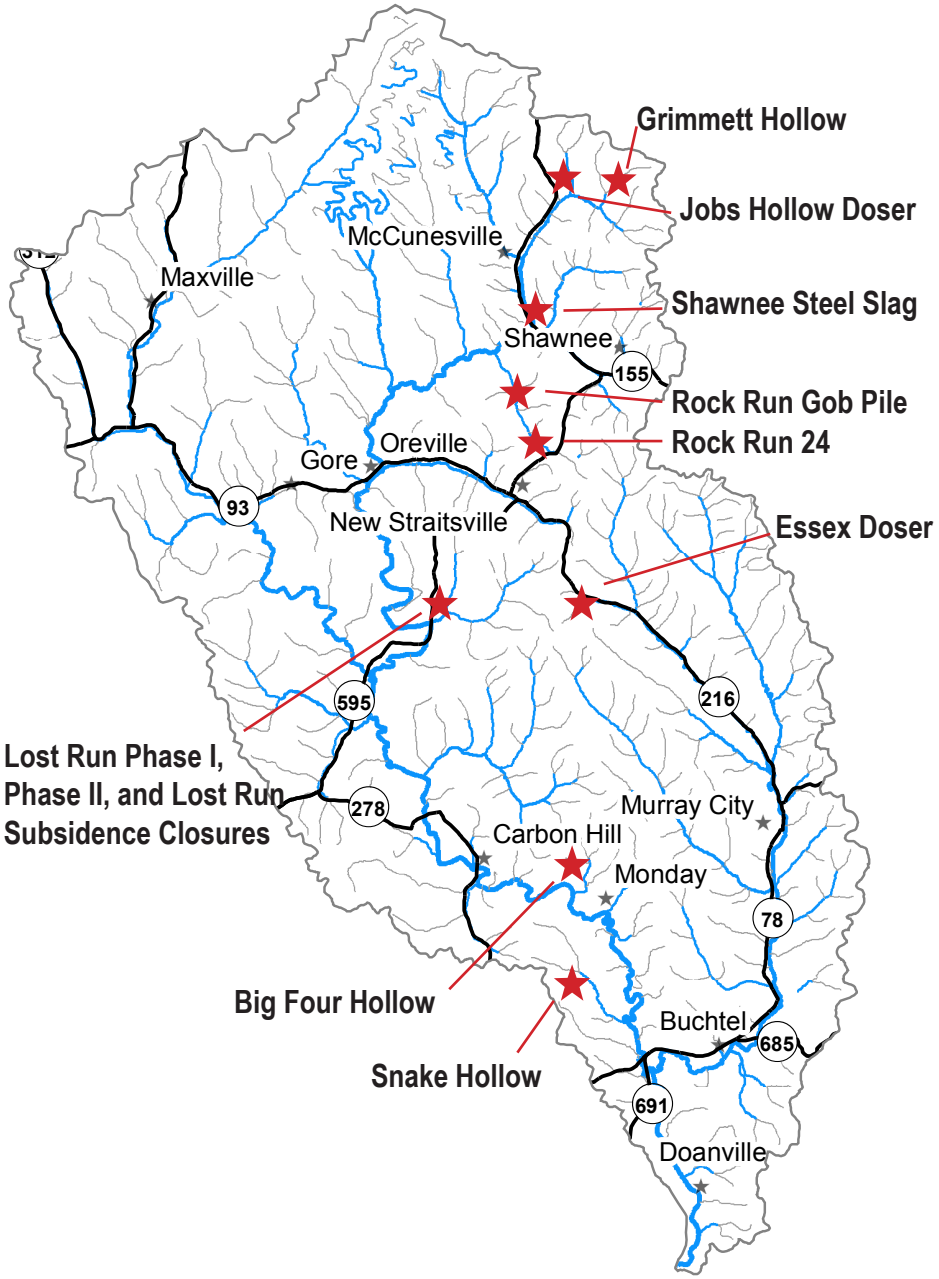
- Monday Creek, located in the Appalachian Region of southeastern Ohio, is a 27-mile long tributary of the Hocking River, the latter which flows directly into the Ohio River. The Monday Creek Watershed drains a 116 square-mile area, with streams winding through portions of Athens, Hocking, and Perry Counties.

- Our project is a collaborative partnership of officials and residents of the Monday Creek watershed, along with more than 20 other organizations and state and federal agencies. Our shared goal is to restore the watershed for the benefit of local communities. Large portions of Monday Creek and its tributaries are dead due to acid mine drainage (AMD) left behind from a century of coal mining.

- Since 1994, our partnership has worked together to identify water quality problems, conduct field research and site characterization, and prioritize and plan on-going restoration activities. The MCRP has completed the reclamation of the Rock Run gob pile in southern Perry County through an EPA Section 319 grant and is beginning another project in the headwaters of Jobs Hollow through 319.

- In 1997-1998, we identified issues to be addressed for the long-term improvement of the watershed, and to the benefit of local communities. These issues, along with goals, objectives, action strategies, and progress indicators are discussed in detail in the Monday Creek Comprehensive Management Plan.

- To learn more about the Monday Creek Restoration Project, visit our website at www.mondaycreek.org or call 740-394-2047



333,935,000 gallons per year eliminated from entering into the deep mines as the result of conducting six stream capture closure projects in Monday creek

Monday Creek Restoration Project

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Reductions

Total acid load reduction = 3,463 lbs/day

Total metal load reduction = 511 lbs/day

Data derived using the Mean Annual Load Method (Stoertz, 2004). (excludes Rock Run Gob Pile Project)

Costs

Design $304,056 *(excluding Snake Hollow)*

Construction $3,658,851

Total costs through 2009 = $3,962,906

Monday Creek Stream Capture Projects

Project status: Six subsidence closures projects were completed from 1995-2007

Project Name	Year project complete	Acres Captured	Agencies funding	Estimated gallons/yr of water diverted from entering the deep mine
Majestic Mine	1999	100	ODNR-DMRM	36,860,000
Salem Hollow	2000	60	ODNR-DMRM	22,116,000
Murray City	2004	5	ODNR-DMRM	1,843,000
Goose Run	1995	506	ODNR-DMRM	186,512,00
Snow Fork	1999	140	ODNR-DMRM	51,604,000
Lost Run	2007	100	USFS	35,000,000

Six stream captures located in the Monday Creek Watershed were closed and completed from 1995 to 2007. A total of 911 acres surface drainage area drained year round into the deep mines and as a result of closing these subsidence holes, 333,935,000 gallons per year were diverted from entering into the deep mine thus abating the generating of acid mine drainage.

2009 NPS Report - Monday Creek Watershed

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Completion

Sub-target 2: Total projects proposed in 1999 AMDAT = 13

Total projects complete = **10 (plus 5 subsidence closures)**

Attainment Miles

Total stream miles assessed impacted by mine drainage **= 83 miles**

Target #1 indicates 30% attainment of impaired streams by 2010 **= 25 miles**

2006 progress = **0 miles** meeting Full WWH attainment *(33 miles assessed in 2006)*

Cumulative BMP's Installed

Shawnee Steel Slag

Treatment Installed

Steel slag bed	22,800 square feet
Open limestone channel	190 linear feet
Sand filter	1 pre-treatment

Projects Completed Jan. 1, 2009–Dec. 31, 2009

Shawnee Steel Slag	**$219,791**

Concentrations and Loads

Shawnee Steel Slag	**Pre**	**Post**
Acid Concentration	15 mg/l	36 mg/l
Metal Load	97 lbs/day	51 lbs/day

2009 NPS Report - Monday Creek Watershed

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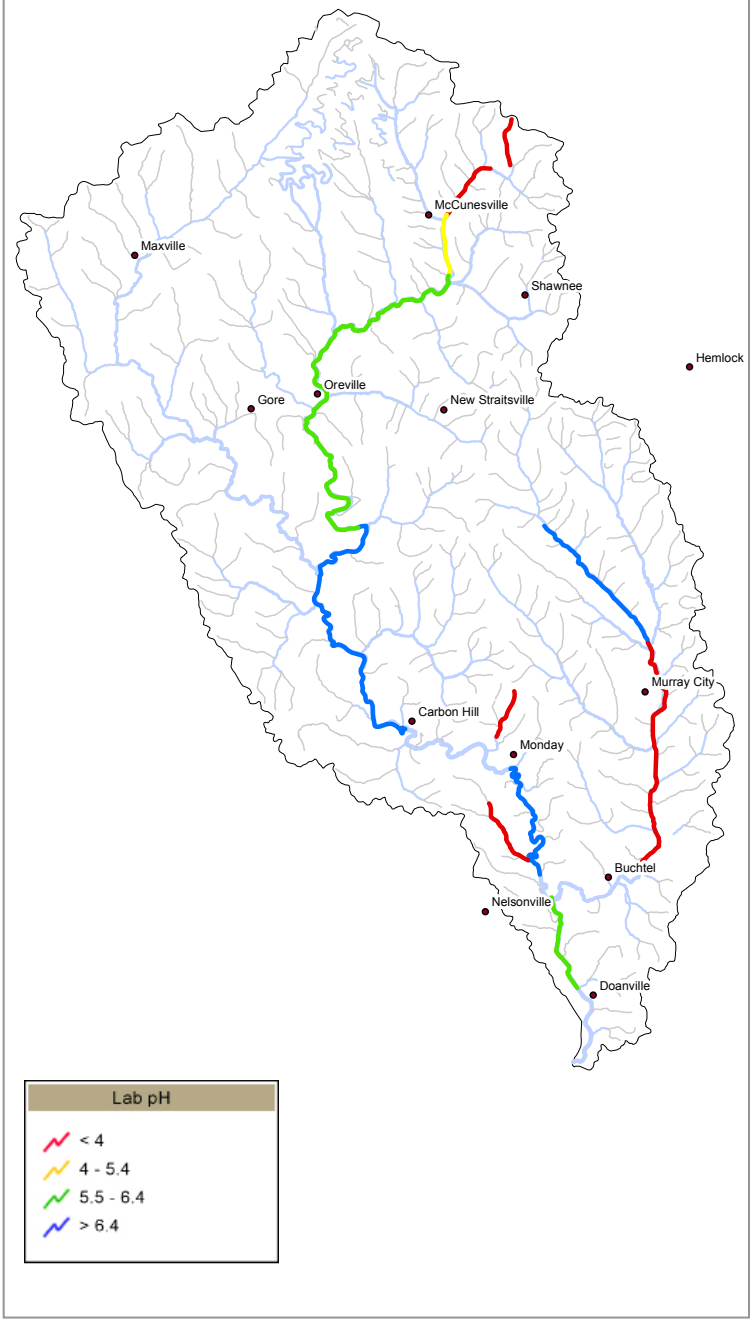
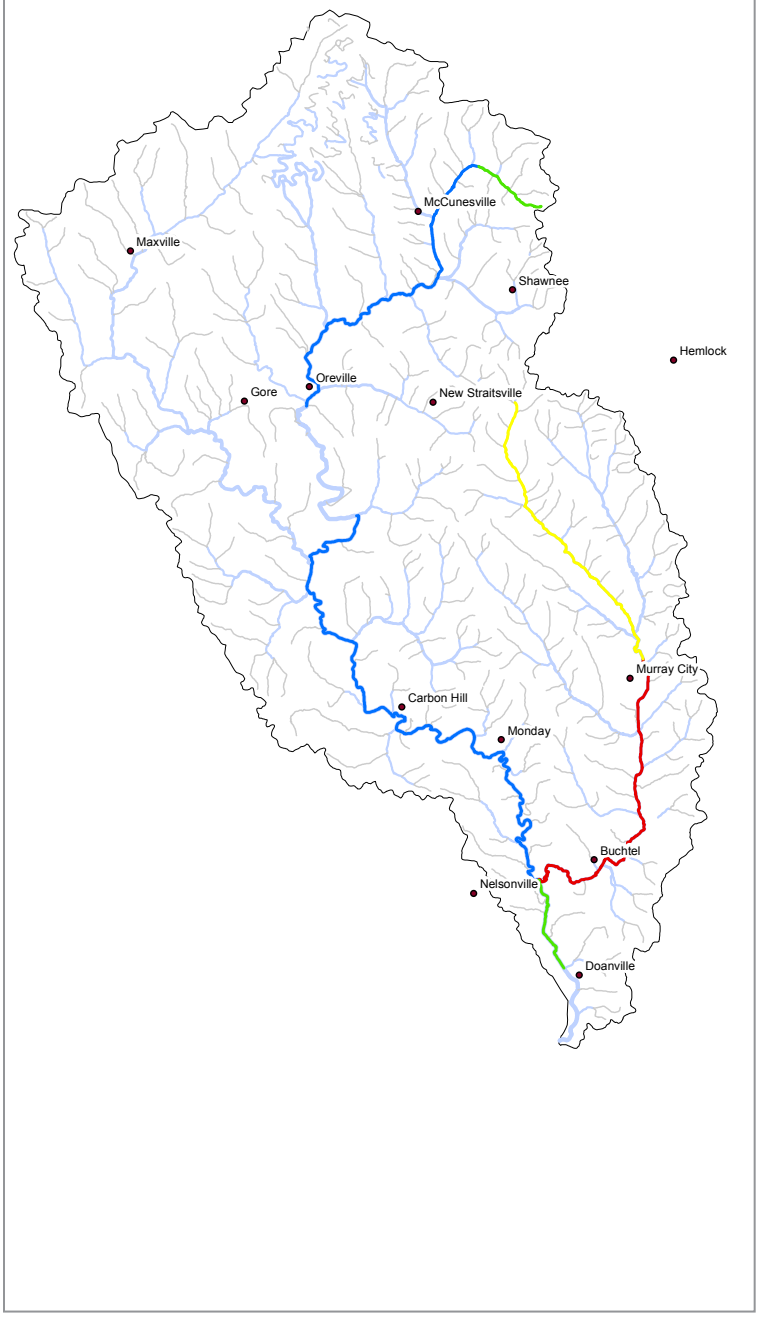
Chemical Water Quality

Monday Creek baseline pH



Monday Creek 2009 pH



In Monday Creek pH values have improved throughout the watershed from baseline conditions (2001) to 2009.

2009 NPS Report - Monday Creek Watershed

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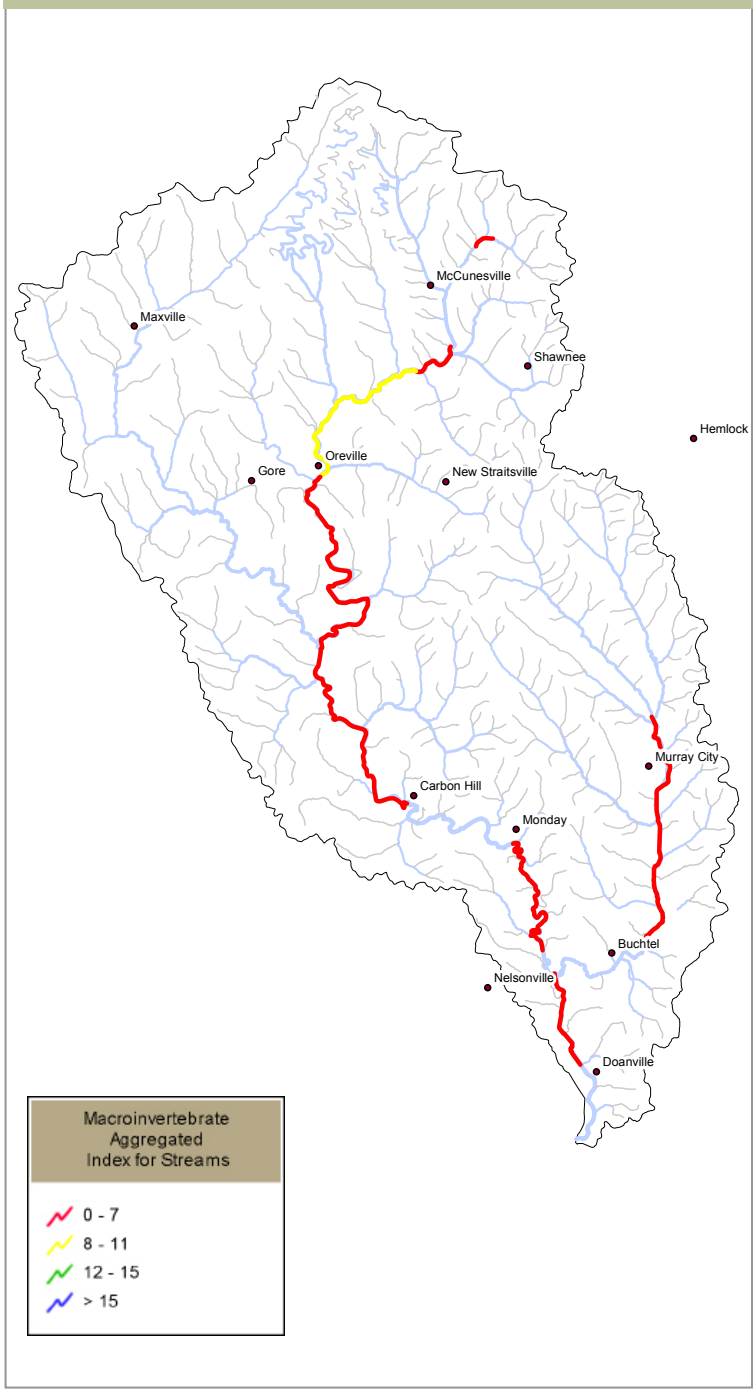
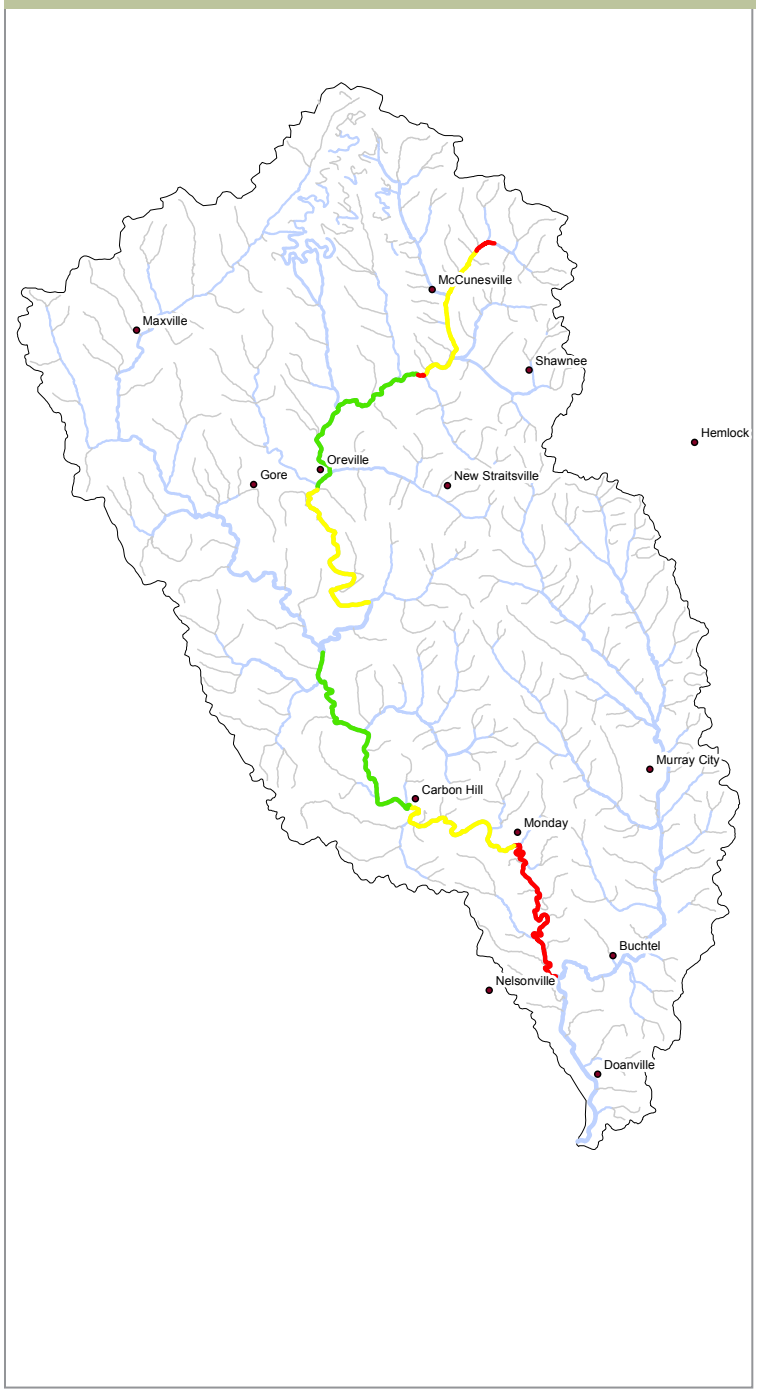
Biological Water Quality

Monday Creek baseline MAIS



Monday Creek 2009 MAIS



MAIS samples were collected throughout Monday Creek at established annual monitoring stations from 2001 through 2009.

2009 NPS Report - Monday Creek Watershed

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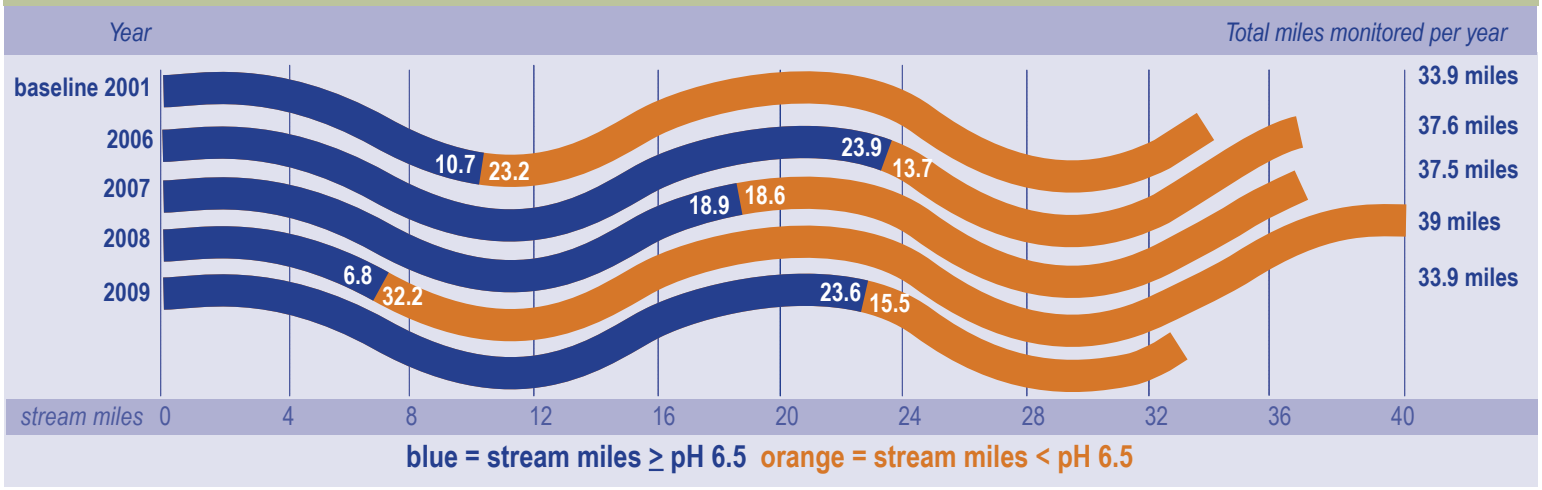
Chemical Water Quality

There are approximately 38 stream miles monitored each year along the mainstem of Monday Creek and major tributary Snow Fork. A restoration target for pH is 6.5. Since 2007 there have been increases and decreases in the number of stream miles that meet this target. In 2007, 19 stream miles of the 38 monitored met the pH target of 6.5. However in 2008 only 7 miles of the 39 miles monitored met this target. Recent 2009 data shows an increase again with 24 miles of the 39 monitored meeting the pH target (Figure A).

Figure A. Monday Creek pH



Biological Water Quality

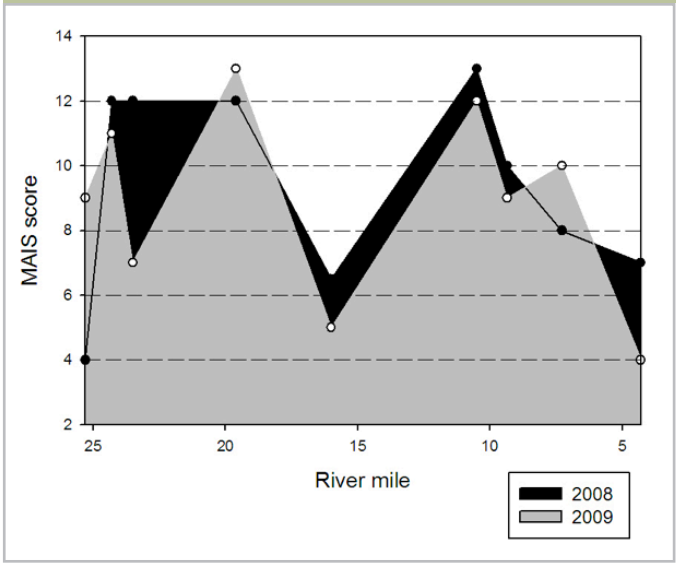
The mainstem of Monday declined relative to the most recent two years, 2007 and 2008, during which biological quality appeared to have improved substantially, especially at RM 10.5 and downstream. In 2009, however, quality declined in the section upstream of RM 19.6 and again upstream of RM 10.5. However, overall the area of degradation in 2009 (-128) is half that recorded in 2003 (-331.9).

Figure B. Area of Degredation

	RM	2003	2005	2006	2007	2008	2009
	25.3						
	24.3	-24	-11	-8	-5	-8	-4
	23.5	-18.4	-5.6	-7.2	-2.4	0	-4.8
	19.6	-50.7	0	-23.4	-11.7	0	-15.6
	16	-50.4	-39.6	-21.6	-14.4	-19.8	-21.6
	10.5	-60.5	-60.5	-27.5	-11	-24.75	-38.5
	9.35	-12.65	-12.65	-4.6	-1.15	-1.15	-3.45
	7.27	-49.92	-33.28	-18.72	-16.64	-12.48	-10.4
	4.3	-65.34	-23.76	-32.67	-23.76	-26.73	-29.7
Total	**-331.91**	**-186.39**	**-143.69**	**-86.05**	**-92.91**	**-128.05**	

Area of Degradation Improved relative to 2003-2006, but declined relative to 2007 -2008

Figure C. Area of Degredation



2009 NPS Report - Sunday Creek Watershed

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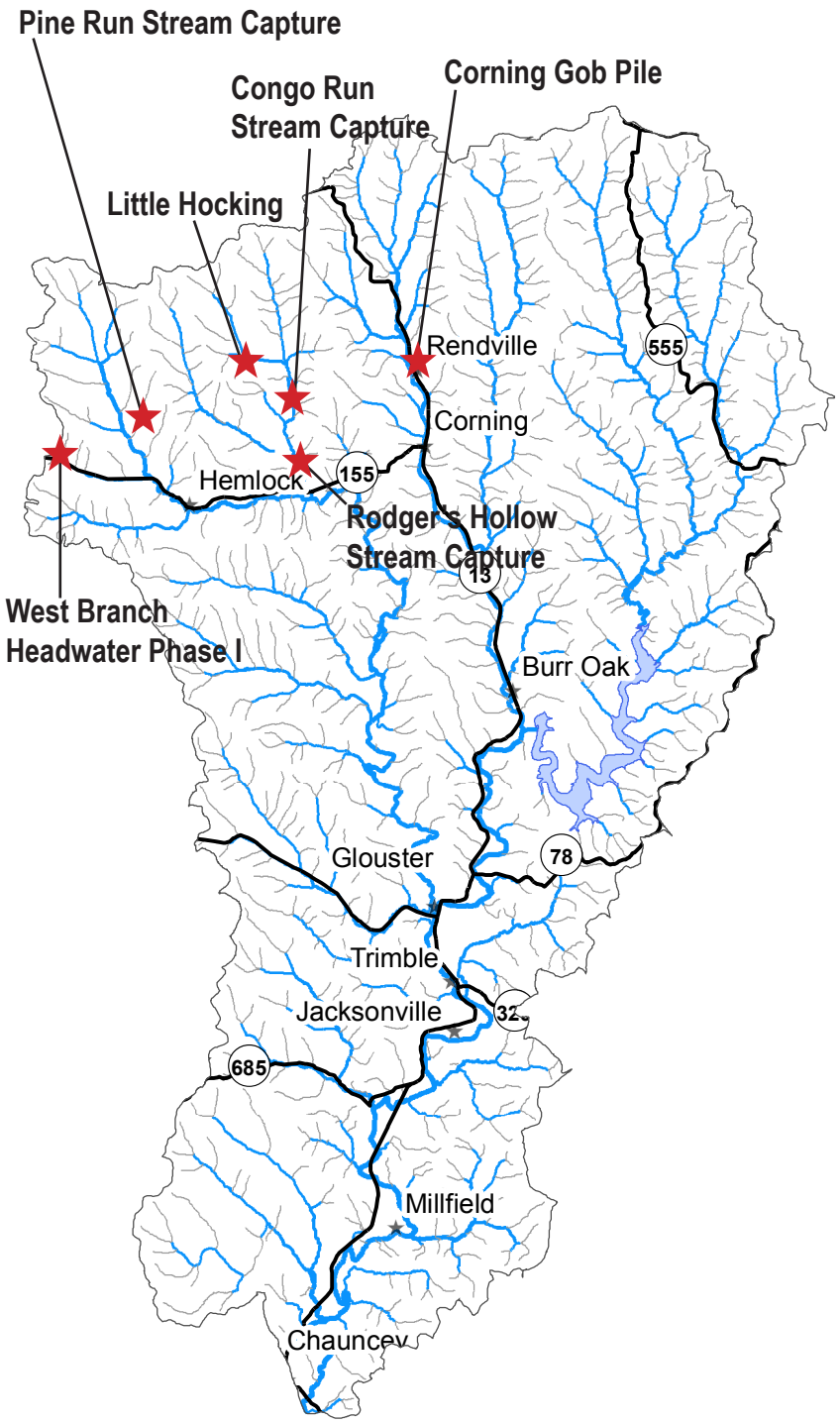
• The Sunday Creek Watershed Group emerged from local residents' concerns for the health of the Sunday Creek. Currently, we are a project of Rural Action. The Sunday Creek Watershed group office is located on 69 High St. Glouster Ohio 45732. The phone number is 740-767-2225 and our web page is http://www.sundaycreek.org. Our most active partners are: Ohio Department of Natural Resources the divisions of Mineral Resource Management and Soil and Water Conservation; Ohio Environmental Protection Agency; Office of Surface Mining; Ohio University; ILGARD; Hocking College; Trimble and Miller School District; Rural Action's Environmental Learning Program and Sustainable Forestry; Local Village Councils; Local Township Trustees; Little Cities of Black Diamonds; Buckeye Trail Group; Moose Lodge; Wayne National Forest; Burr Oak State Park.

• Our mission statement, as adopted by the Sunday Creek Watershed Group in 2000; "The Sunday Creek Watershed Group is committed to restoring and preserving water quality through community interaction, conservation, and education; in pursuit of a healthy ecosystem capable of supporting bio-diversity and recreation."

• The Sunday Creek Watershed is located in the Appalachian foothills, in the unglaciated part of Ohio. It is mostly rural with many small villages throughout, and the majority of the land is privately owned. The Sunday creek watershed starts in the East Branch, north of Rendville and the West Branch at Shawnee. The creek follows SR 13 through Corning, Glouster, Millfield and it goes into the Hocking River right in Chauncey. The watershed covers 139 square miles crossing Athens (38.8%), Perry (42.84%), Morgan (18.35%), and Hocking (0.01%) Counties. According to the Ohio Department of Natural Resources, in 1994, land cover classification for Sunday Creek consisted of 78% wooded, 17% agricultural, 2.4% brush, 1% urban, 1% open water, 0.3% barren, and 0.2% non-forested wetland (Map 2: land use/land cover). The U.S. Forest Service manages approximately 15% of the total acreage.



2009 NPS Report - Sunday Creek Watershed

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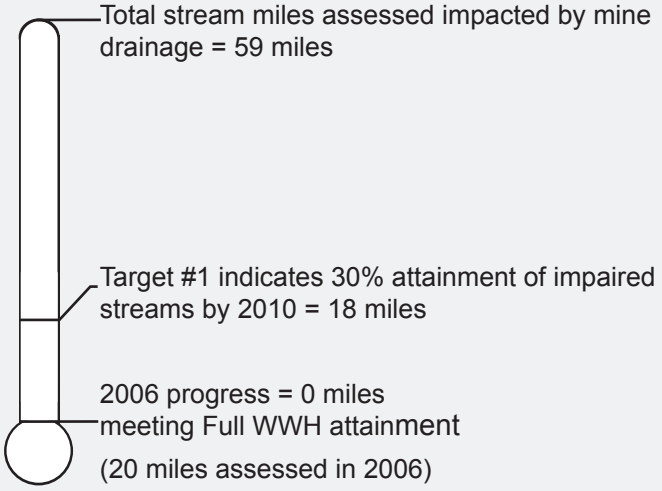
In the fall of 1999, Jim Hart began putting together a list of other local residents interested in water quality in the Sunday Creek watershed. A group of over 20 people attended the first meeting, which was held in the Trimble High School library. At the beginning, the group focused on organization, establishing a mission, and getting a sense of the community's concerns for the Sunday Creek. In 2000, the group partnered with Rural Action and got its first full time Americorp VISTA. That year we received an EPA 319 planning grant to develop a management plan. With that grant we completed a State Endorsed Management Plan and an Acid Mine Drainage Abatement Plan with additional funding from ODNR-MRM. In 2002, we received a six year ODNR Soil and Water Conservation Watershed Coordinator grant. In 2003 we began our first EPA 319 2002 implementation grant. Currently we are in the last year of our second (2004) EPA 319-implementation grant. We also received an Appalachian Clean Stream Initiative Grant from OSM. All of this funding has been made possible with our strong partnership and match funding from the ODNR division of Mineral Resource Management. We have finished our first acid mine drainage remediation project at Congo Run, a subsidence closure. The SCWG is currently coordinating major reclamation projects in the West Branch of Sunday Creek and Headwaters. We have also completed 17 upgrades of septic systems, planted thousands of trees, cleaned up over 200 tons of garbage, and educated thousands of students.

Reductions

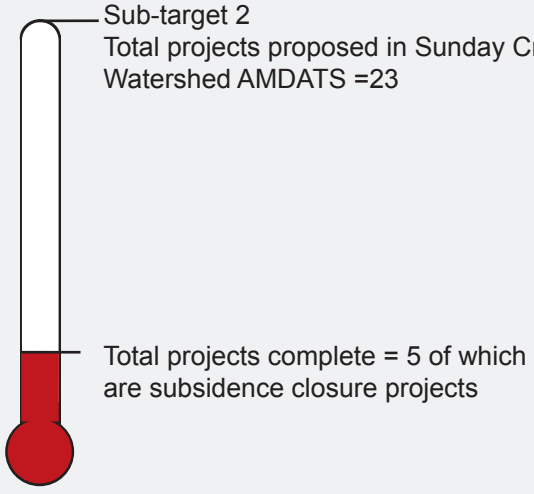
Project Name	Year Completed	Acres Captured	Agencies funding	Estimated water diverted from entering the deep mine
Congo Run CR-15	2004	72	ODNR-DMRM, OSM	24,000,000 gallons/yr
Pine Run	2007	138	ODNR-DMRM, OEPA	50,867,000 gallons/yr
Rodgers Hollow	2007	1,600	ODNR-DMRM, OEPA	589,290,000 gallons/y
Little Hocking	2009	286	ODNR-DMRM, OSM	105,400,00 gallons/yr

Four stream captures located in the Sunday Creek Watershed were closed and completed from 2004-2009. A total of 2096 acres surface drainage area drained year round into the deep mines and as a result of closing these subsidence holes 769,557,000 gallons per year were diverted from entering into the deep mine thus abating the generating of acid mine drainage. Expected additional alkaline loading from these closures returning clean water to the recieving streams is 986 lbs/day. As result of the Rodgers Hollow Subsidence closure, the deep mine discharge in Drakes has seen a reduction in Acidity loads by 18 lbs/day.

Attainment Miles



Completion



Costs

Design = $208,941
Construction = $1,004,705

Total costs through 2009 = $1,213,646
(excluding Congo Run CR-15 design)

2009 NPS Report - Sunday Creek Watershed

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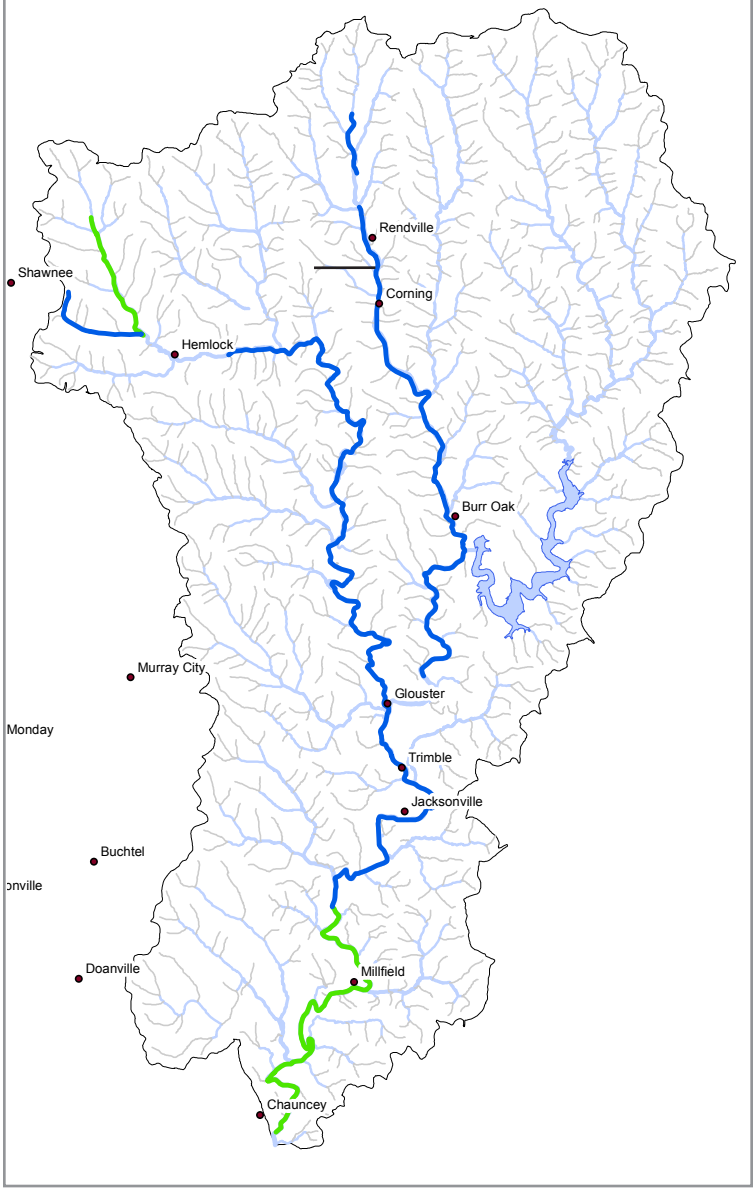
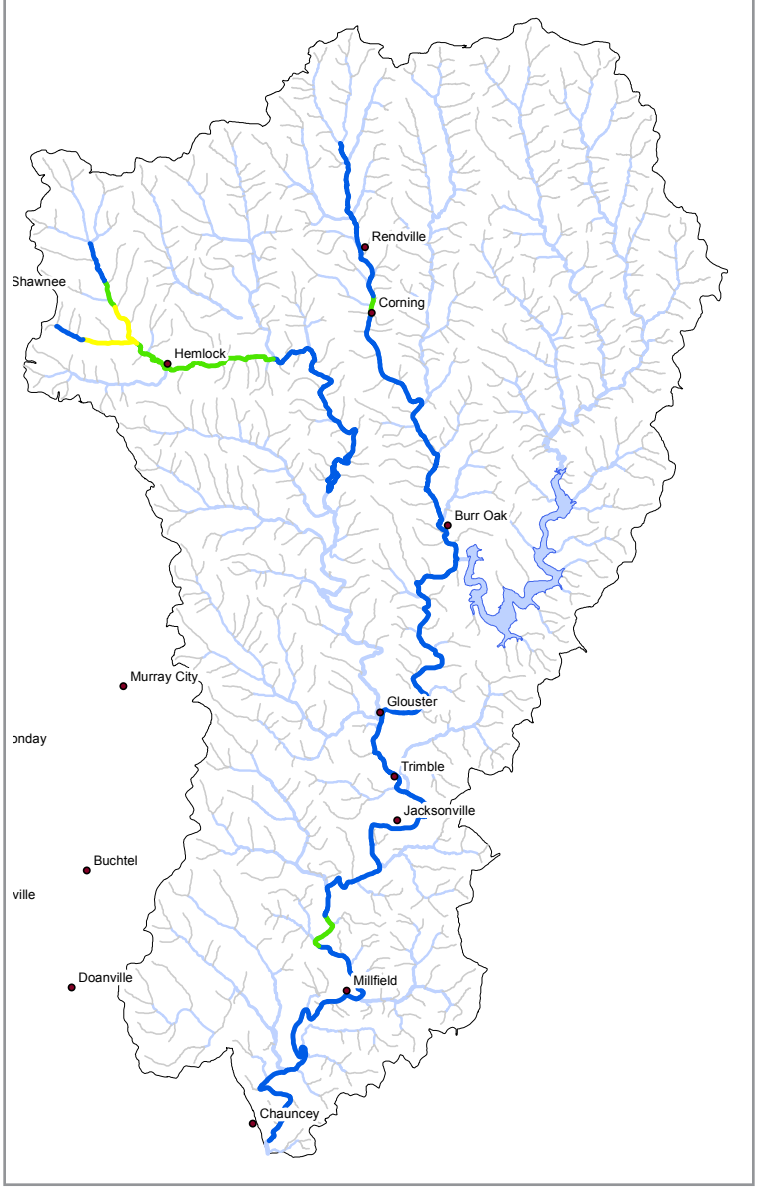
Chemical Water Quality

Sunday Creek baseline pH



Sunday Creek 2009 pH



Water quality along the West Branch Sunday Creek has been degrading since baseline conditions in 2001. Values of average pH dropped from >6.4 to 4.0-5.4 range in 2005 to 2006 and remained constant in 2007. When the subsidence features increased in Rodger's Hollow, funneling more water into the mine that generated AMD and discharged it into West Branch of Sunday Creek, the water quality decreased. However, since the subsidence closure in Rodger's Hollow in late 2007, the 2008 data for the first time shows an increase in pH along this stream segment. The average pH in 2007 at site WB 003 was 4.83, in 2008 5.97, and in 2009 6.08.

2009 NPS Report - Sunday Creek Watershed

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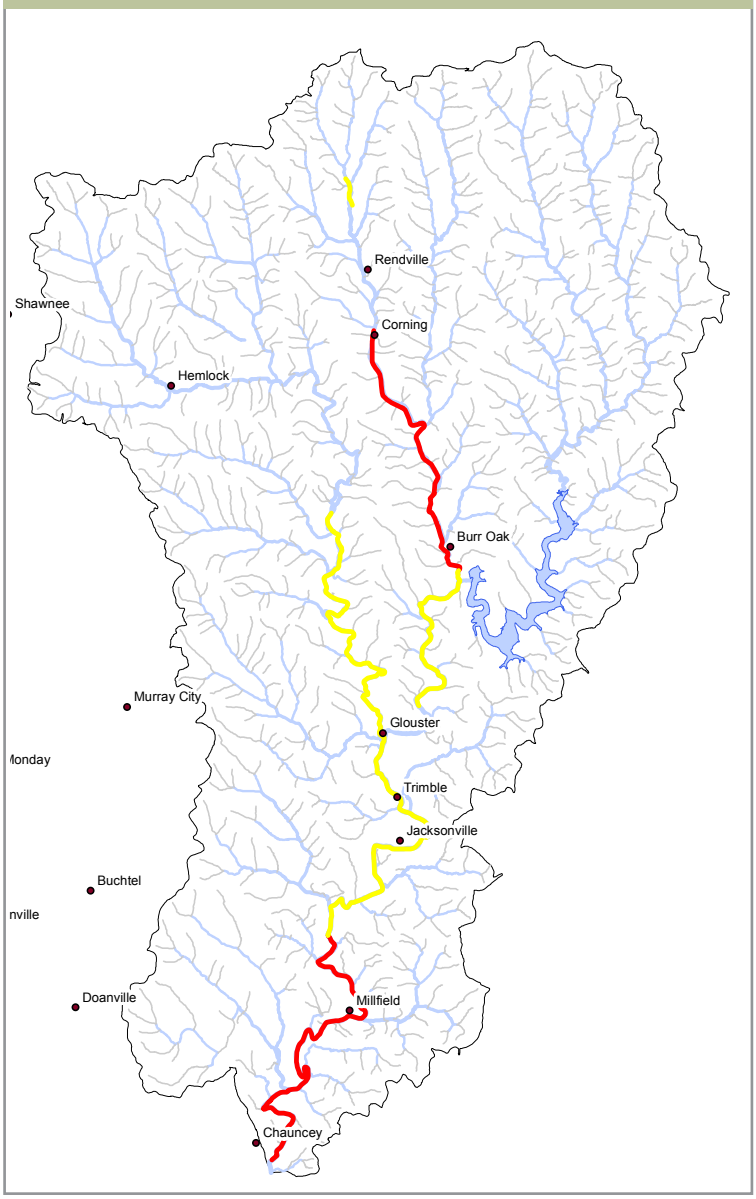
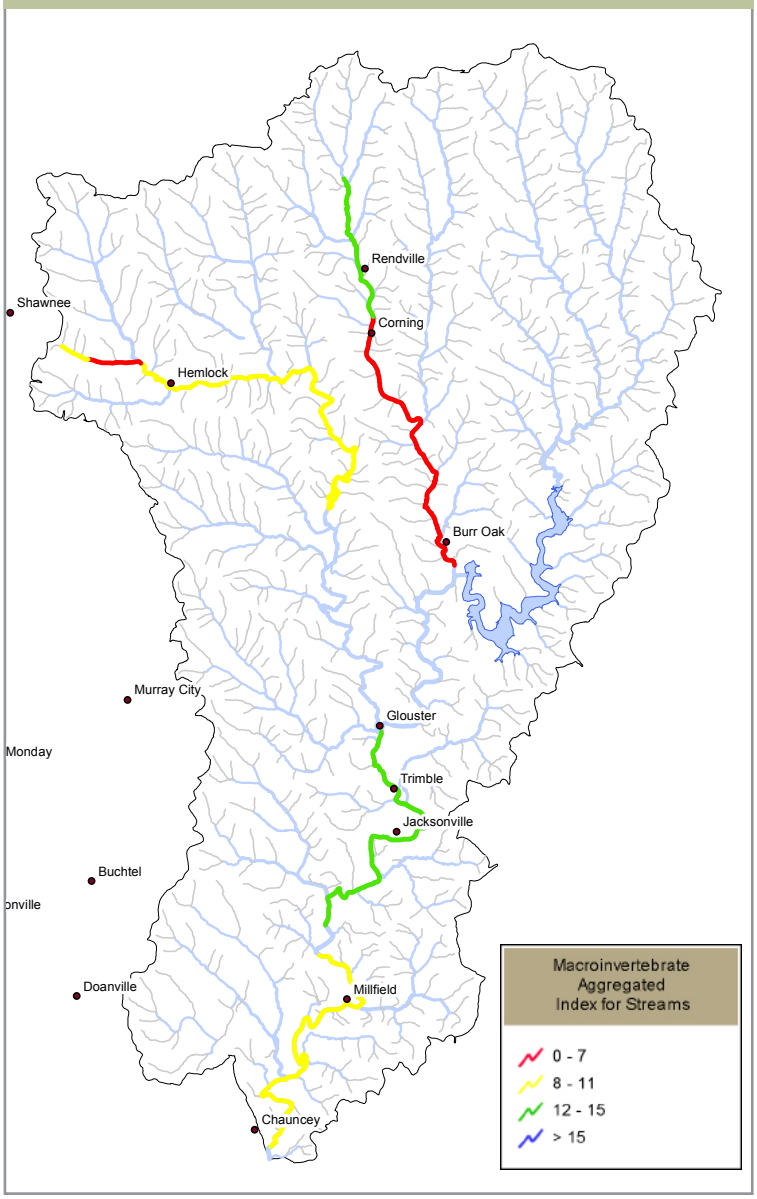
Biological Water Quality

Sunday Creek baseline MAIS



Sunday Creek 2009 MAIS



MAIS samples were collected throughout Sunday Creek at established annual monitoring stations from 2001 through 2009.

2009 NPS Report - Sunday Creek Watershed

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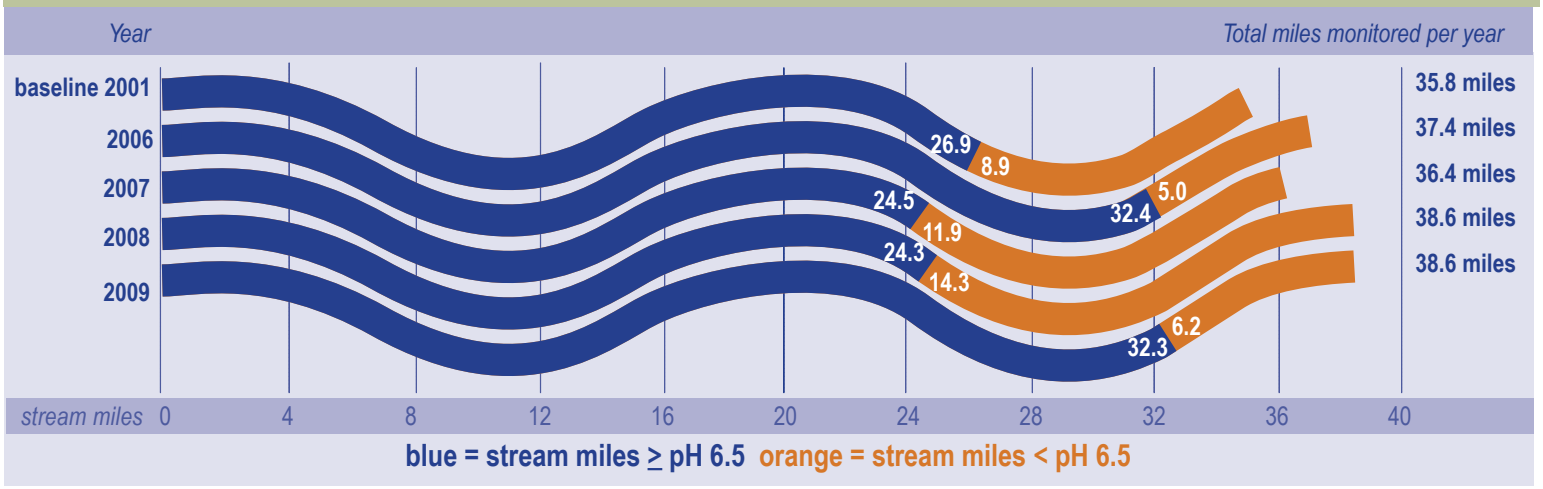
Chemical Water Quality

There are approximately 39 stream miles monitored each year along the mainstem of Sunday Creek and major tributary West Branch. A restoration target for pH has been set to 6.5. Since 2007 there have been increases and decreases in the number of stream miles that meet this target. In 2007 nearly 25 miles of the 35 monitored met this target. In 2008, there number remained constant. In 2009 a 25% increase was recorded with 32 stream miles of the 39 monitored met the pH target of 6.5 (Figure A).

Figure A. Sunday Creek pH



Biological Water Quality

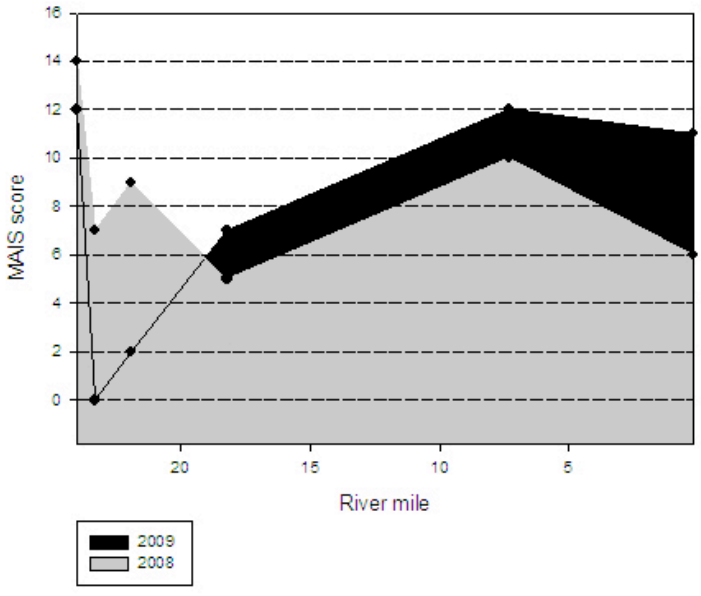
The 2009 MAIS scores suggest that the total area of degradation along the length of the Sunday Creek mainstem is reduced (e.g. biological quality has increased, with more + values) compared to each of the three preceding years (2008, 2007, 2006). However, this improvement is largely attributable to changes at the two lowermost stations (below river mile 7.3). The Sunday Creek mainstem above these stations showed no improvement, and in fact exhibits reductions in biological quality in 2009 compared to the three preceding years.

Figure B. Area of Degredation in Sunday Creek mainstem from 2008 to 2009

RM	2006	2007	2008	2009
24				
23.3	-7.7	-8.4	-2.1	-8.4
21.9	-22.4	-23.8	-11.2	-30.8
18.2	-40.7	-33.3	-37	-55.5
7.3	-65.4	-43.6	-98.1	-54.5
0.2	-49.7	-78.1	-56.8	-7.1
Total area of degradation	**-185.9**	**-187.2**	**-205.2**	**-156.3**

Improved relative to 3 prior years

Figure C. Area of Degredation 2008-2009



2009 NPS Report - Huff Run Watershed

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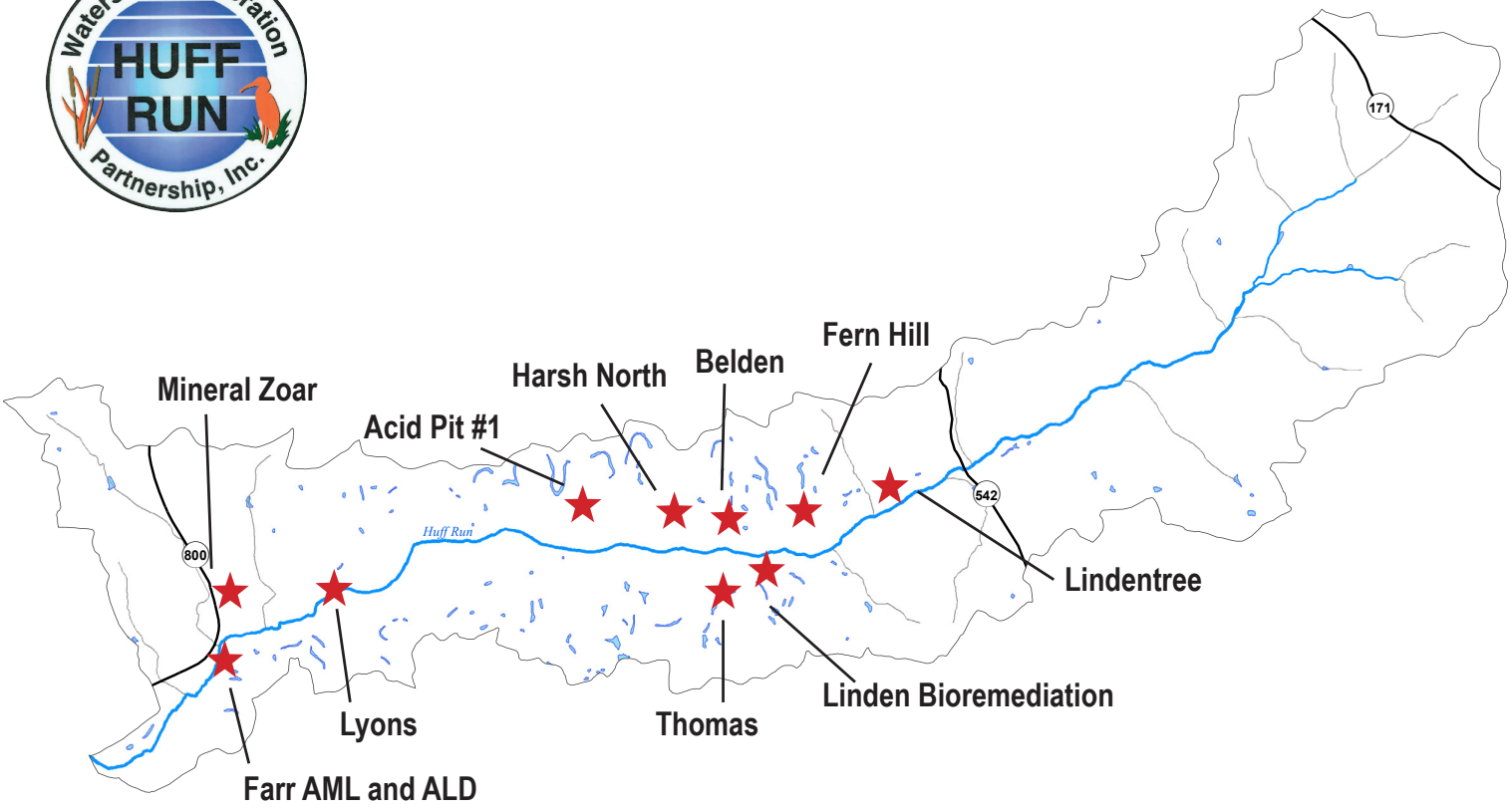


• Huff Run flows from the Morges community in Carroll County, into Tuscarawas County and has its confluence in the Conotton Creek just South of Mineral City, Ohio. Huff Run is 9.9 miles long with a 13.9 square mile watershed. Almost all land east of State Route 542 (about 2/3 of the watershed) has been mined for coal and some limestone and clay. Because much of the land mined was not reclaimed, the watershed is plagued with the resulting acid mine drainage. Other pollution issues in the watershed include illegal dumping, poor riparian buffers, raw sewage entering the stream, oil and gas impacts, and agricultural impacts.

• The Huff Run Watershed Restoration Partnership Inc. (HRWRP) was founded in 1996 by a group of concerned citizens. The HRWRP has partnered with ODNR/MRM, Rural Action, OEPA, Crossroads RC&D, OSM and others to fulfill their mission statement which is "To restore the Huff Run watershed by improving water quality and enhancing wildlife habitat, through community support and involvement."

• The Farr Anoxic Limestone Drain, the first passive treatment system in the watershed, was constructed in 2000. Also, HRWRP can boast of building the first bioremediation system in Ohio with their Linden Restoration Project. They also were awarded a US EPA Targeted Watershed Grant in 2005 for their Belden Successive Alkaline Producing System. At their 10 year anniversary, seven restoration projects have been completed with funding obtained for five more.

• To learn more about the HRWRP, visit their website at www.huffrun.org or call 330-859-1050 to reach their office.

2009 NPS Report - Huff Run Watershed

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Attainment Miles

Total stream miles assessed impacted by mine drainage=9.90 miles

Target #1 indicates 30% attainment of impaired streams by 2010=2.97 miles

2006 progress = 0 miles meeting Full WWH attainment, however 3.90 miles changed from Non-supportive to Partial Attainment

(9.90 miles assessed in 2006)

Completion

Sub-target 2 - Total projects proposed Huff Run Watershed = 11 projects

Total projects complete = 10 projects

Reductions

Total acid load reduction = 81 lbs/day at site HRR08

Total acid load reduction = 240 lbs/day

at project effluent sites Linden, Lindentree, Belden and Lyons, where acid load reduction could be calculated.

Costs

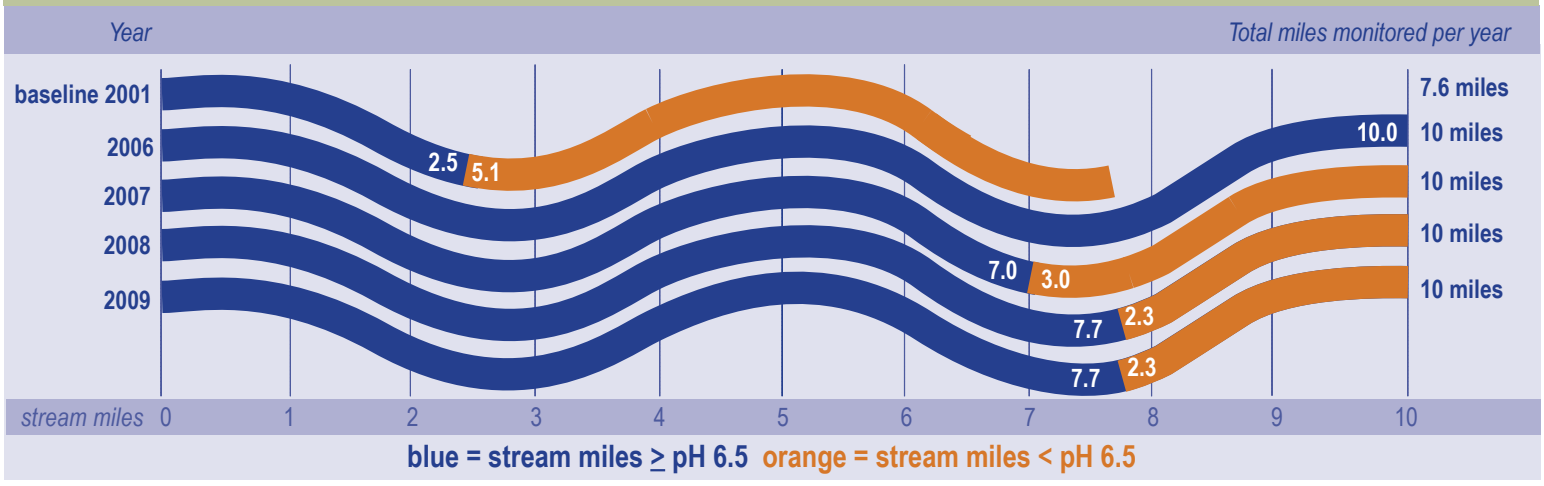
Design $502,860 (excluding Fern Hill)

Construction $3,936,8259

Total cost through 2009=$4,439,685

The mainstem of Huff Run is approximately 10 miles in length with monitoring occurring year round. In 2009, 7.75 miles met the pH target of 6.5 while the two downstream stream reaches (HRR08 and HRR07) fall slightly below the target with an average pH of 6.4 (Figure A). This average has increased 0.2 pH units since 2008.

Figure A. Huff Run pH



Timeline of the Huff Run Watershed
Project Milestones & AMD Projects

This timeline demonstrates this history of the Huff Run Watershed Restoration Partnership and the work done to restore Huff Run. AMD projects have been administered through Crossroads RC&D, the Tuscarawas Soil and Water Conservation District and the present sponsor of Huff Run, Rural Action. Funding has been secured for projects through the Office of Surface Mining, Ohio EPA 319 Program, US EPA Targeted Watershed Grant Program and match from the Ohio Department of Natural Resources, Division of Mineral Resources Management.

1985 Study funded by ODNR/DR conducted by Benatec Associates to identify acid problems in Huff Run Watershed

1988 First abandoned mine land project, Jobes, completed in the watershed

1996 Huff Run Watershed Restoration Partnership founded

2000 Huff Run AMDAT completed

Huff Run Watershed Coordinator funded for six years

First acid mine drainage restoration project, Farr, completed in watershed

2001 First draft of Huff Run Watershed Plan completed

2002 Linden Bioremediation Project constructed

2003 Acid Pit Restoration Project completed

2004 Lindentree Restoration Project completed

2005 Rural Action and Huff Run awarded US EPA Targeted Watershed Grant

Rural Action adds VISTA volunteer to Huff Run staff

Second draft of Huff Run Watershed Plan authored, endorsed by the State of Ohio

Lyons Restoration Project constructed

2006 Harsha North Restoration project completed

2008 Belden Restoration Project constructed

Fern Hill (HR-42) Phase II Project constructed

2009 Huff Run Watershed Coordinator funded for three years

Mineral Zoar Project completed

Thomas Project constructed

Rural Action adds AmeriCorps volunteer to Huff Run staff

2009 NPS Report - Huff Run Watershed

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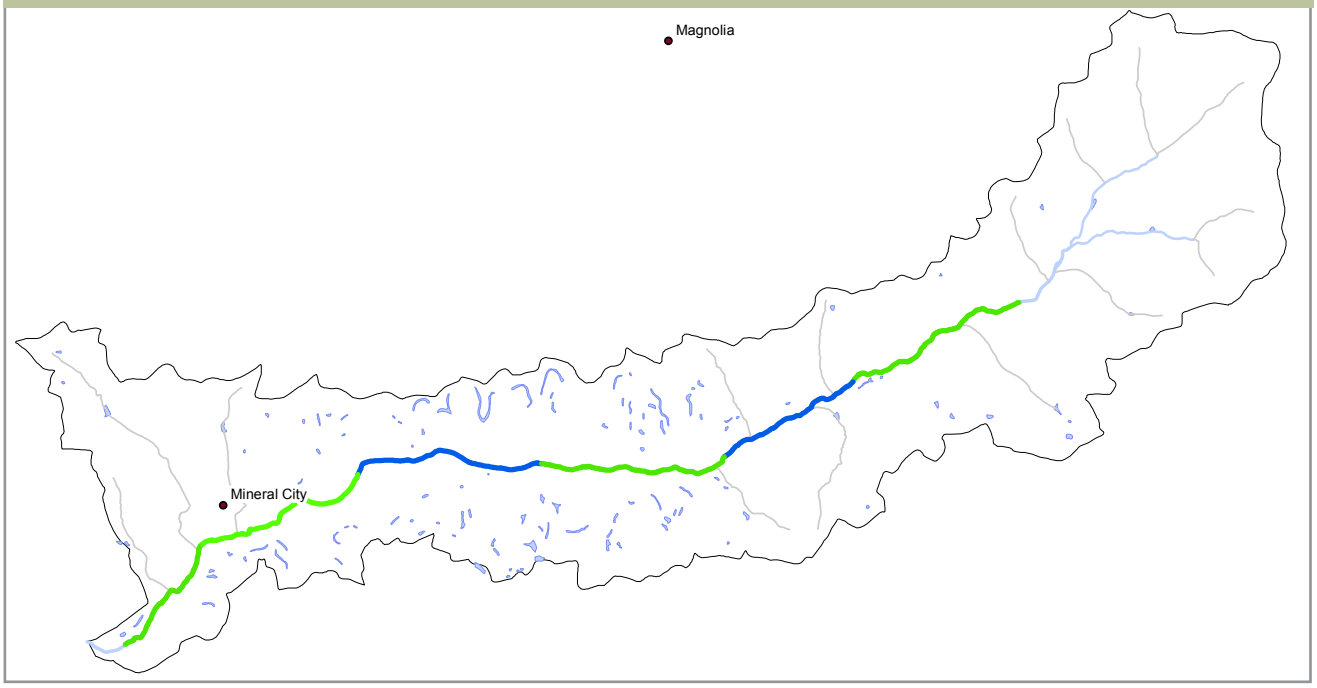
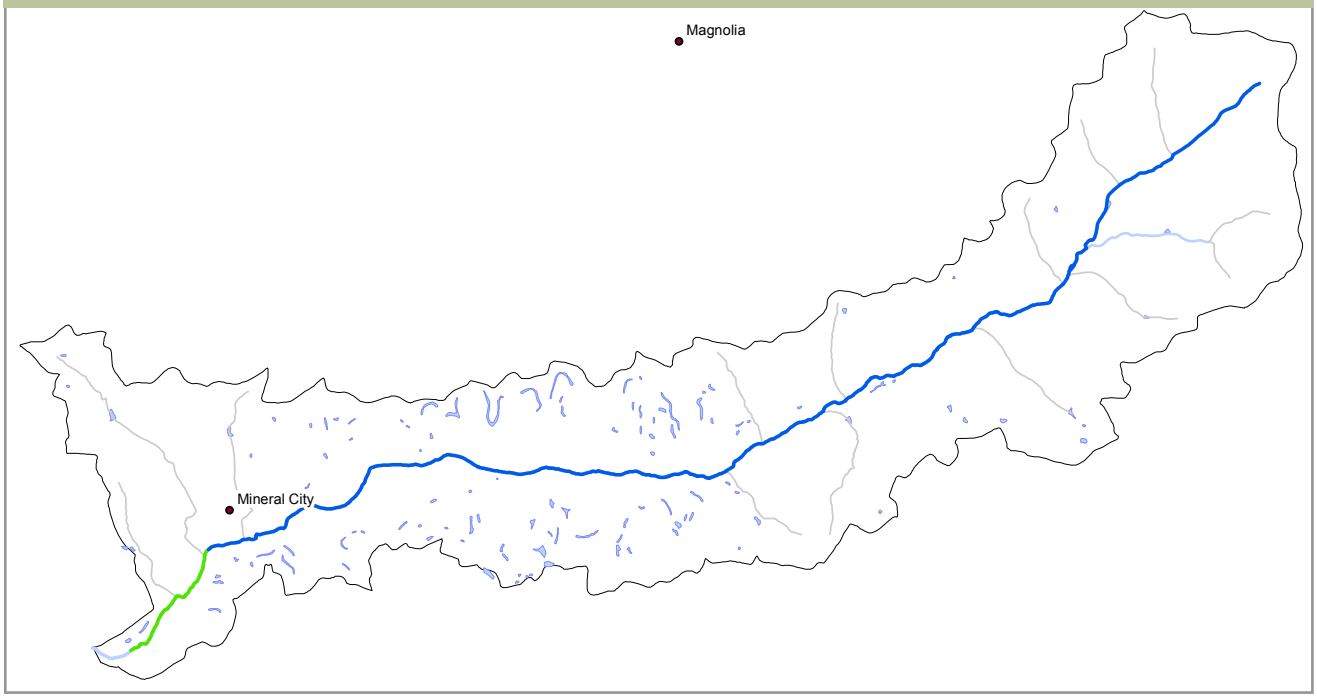
Chemical Water Quality

Huff Run baseline pH



Huff Run 2009 pH



Huff Run pH values have improved from baseline conditions (1985-1998) to 2009.

Lab pH

- < 4
- 4 - 5.4
- 5.5 - 6.4
- > 6.4

2009 NPS Report - Huff Run Watershed

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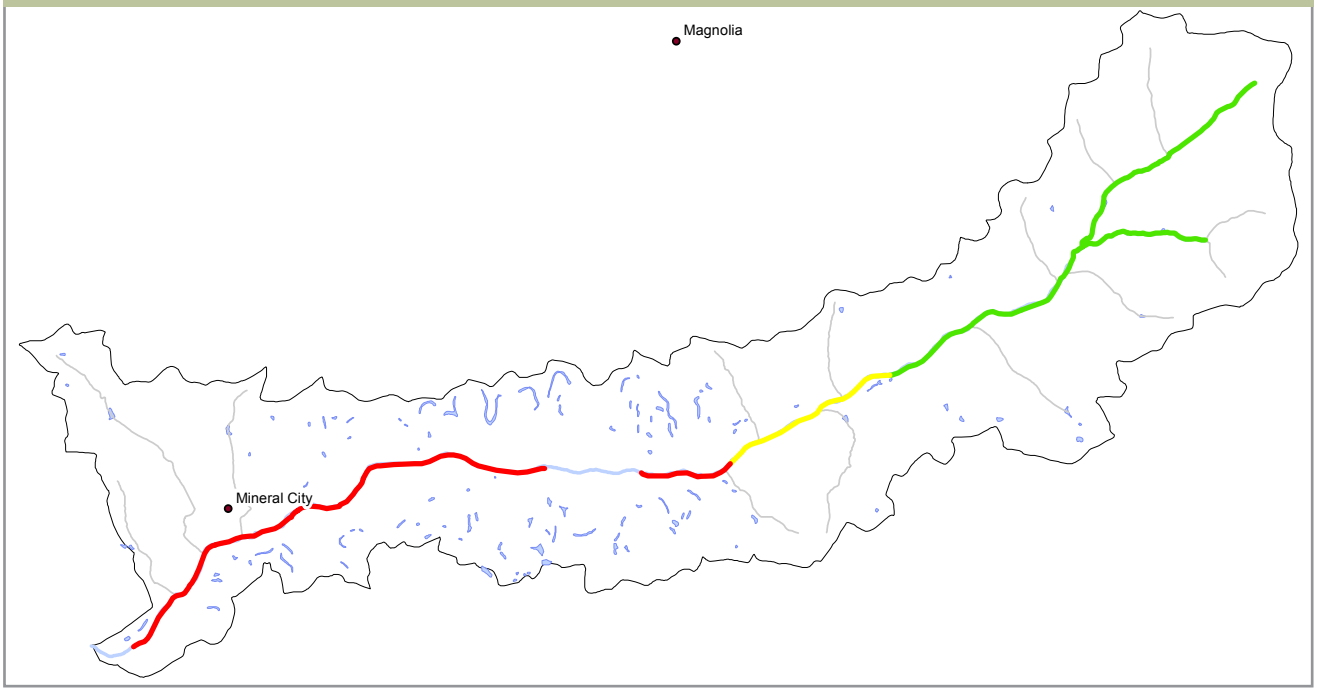
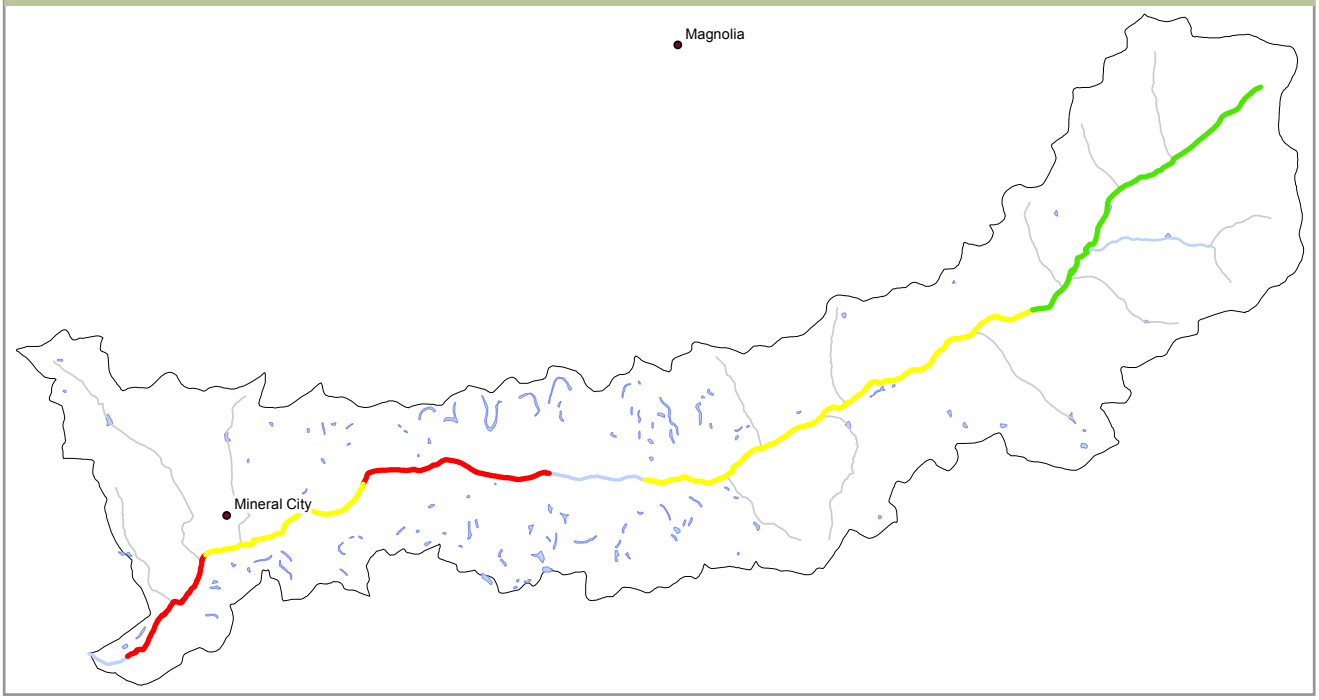
Biological Water Quality

Huff Run baseline MAIS



Huff Run 2009 MAIS



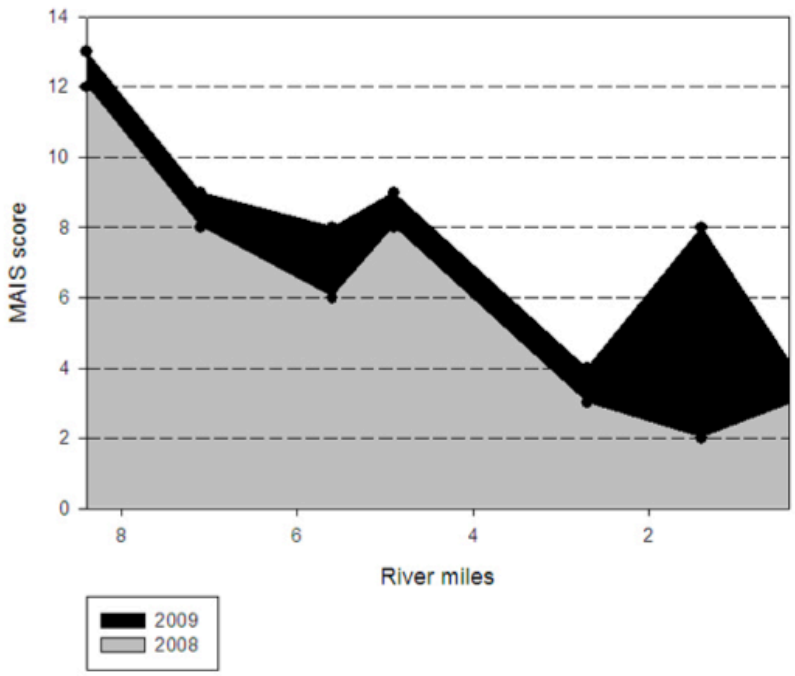
Huff Run aquatic life use has improved from baseline conditions (1985-1998) to 2005. Aquatic life use changed from WWH non-sportive to WWH partial attainment along 3.9 miles in Huff Run. In 2008 the MAIS score increased in the headwaters slightly (HR0, RM 8.4) and at HR11/HRR04 the site downstream of Lindentree Project, a pattern held over from 2007.

The area of degradation analysis for the seven mainstem sites along Huff Run (-93, Figure 4), shows modest improvement at the upstream sites, but little evidence of improvement below RM 4.1 (HRR05).

Macroinvertebrate Aggregated Index for Streams

- 0 - 7
- 8 - 11
- 12 - 15
- > 15

Figure C. Huff Run Area of Degradation 2008-2009



Calculation of the area of degradation in Huff Run based on 2009 macroinvertebrate data shows improvement at all stations.

Figure B. Huff Run Area of Degredation

RM	2006	2007	2008	2009	
8.4					
7.1	-6.5	-5.2	-5.2	-2.6	Improved
5.6	-15.0	-13.5	-15.0	-10.5	Improved
4.9	-7.7	-5.6	-7.0	-4.9	Improved
2.7	-28.6	-22.0	-28.6	-24.2	Some improvement
1.4	-22.1	-20.8	-24.7	-15.6	Improved
0.4	-22.1	-17.9	-20.0	-12.6	Improved
Total area of degradation	**-102.0**	**-85.0**	**-100.5**	**-70.4**	

Section III – AMD project reports

Raccoon Creek Watershed comprehensive acid mine drainage projects progress report for 2009.

Section III contains individual AMD project reports displaying photos of the project site, a description of the project, water quality data at the site and its impact to the receiving stream, and acid/metal loading reductions as a result of the project.

List of acid mine drainage reclamation projects reported in the 2009 NPS monitoring report:

1. Carbondale II Doser
2. Mulga Run
3. Middleton Run
4. State Route 124 Seeps
5. Flint Run East
6. Lake Milton
7. Buckeye Furnace/Buffer Run
8. East Branch Phase I
9. Pierce Run
10. East Branch Phase II

Archive

11. Hope Clay – Status Completed archived in 2008 report*

* "Status Completed" projects are no longer being monitored

2009 NPS Report - Raccoon Creek Watershed - Carbondale II Doser

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 2004 ODNR Project Number: AT-WI-05

Pre-construction

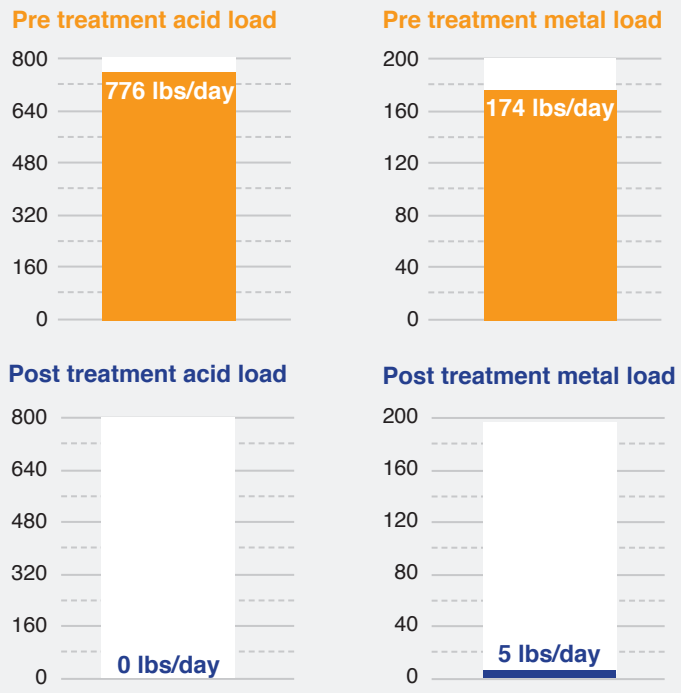
Carbondale East Seep, Photo by Brett Laverty

Post-construction

Carbondale II Project Doser, Photo by JT Kneen

Carbondale II Wetland is located in Section 30 of Waterloo Township in Athens County and lies within the 14-digit HUC unit #05090101030010. The site is seven acres and located in the subwatershed Hewett Fork of Raccoon Creek Watershed. The majority of AMD in Hewett Fork originates from abandoned underground coal mines near Carbondale. ODNR-DMRM installed a passive wetland treatment system to reduce the acid and metal load from two mine portals in this area in the mid 1990's. This wetland was effective at reducing metal and acid loads but was not efficient enough to produce improvements in Hewett Fork. The Carbondale Doser was implemented as Phase II at the site to remediate the entire acid load from the mine discharge in 2004. The design was completed by ATC Associates for $48,023. The treatment approach for this site was to install an Aqua-fix lime-dosing unit. The major considerations in this design were the metal precipitates discharge into Hewett Fork because of the limited space for storage ponds on site. The goal of the design was to reduce 100 percent of the acid load discharging from the Carbondale mine seeps. One problem encountered at this site was the dosing material performance. Initially lime kiln dust was used, but the material bridges in the dosing unit. The material was switched to calcium oxide, a more expensive material but greater neutralizing potential. Therefore the doser now has the ability to over-treat and neutralize acid mine drainage from downstream sources. Construction was complete April 1, 2004, by Law General Contracting for a cost of $389,637. The major responsibility of the construction company was to remove existing metal retention wetlands and install the doser and a concrete mixing channel. The funding source for the project design was ODNR-DMRM, and for construction the sources were ODNR-DMRM, OEPA, and OSM-ACSI. Figures 3 and 4 (shown on page 3) estimate approximately 776 lbs/day of acid were reduced from entering into Hewett Fork as a result of this AMD reclamation project. In addition to the acid load reduction there is an addition of approximately 174 lbs/day of alkalinity to Hewett Fork both as dissolved and solid unused calcium oxide. Dissolved metal load reduction occurring at this site was approximately 169 lbs/day. The metals precipitate as a result of the high pH water and become part of the substrate in the receiving stream.

Site: HF131



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

2009 NPS Report - Raccoon Creek Watershed - Carbondale II Doser

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Water Quality Report

Water quality data was collected at the project discharge as well as multiple stations pre- and post-construction. The graphs below show changes in pH (Figure 1) and acidity (Figure 2) along the mainstem of the receiving stream upstream and downstream of the project discharge as a result of the AMD reclamation project.

As a result of the Carbondale II Doser project, the pH and net acidity has improved downstream of the reclamation site for 11 miles. Pre-construction data showed, pH in the range of 2.8 – 5.9 downstream of the project. However, after installation of the Carbondale II Doser, post-construction data shows pH in the range of 6.2 – 9.2 downstream of the project discharge. The net acidity concentrations decreased, showing net alkaline conditions continuing for 11 miles downstream to station HF010.

Figure 1. Pre and Post pH

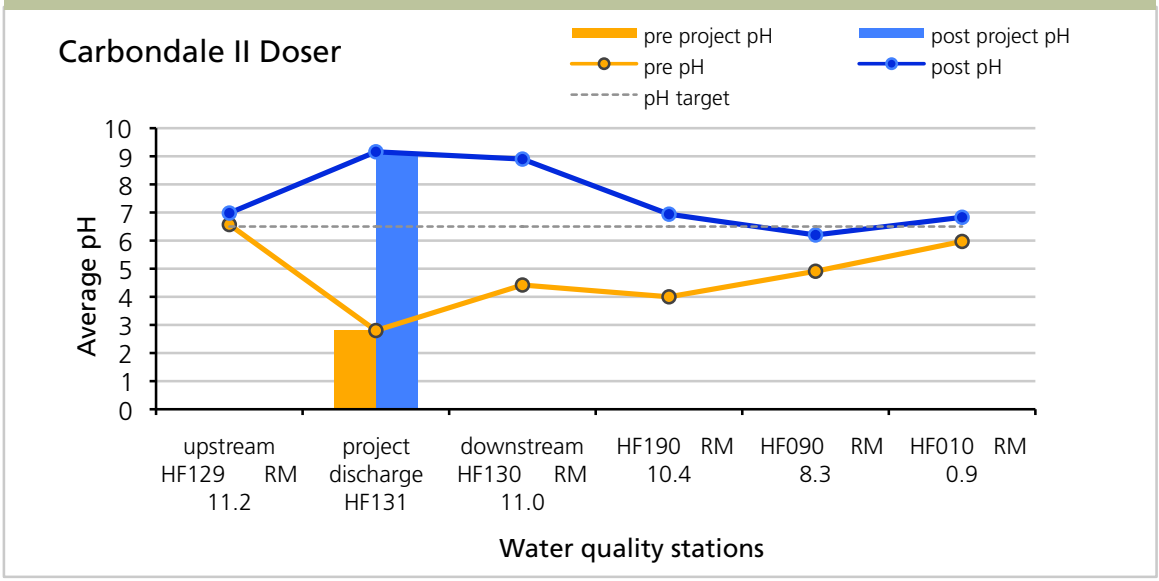
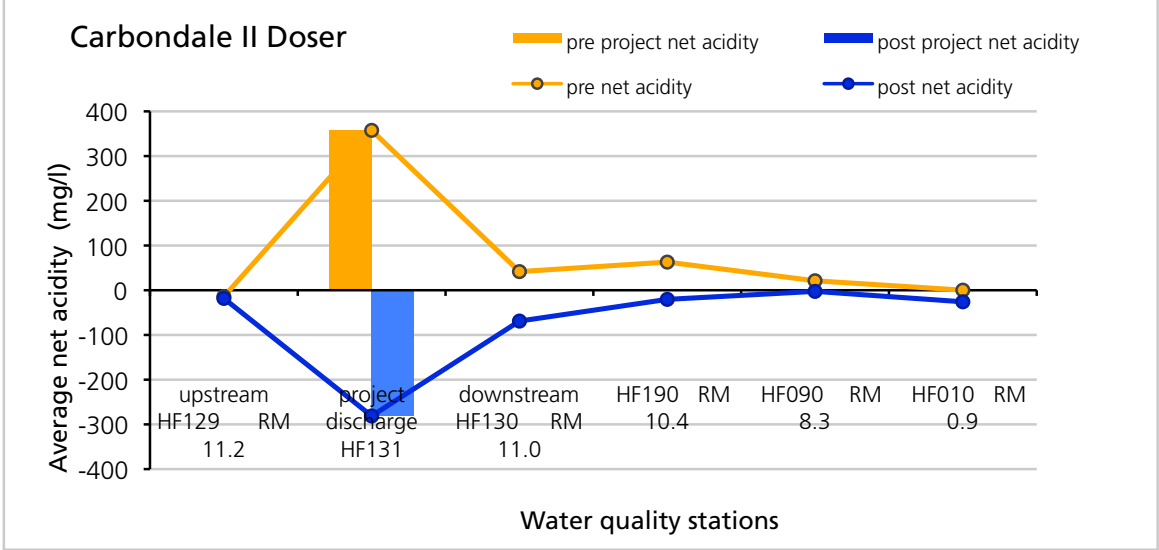


Figure 2. Pre and Post Acidity



Water Quality – load reductions

Using the Mean Annual Load Method (Stoertz, 2004) acid and metal load reduction occurring at this project were plotted and shown in Figure 3 and 4. Acidity, iron, aluminum and discharge were measured pre- and post-construction at the project discharge from 6/21/1996 to 5/1/2003 for pre-construction and from 6/1/2004 to 12/31/2009 for post-construction.

Average discharge measurements were used to calculate load reductions using the Mean Annual Load Method (Stoertz, 2004) instead of deriving the mean annual discharge from the drainage area because the discharge from the Carbondale II Doser site is controlled primarily by deep mine drainage and not surface drainage.

Figure 3. Acid Load Reduction

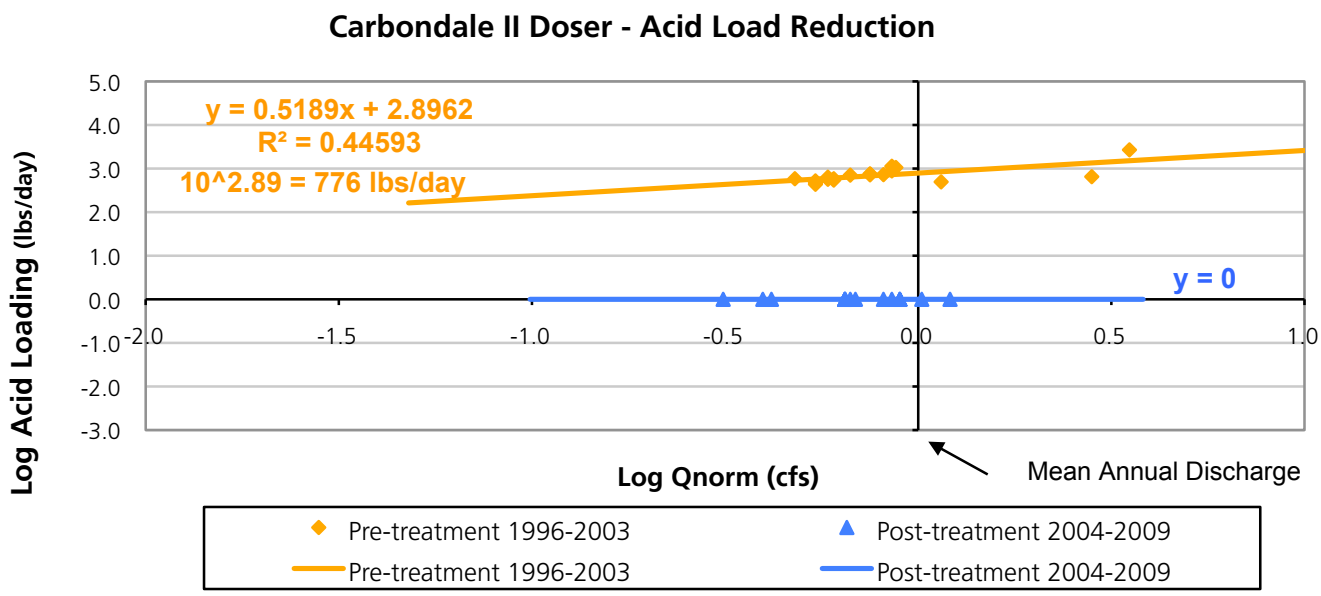
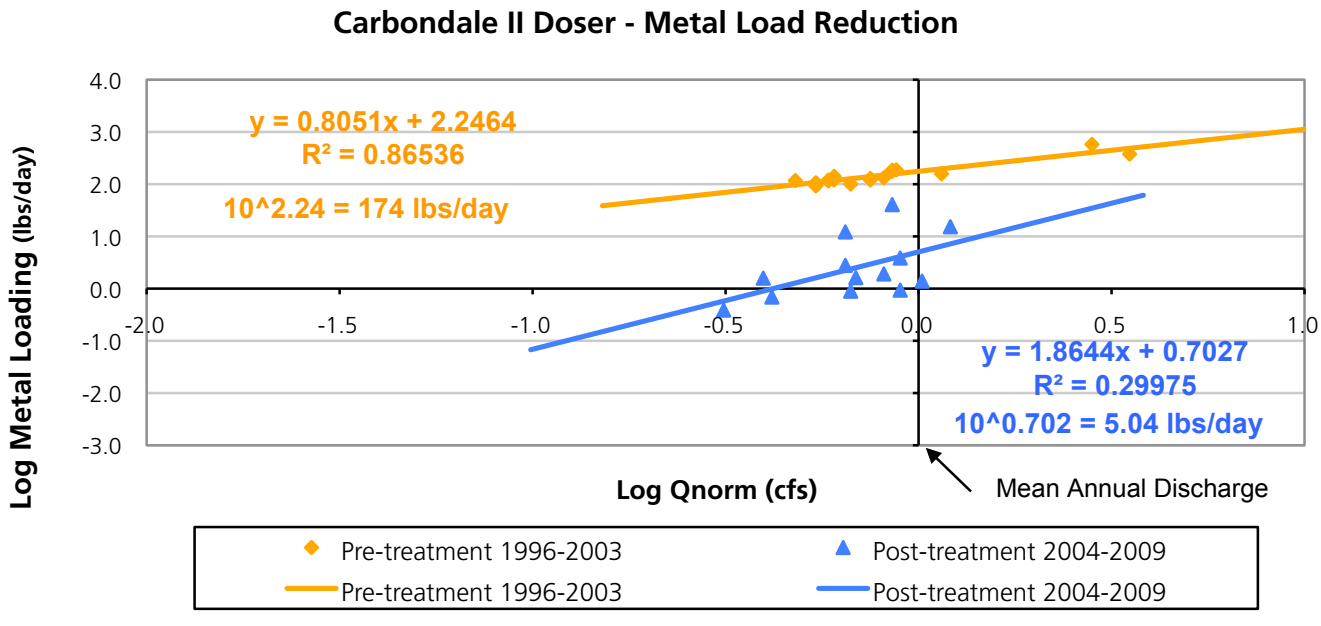


Figure 4. Metal Load Reduction



Similar to other environmental best management practices (BMPs), performance of acid mine drainage reclamation projects are also expected to decline with time. Currently, operation and maintenance plans are being designed for each existing system and for future projects. Figure 5 and 6 show the mean annual acid and metal load reduction (Stoertz, 2004) for each year (or group of years) during post-construction from the project effluent. These graphs show the rate of decline (and/or improvement) with time in the performance of the treatment system. Knowing this rate of decline will aid in the implementation of operation and maintenance plans for each site. Yearly load reductions are plotted and shown in Figure 5 and 6.

Figure 5. Yearly Acid Load Reduction

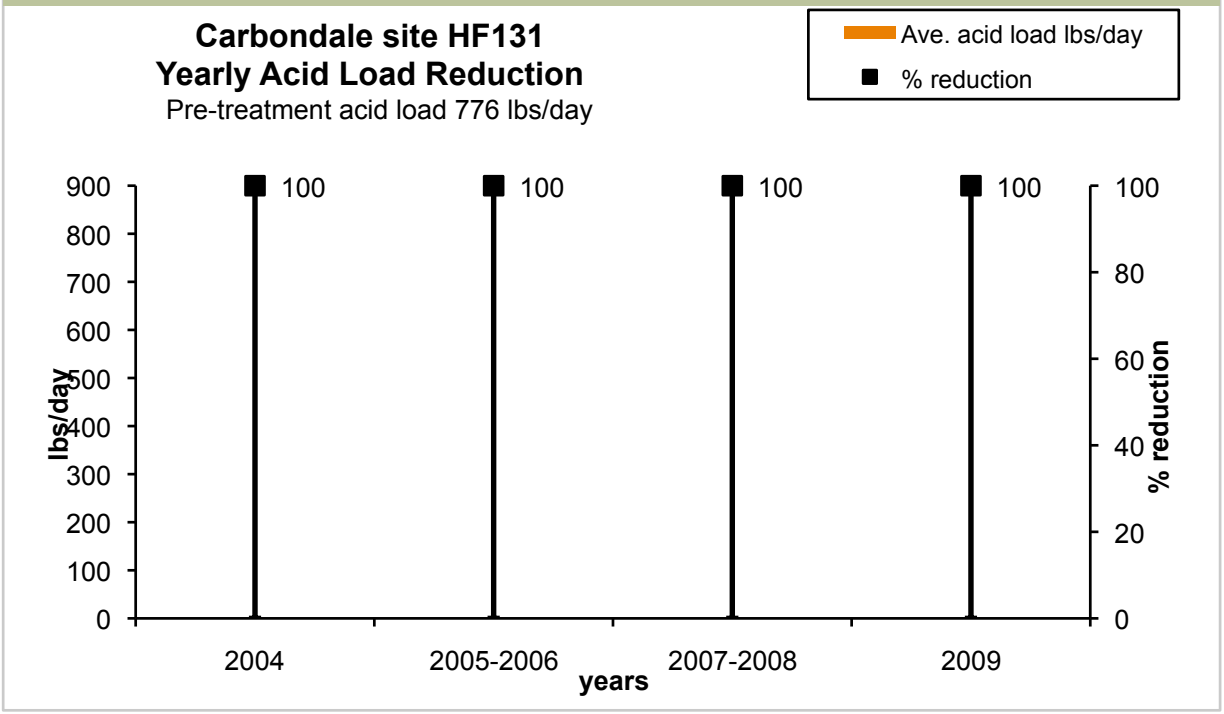
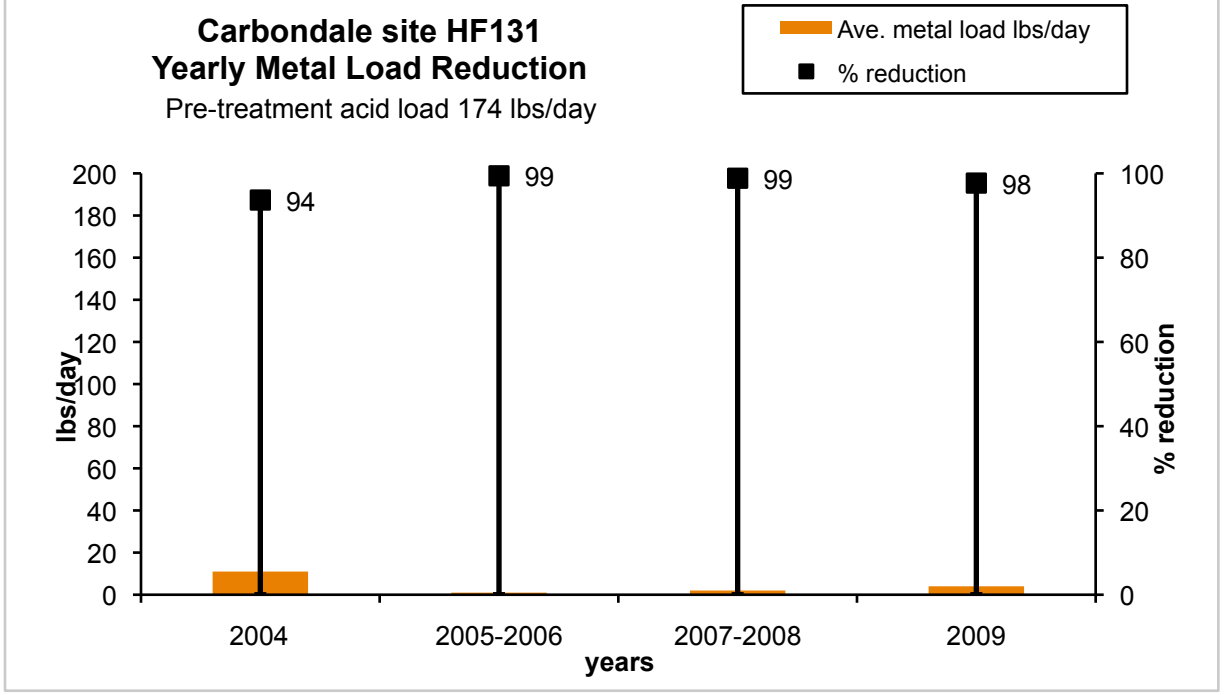


Figure 6. Yearly Metal Load Reduction



2009 NPS Report - Raccoon Creek Watershed - Mulga Run

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 8/30/2004 ODNR Project Number: JK-MI-51

Pre-construction

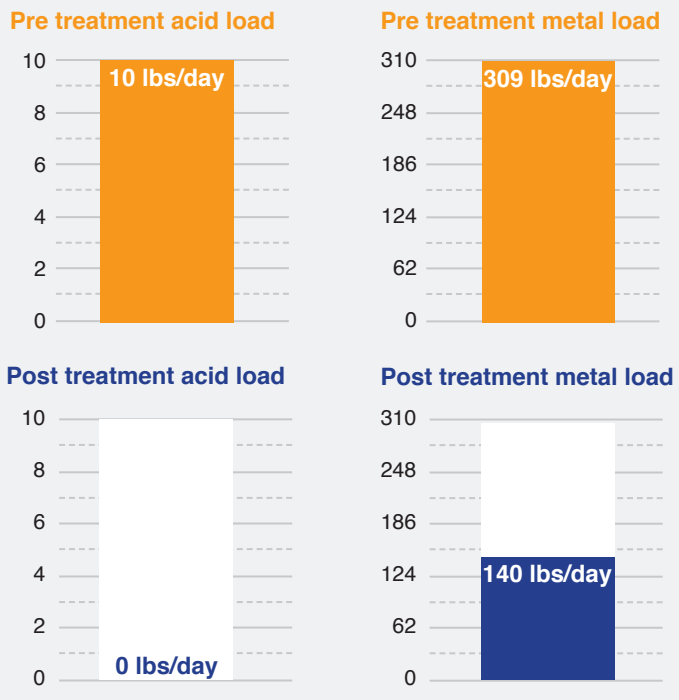
Underground mine entrance, Photo by Brett Laverty

Post-construction

Jaymar Steel Slag Leach Bed, Photo by Brett Laverty

Mulga Run Reclamation Project is located in Section 10 of Milton Township in Jackson County and lies within the 14-digit HUC unit #05090101050030. The site is 6.8 acres and is located in the Little Raccoon Creek subwatershed. Mulga Run is considered the third largest contributor of acid mine drainage to this subwatershed according to the AMDAT in 2001. Due to drainage from abandoned deep mines and un-reclaimed coal refuse piles throughout, a basin wide treatment approach was used to reduce acid and metal loads to Little Raccoon Creek. The design was completed by ATC Associates for $247,127. The treatment approach for this site was to install two steel slag leach beds and conduct a wetland enhancement project. The major consideration for this design was to attempt to treat entire basin with steel slag leach beds and wetland instead of treating all acid mine drainage sites in the basin. Mulga Run discharge was sometimes net alkaline; however, the site was also capable of producing acid spikes (3000 lbs/day) throughout the year. The goal of the design was to reduce 100 percent of the acid spikes and create consistent net alkaline water discharging into Little Raccoon Creek. The project goal was met by 100 percent. A private residence height was increased to reduce the flood risk adjacent to the project site. Construction was complete August 30, 2004, by Stockmeister Enterprises for a cost of $440,783. The funding source, for this the project design were Ohio EPA and ODNR-DMRM and for construction the sources were ODNR-DMRM, OEPA and OSM-ACSI. Figure, 3 and 4 (shown on page 3) estimate approximately 10 lbs/day of acid and 169 lbs/day of metals were reduced from entering into Little Raccoon Creek as a result of this AMD reclamation project.

Site: MR0010



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

2009 NPS Report - Raccoon Creek Watershed - Mulga Run

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Water Quality report

Water quality data was collected at the project discharge as well as multiple stations pre- and post-construction. The graphs below show changes in pH (Figure 1) and acidity (Figure 2) along the mainstem of the receiving stream upstream and downstream of the project discharge as a result of the AMD reclamation project.

As a result of the Mulga Run Reclamation project, the pH and net acidity has improved downstream of the reclamation site for 2.1 miles. Pre-construction data showed pH in the range of 5.5 – 6.9 downstream of the project. However, after installation of the Mulga Run Reclamation project, post-construction data shows pH in the range of 6.8 – 7.1 downstream of the project discharge. The net acidity concentrations decreased, showing net alkaline conditions continuing for 5.7 miles downstream to station LRC0045.

Figure 1. Pre and Post pH

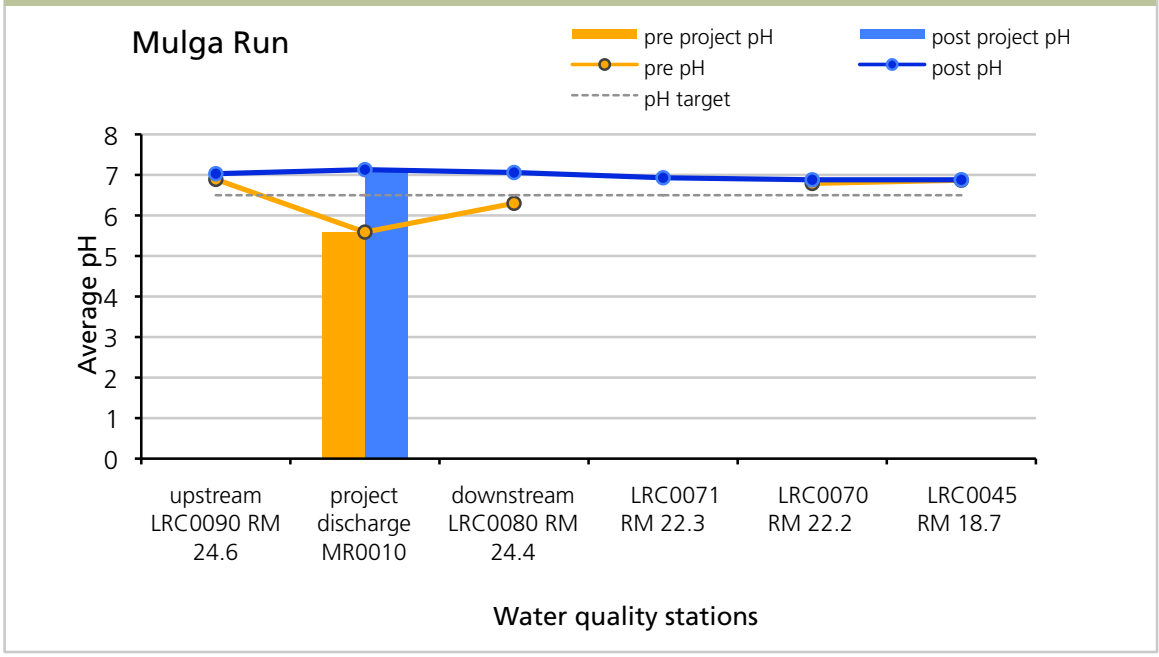
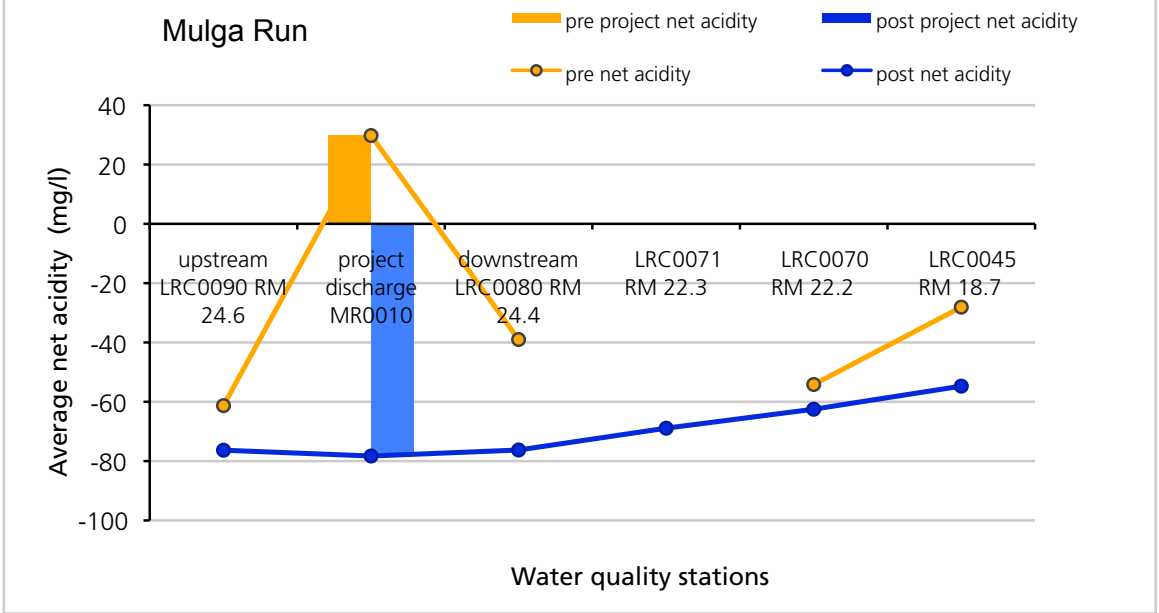


Figure 2. Pre and Post Acidity



Water Quality – load reductions

Using the Mean Annual Load Method (Stoertz, 2004) acid and metal load reduction occurring at this project were plotted and shown in Figure 3 and 4. Acidity, iron, aluminum and discharge were measured pre- and post-construction at the project discharge from 1/1/1998 to 8/1/2003 for pre-construction and from 9/1/2004 to 12/31/2009 for post-construction.

The trendline in Figure 3 for pre-treatment acid loading is not well-defined due to the sporadic chemical water quality conditions at the Mulga Run site. Sometimes net alkaline conditions were present, and sometimes acid spikes were produced (3000 lbs/day). The goal of this project was to decrease acidity and eliminate the acid spikes from entering into Little Raccoon Creek. Figure 3 shows these variations during the pre-treatment time period and shows 100 percent acid load reduction during post-treatment. *Stoertz, Mary W. and Douglas H. Green, 2004. Mean Annual Acidity Load: A Performance Measure to Evaluate Acid Mine Drainage Remediation. Ohio Department of Natural Resources Conservation and Restoration Innovations 2004 Applied Research Conference at Ohio University.*

Figure 3. Acid Load Reduction

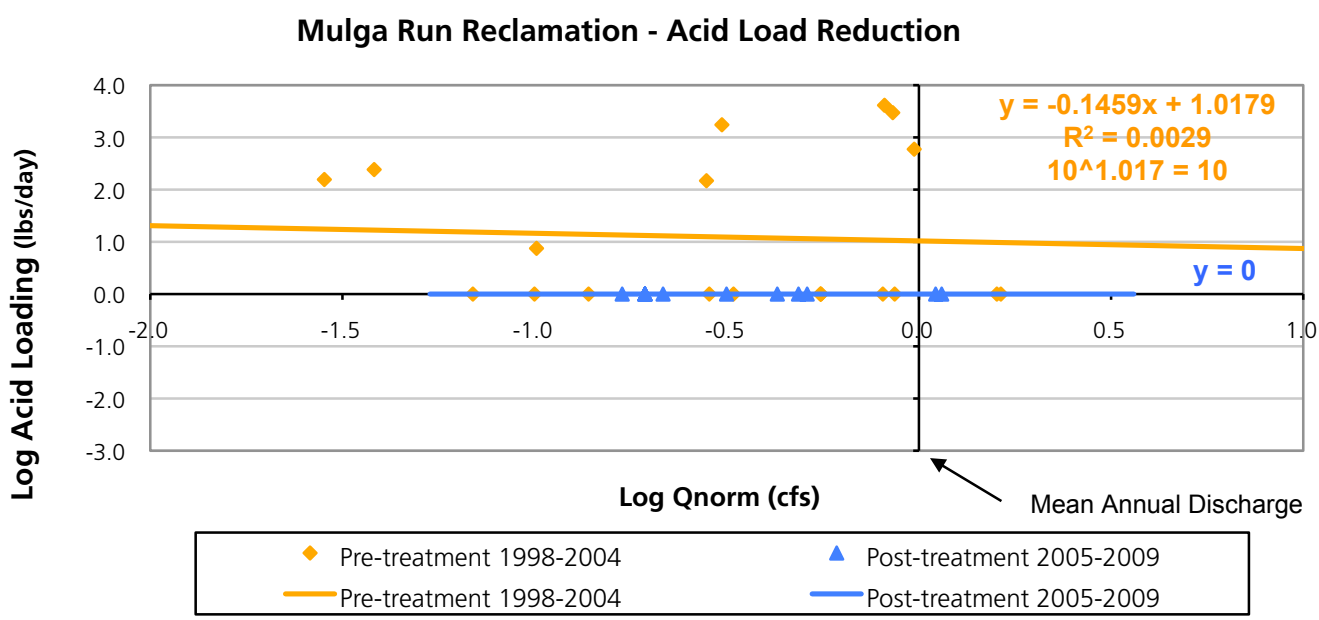
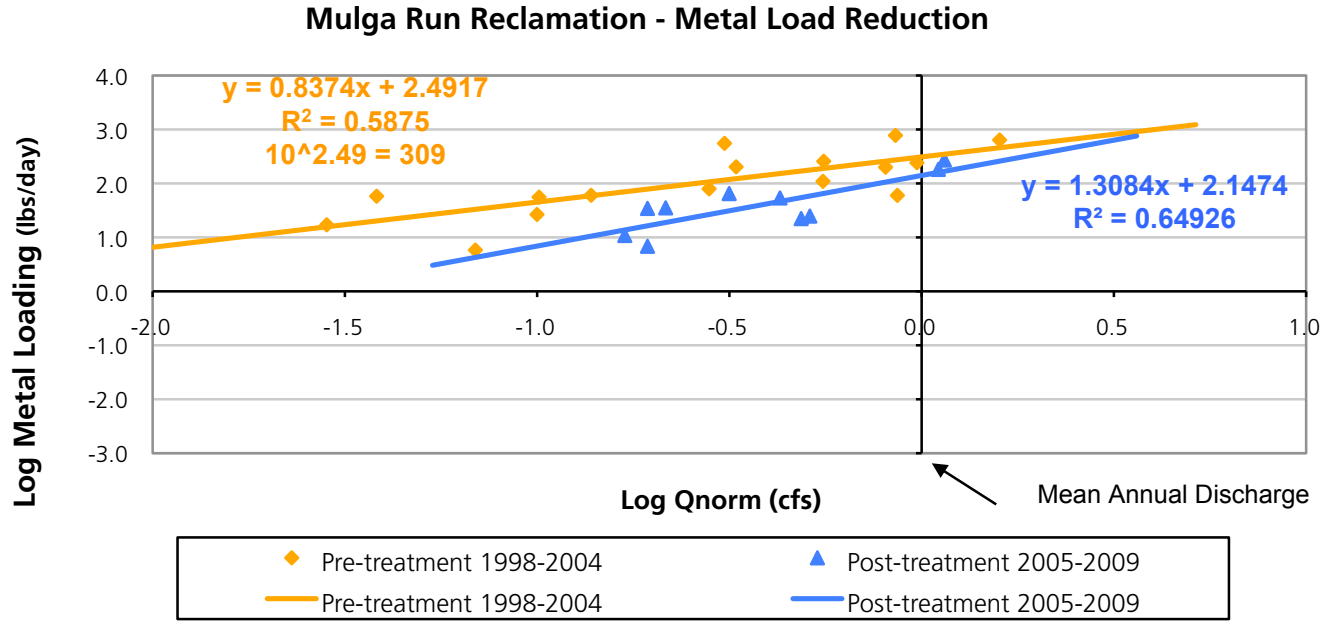


Figure 4. Metal Load Reduction



Similar to other environmental best management practices (BMPs), performance of acid mine drainage reclamation projects are also expected to decline with time. Currently, operation and maintenance plans are being designed for each existing system and for future projects. Figure 5 and 6 show the mean annual acid and metal load reduction (Stoertz, 2004) for each year (or group of years) during post-construction from the project effluent. These graphs show the rate of decline (and/or improvement) with time in the performance of the treatment system. Knowing this rate of decline will aid in the implementation of operation and maintenance plans for each site. Yearly load reductions are plotted and shown in Figure 5 and 6.

Figure 5. Yearly Acid Load Reduction

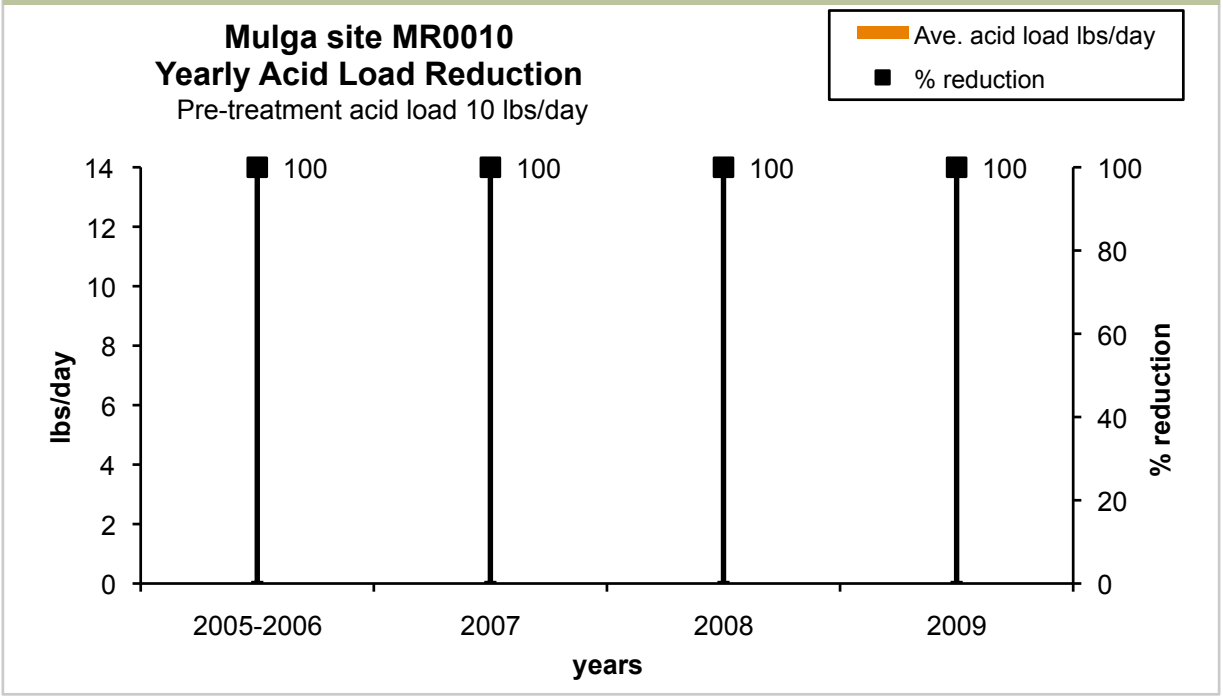
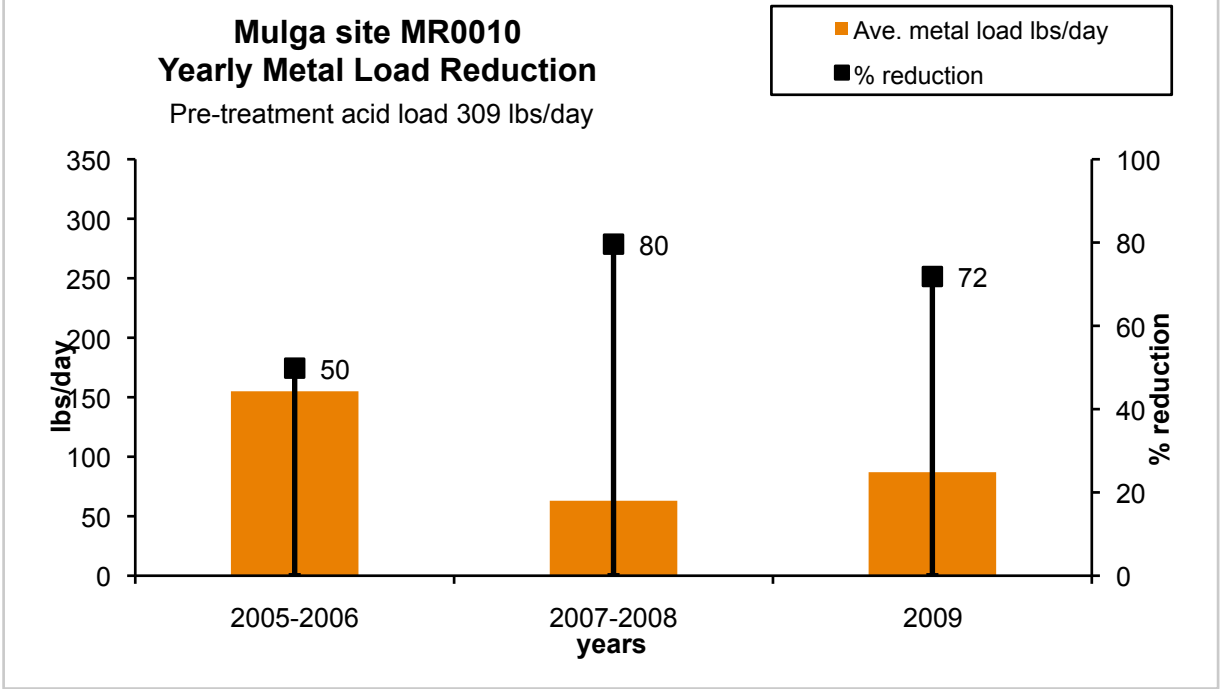


Figure 6. Yearly Metal Load Reduction



2009 NPS Report - Raccoon Creek Watershed - Salem Road/Middleton Run

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 2005 ODNR Project Number: JK-MI-51

Pre-construction

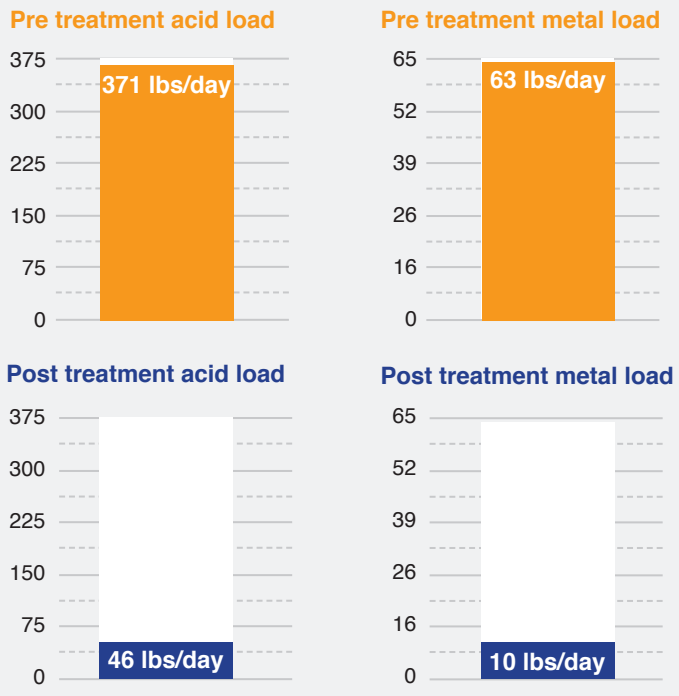
Exposed mine pit floor, Photo by Brett Laverty

Post-construction

Middleton Run limestone channels, Photo by Ian Hughes

Salem Road/Middleton Run Project is located in Section 15 of Milton Township in Jackson County and lies within the 14-digit HUC unit #05090101050030. The site totals 60 acres and is located in the Little Raccoon Creek subwatershed. This large area has been affected by deep mines, strip mine lands, and un-reclaimed mine spoil that was part of the Broken Aro mine. Abandoned surface mines affect about 63% of this watershed while abandoned subsurface mines affect about 5 %. The main valley on the sites was exposed pit floor with high amounts of clay and acidic spoil. Additionally, acidic lakes were present as well as a discharging undgerground mine. This project has three different drainages, all tributaries to Middleton Run. The design was completed by GAI Consultants Inc. and Bergmann Associates for $193,283. The treatment approach for this site was to install 3 separate treatment components consiting of: open limestone channels, steel slag channels, reclamation, J-trenches, and a limestone leach bed (see diagram on page 3 of this report). The major consideration for this design was to eliminate all water storage, create contours for positive drainage, cover toxic materials, and generate alkalinity. The goal of the design was to reduce 100 percent of the acidity loading discharging into Little Raccoon Creek. Data monitored at the mouth of Middleton Run (MiR0010) for 2006-2008 have shown that 554 lbs/day of acid and 50 lbs/day of metal loads have been reduced from entering Little Raccoon Creek. Construction was complete November 15, 2005, by Stockmeister Enterprises Inc. for a cost of $687,913. The funding source, for the project design and construction were ODNR-DMRM and Ohio EPA. Figures 4 and 5 (shown on page 5 and 6 of this report) estimate approximately 325 lbs/day of acid and 53 lbs/day of metals were reduced from entering into Middleton Run Creek as a result of these three AMD reclamation project. Each of the three treatment components are evaluated further on page 4 of this report. Monitoring in 2008 to 2009 showed site MiR0021 as the only treatment functioning and providing alkalinity for Middleton Run. The other two treatment sites (MiR0032 and MiR0092) have failed due to clogging.

SITE: MiR0021, MiR0032, MiR0090



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

2009 NPS Report - Raccoon Creek Watershed - Salem Road/Middleton Run

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Water Quality Report

Water quality data was collected at three project discharges as well as multiple stations pre- and post-construction. The graphs below show changes in pH (Figure 1) and acidity (Figure 2) along the mainstem of the receiving stream upstream and downstream of the project discharge as a result of the AMD reclamation project.

As a result of the (Salem Road/Middleton Run) project, the pH and net acidity has improved downstream of the reclamation site for 11 miles. Pre-construction data showed pH in the range of 2.8 – 6.7 at the project cumulative discharges and downstream of the project. However, after installation of the Salem Road/Middleton Run reclamation project, post-construction data shows pH in the range of 6.0–7.0 downstream of the project discharge. The net acidity concentrations decreased by 100 percent at the three project discharges cumulatively adding to the net alkaline conditions for 9.7 miles downstream to station LRC0030.

Figure 1. Pre and Post pH

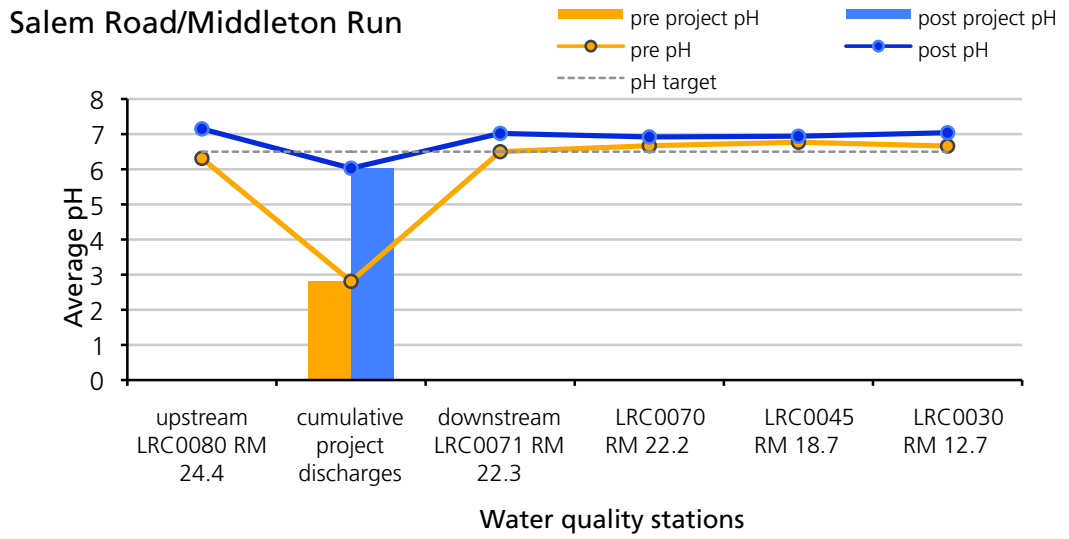
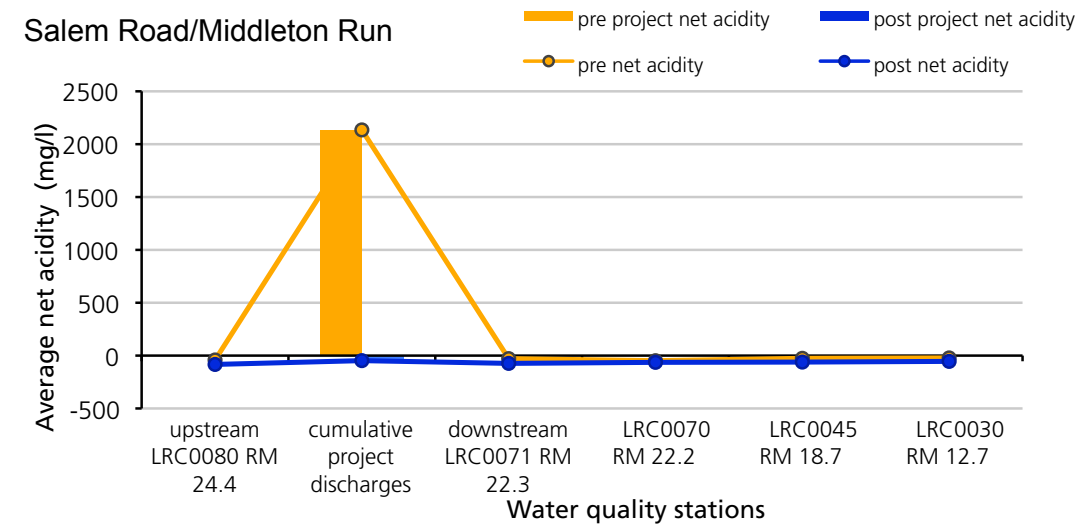
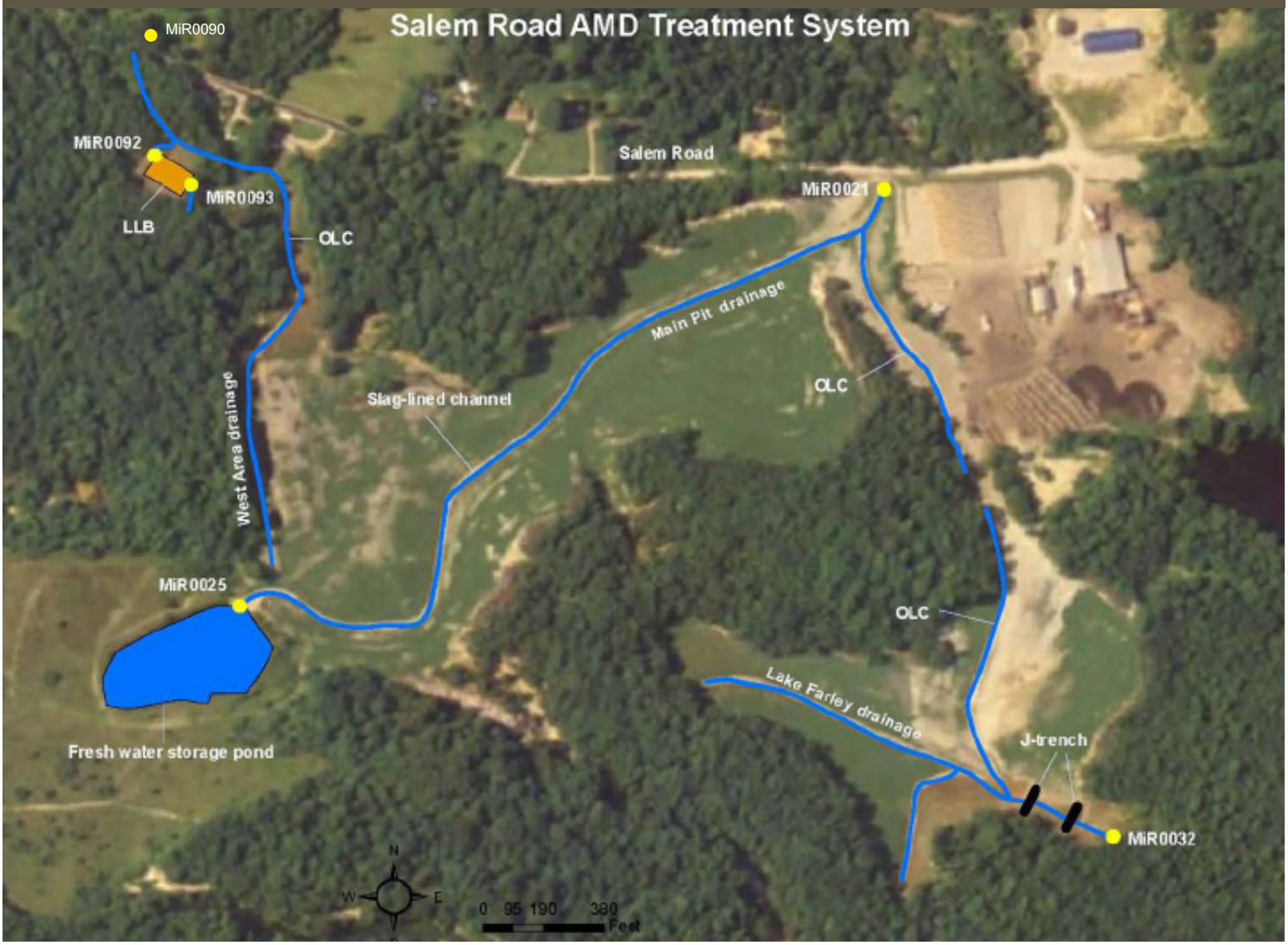


Figure 2. Pre and Post Acidity



2009 NPS Report - Raccoon Creek Watershed - Salem Road/Middleton Run

Generated by Non-Point Source Monitoring System
www.watersheddata.com



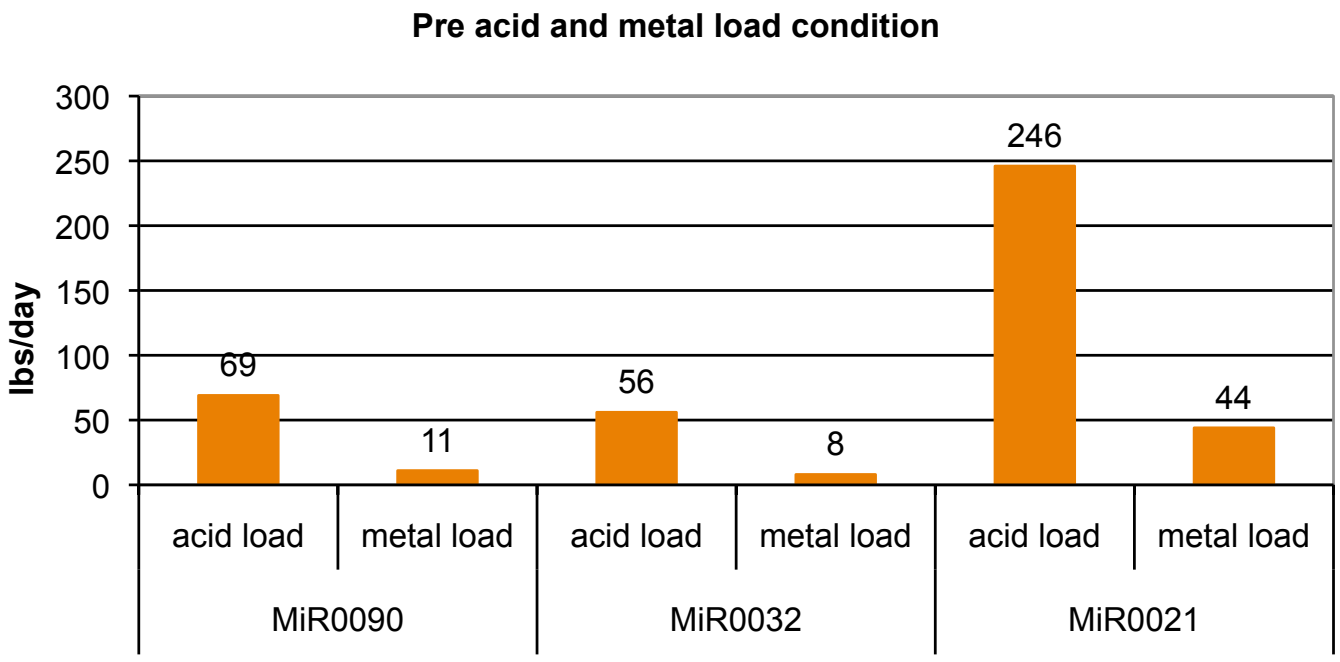
An analysis of the acid and metal load reductions of the three separate treatment components are shown below.

Sample site ID	Description of the sampling station
MiR0090	Tributary draining limestone leach bead treatment, site is at crossing with Salem Road
MiR0090	Tributary draining limestone leach bed treatment, site is at crossing with Salem Road
MiR0032	Sample site located directly below the dam at MiR0031. Two limestone J-trenches with steel slag cores.
MiR0021	The site represents discharge across the former mine pit floor. Sample site is at the Salem Road culvert (Fresh water pond draining into a limestone and steel slag channel.)

Water Quality – load reductions

Using the Mean Annual Load Method (Stoertz, 2004), acid and metal load reduction occurring at this project were plotted and shown in Figure 3, 4, and 5. Acidity, iron, aluminum and discharge were measured pre- and post-construction at the project discharge from 1997 to 2005 for pre-construction and from 2006 to 2009 for post-construction at site MiR0090, MiR0032 and MiR0021.

Figure 3. Acid Load Reduction Three project discharges at the Salem Road Project Site



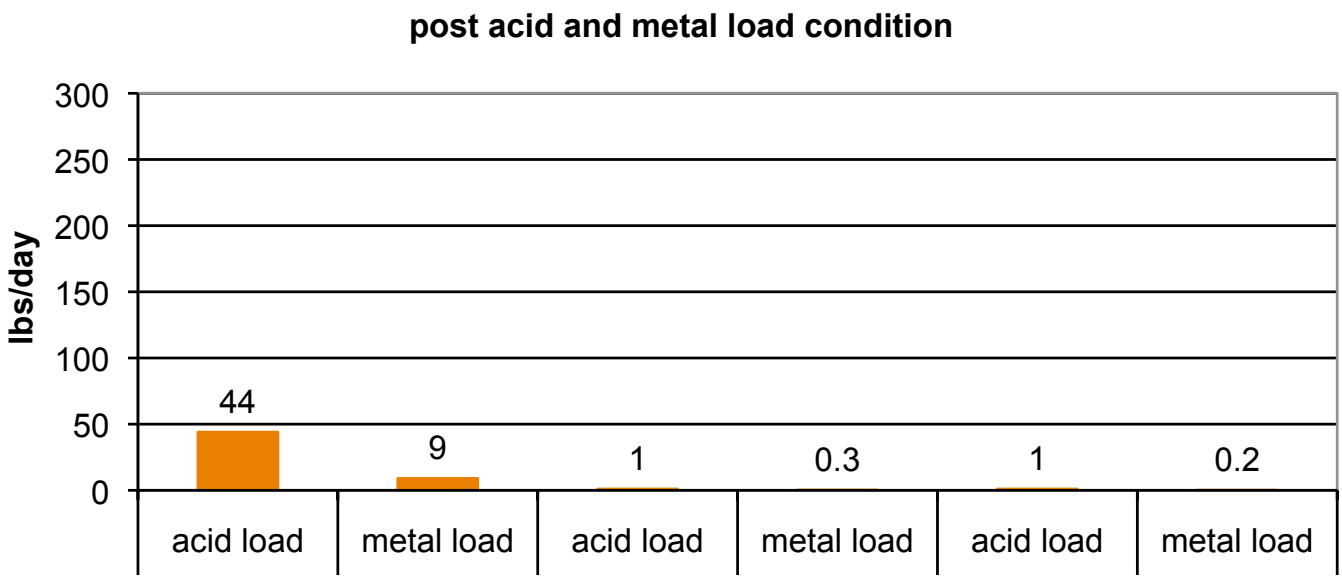
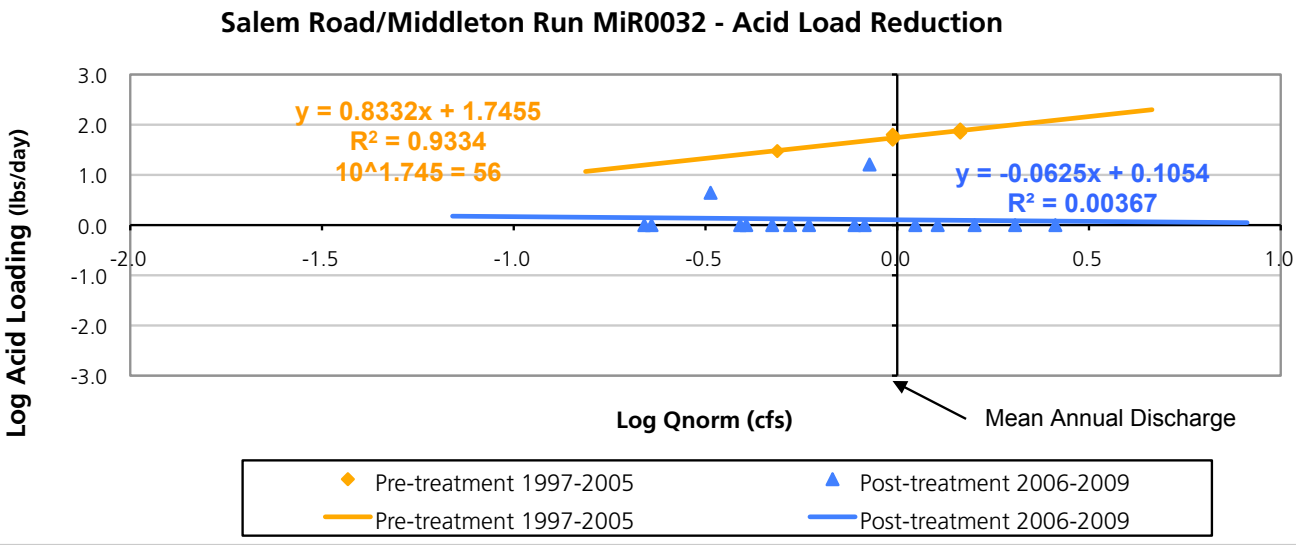
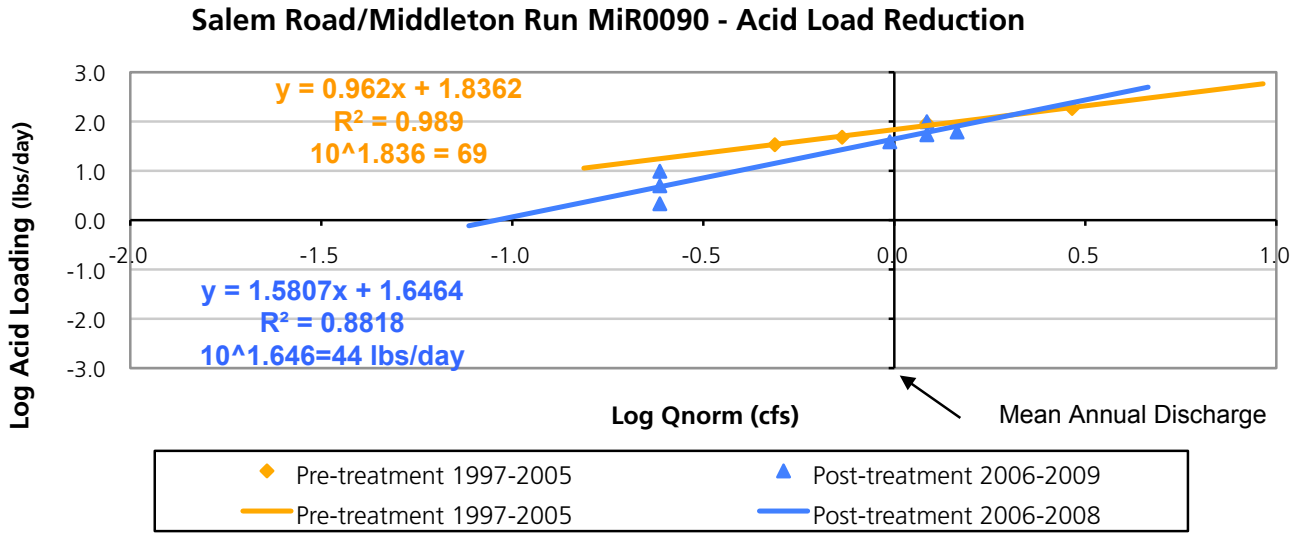


Figure 4. Acid Load Reduction





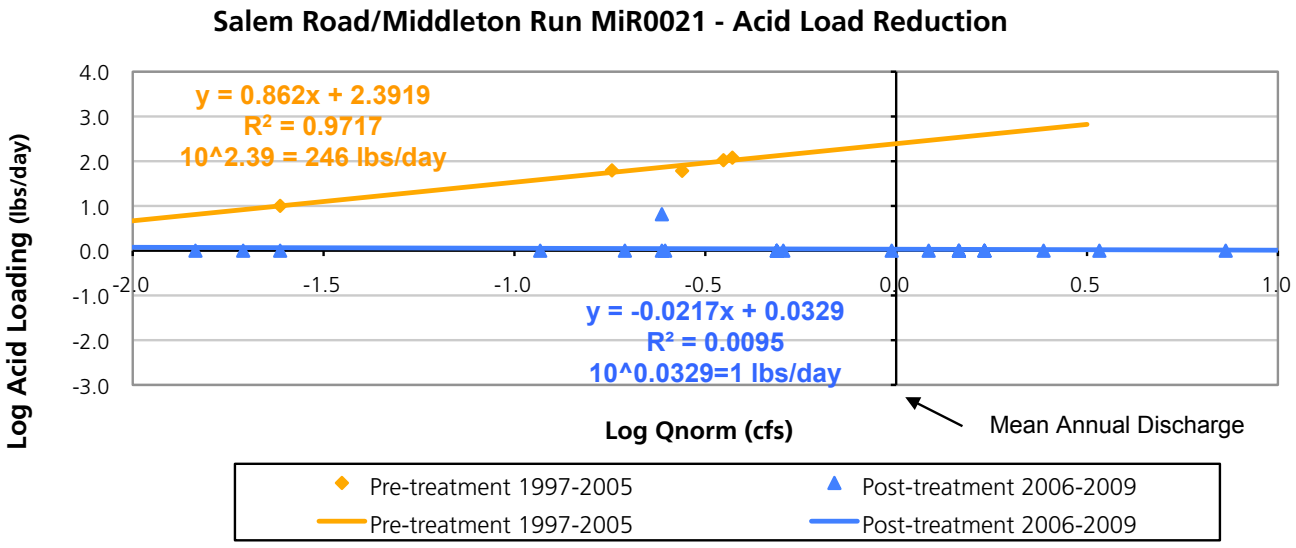
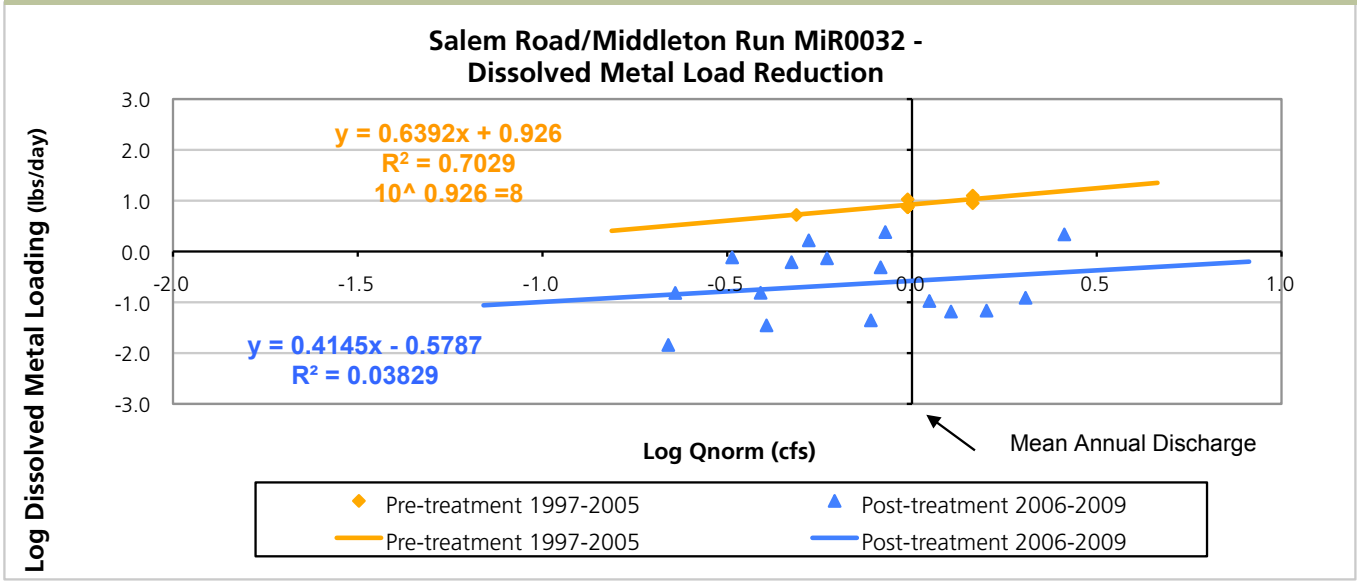
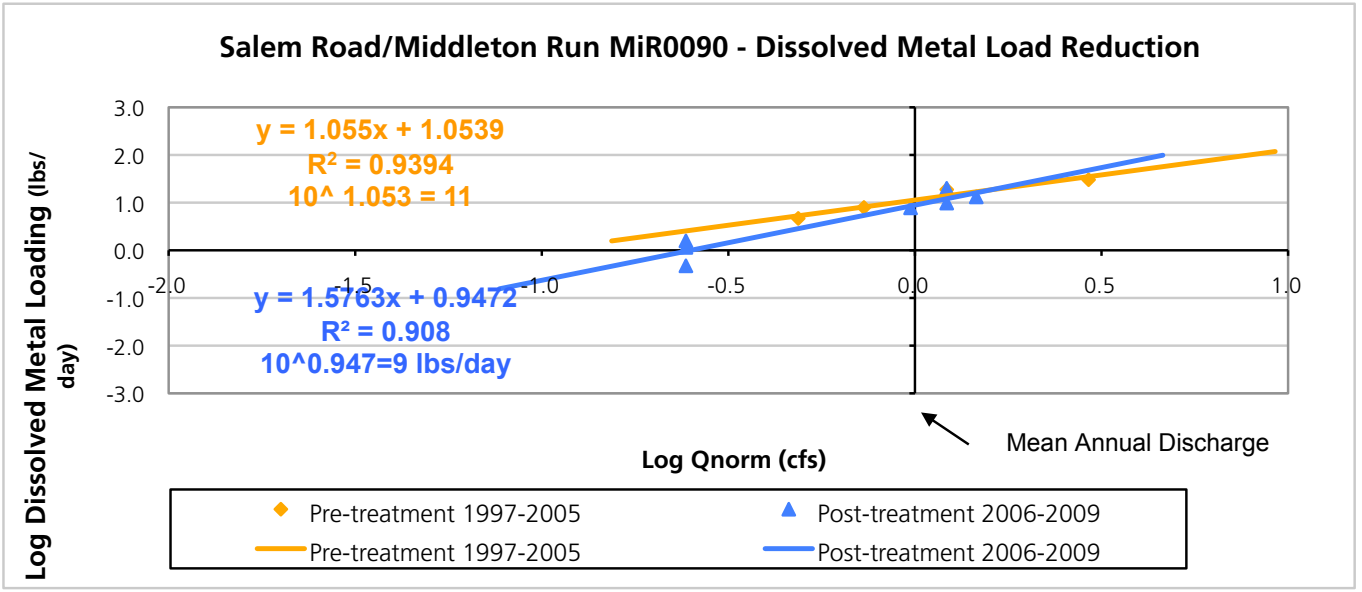


Figure 5. Dissolved Metal Load Reduction





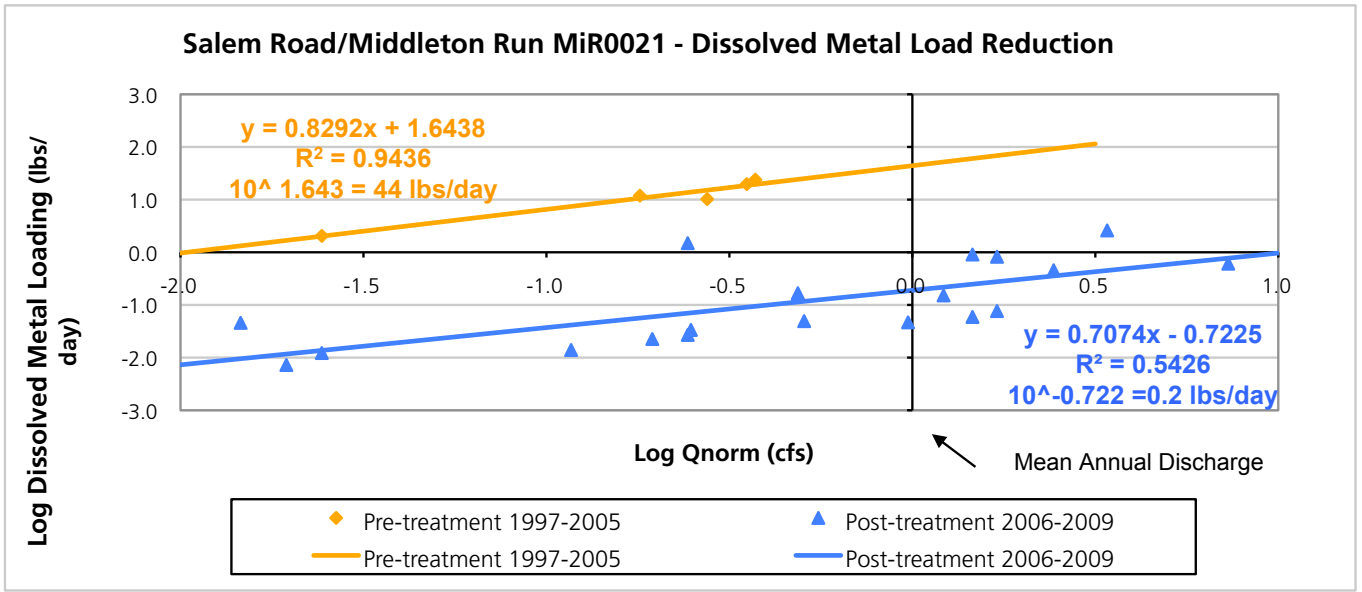
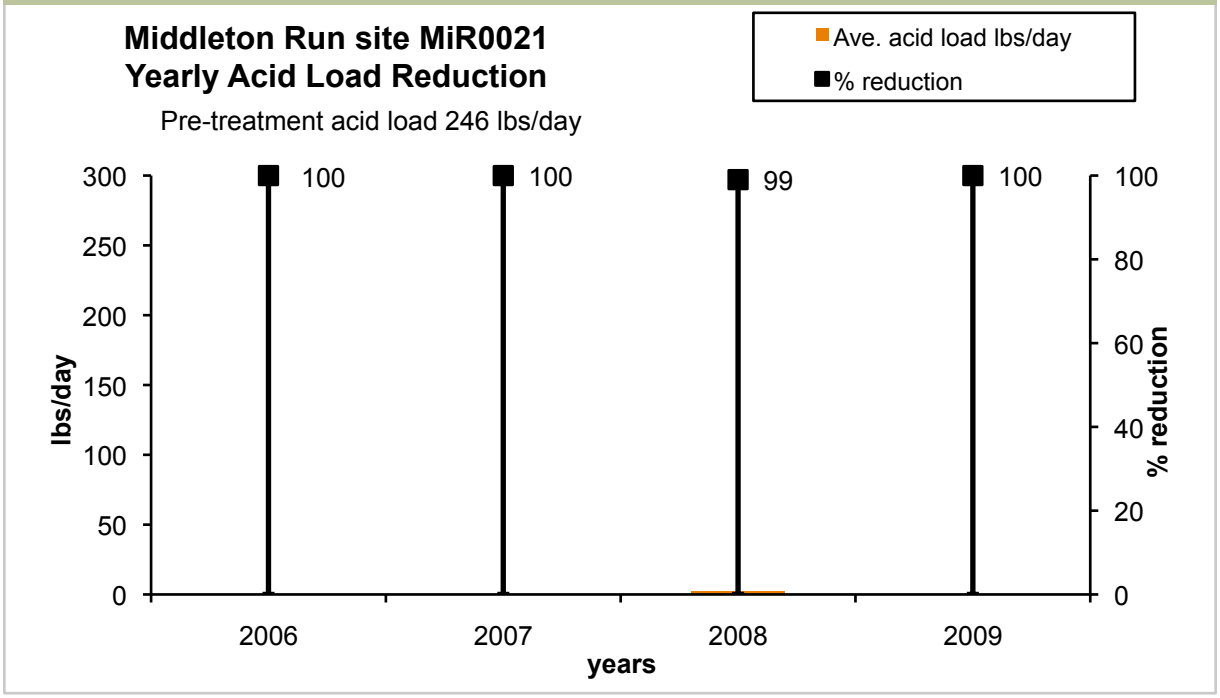


Figure 6a. Yearly Load Reduction



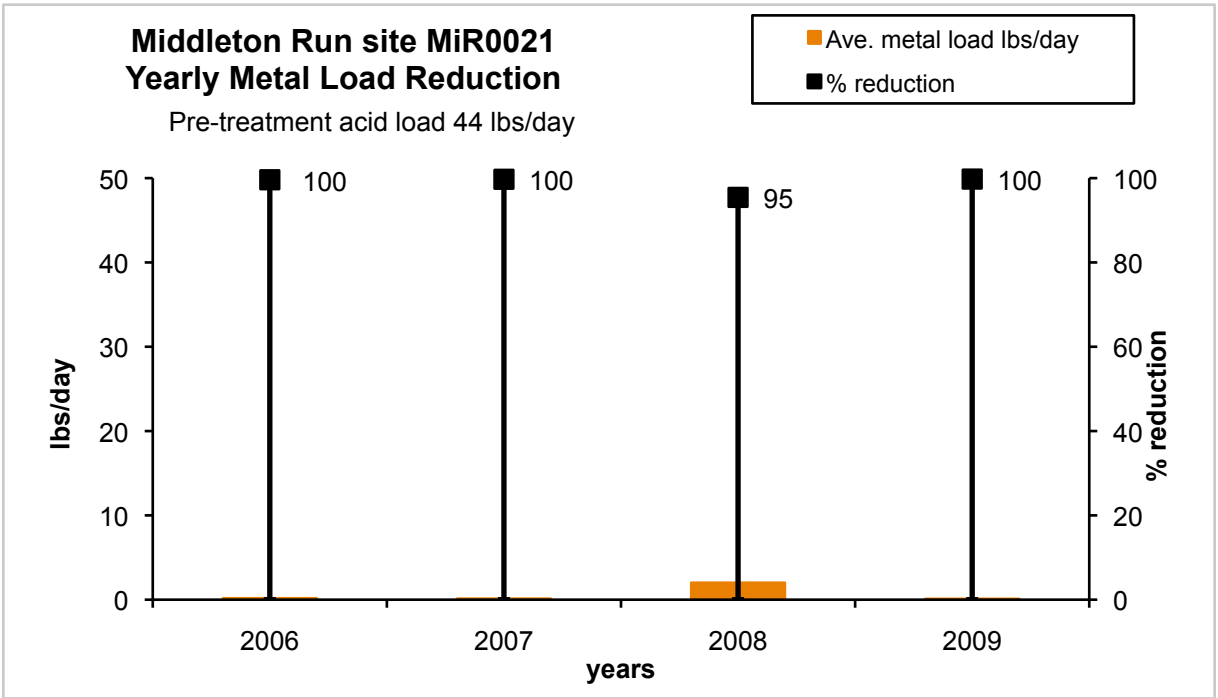
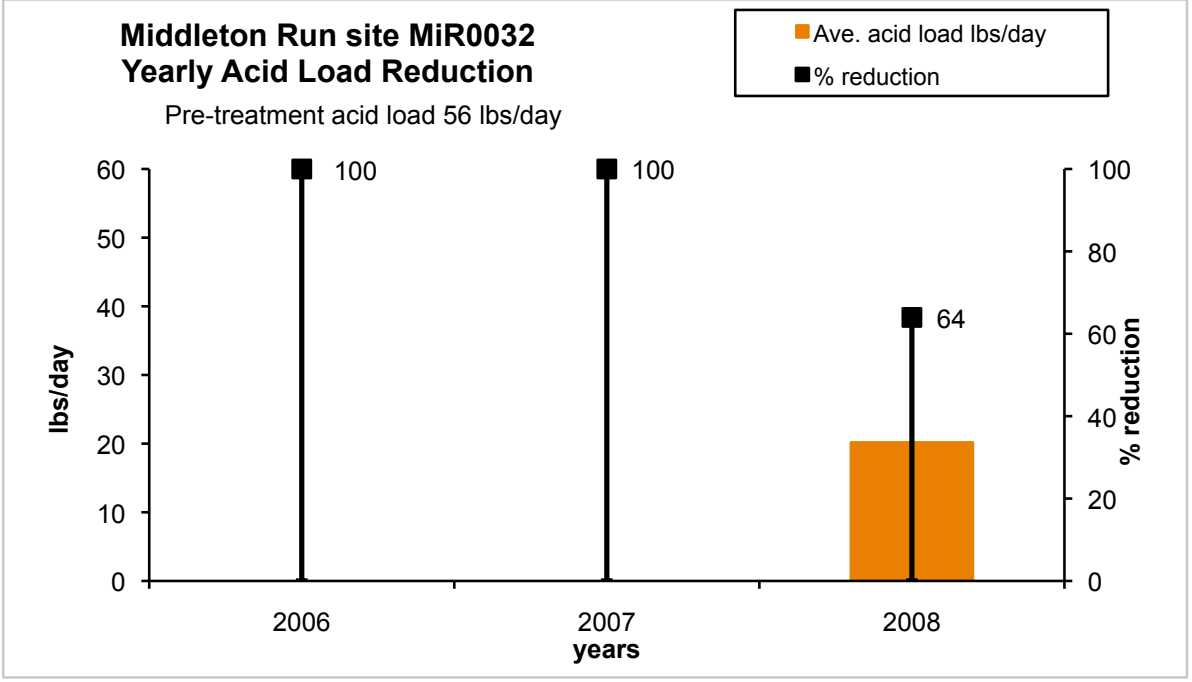


Figure 6b. Yearly Load Reduction



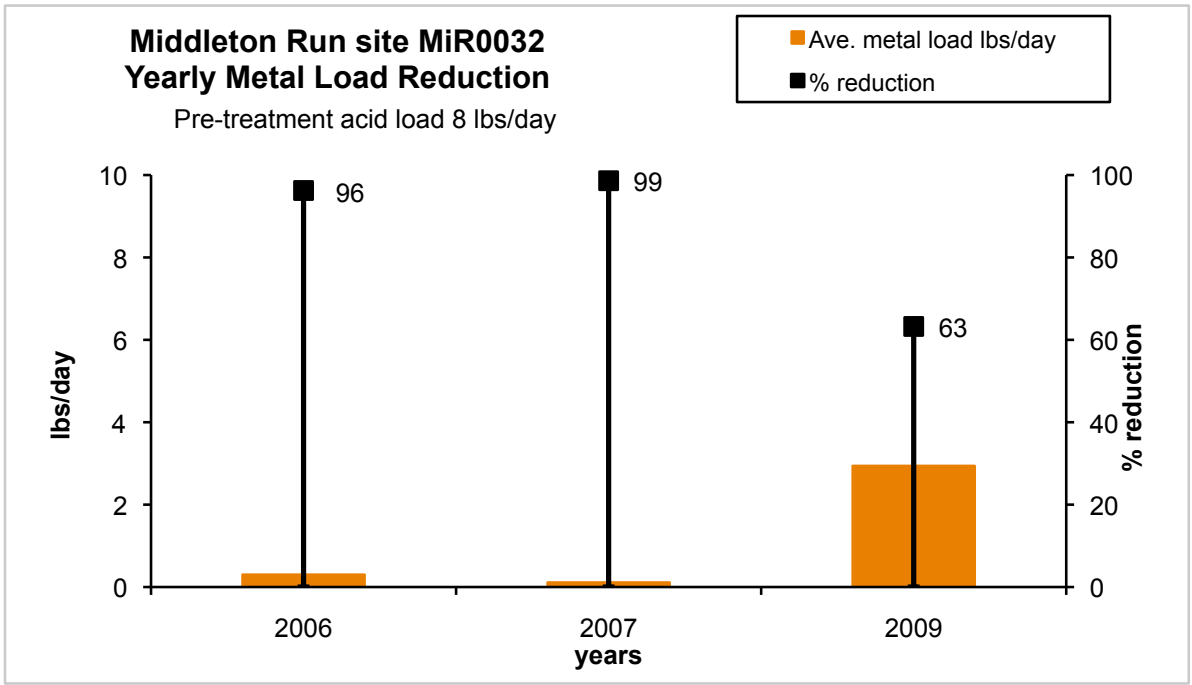
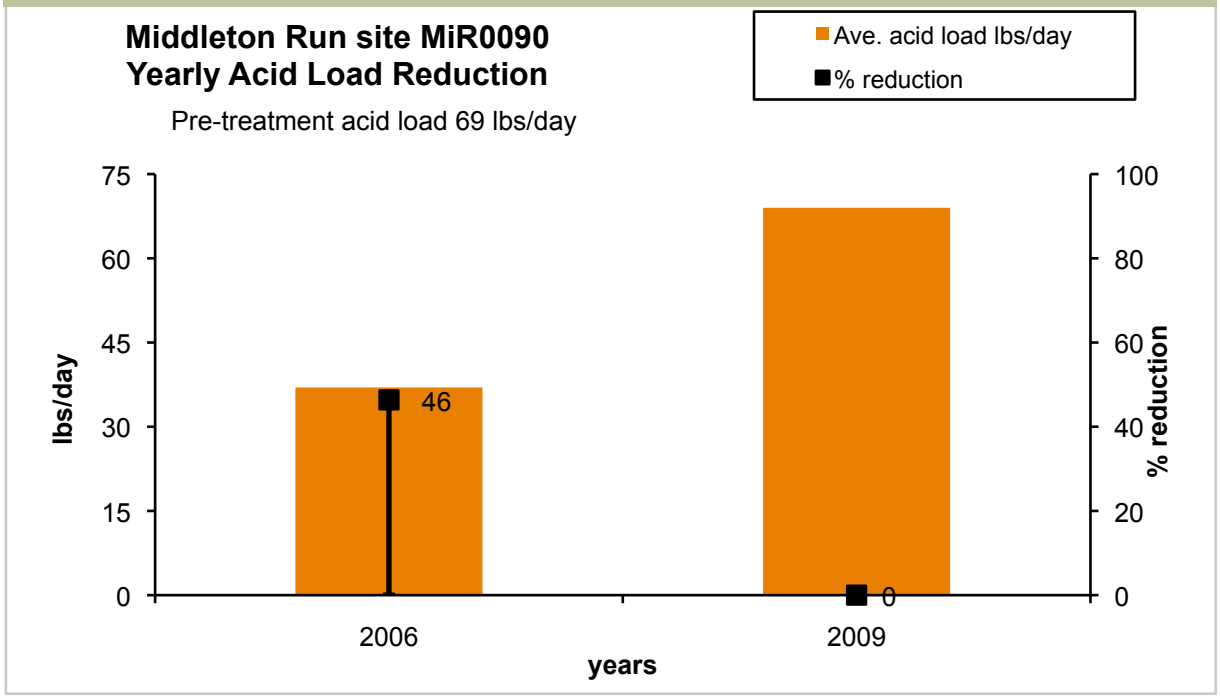
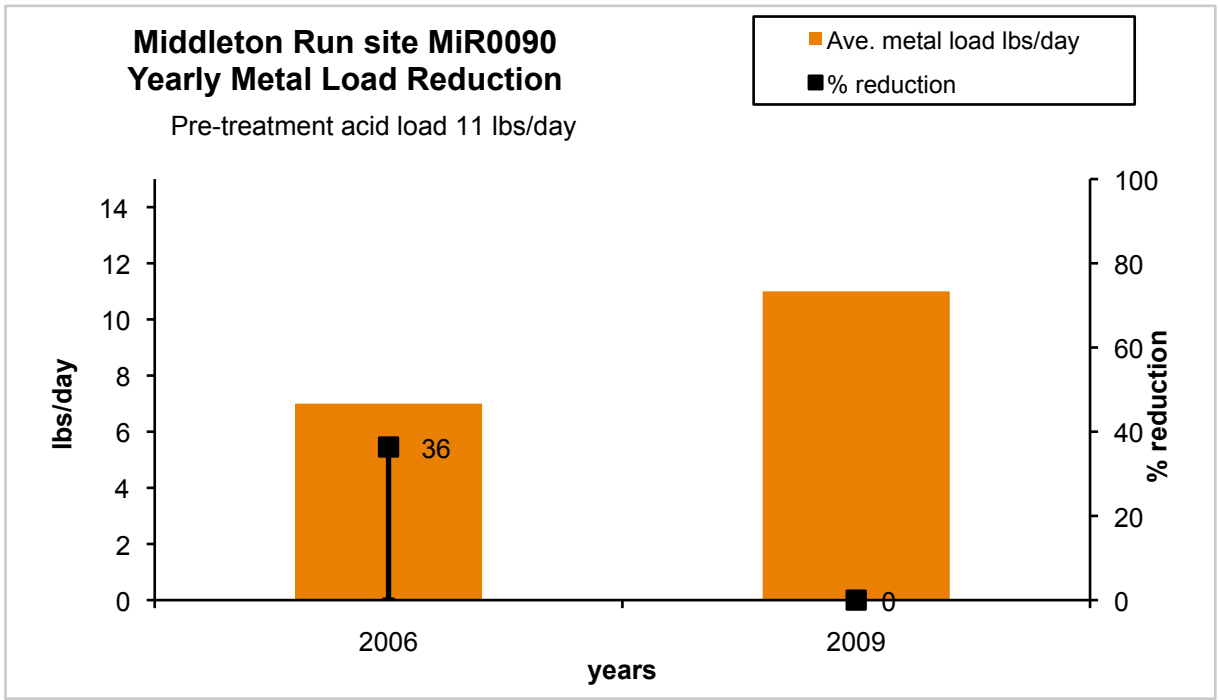


Figure 6c. Yearly Load Reduction





2009 NPS Report - Raccoon Creek Watershed - State Route 124 Seeps

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 6/18/2001 ODNR Project Number: JK-MI-47

Pre-construction

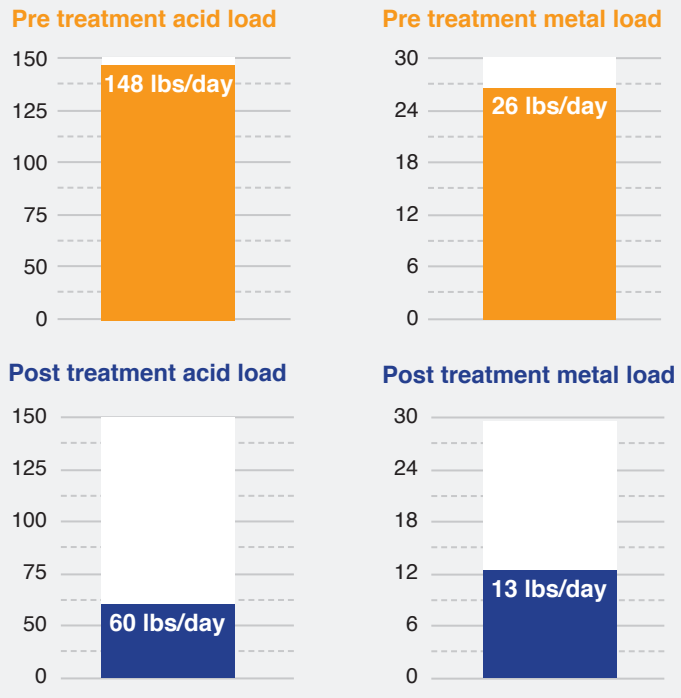
Between pond and seep, Photo by Brent Miller

Post-construction

Sr 124 hillside limestone channel, Photo by Chip Rice

State Route (SR) 124 Seeps Project is located in Section 15 of Milton Township in Jackson County and lies within the 14-digit HUC unit #05090101050030. The site is 7 acres and is located in the Little Raccoon Creek subwatershed. This area consisted of an abandoned surface coal mine with an acidic surface pit. This un-reclaimed mine, resulted in seeps which drained directly into Little Raccoon Creek adjacent to SR 124. The site was reclaimed, pit was drained and regraded, and an open limestone channel was installed to collect drainage before discharging off site. The design was completed by ATC Associates Inc. for $80,000. The treatment approach for this site was to install several open limestone channels and conduct basic reclamation. The major consideration for this design was to establish positive drainage, remove several highwall impoundments, cover toxic materials, establish vegetations, and add alkalinity through the limestone channels. The goal of the design was to remove acidity from entering into Little Raccoon Creek. The project goal was met by 100 percent. Construction was complete June 18, 2001, by Oldtown Coal Company for a cost of $315,490. The major responsibility of the construction company was to complete all reclamation activities described in the project design. The funding source, for the project design and construction were ODNR-DMRM and Ohio EPA. Figures 3 and 4 (shown on page 3) estimate approximately 88 lbs/day of acid and 13 lbs/day of metals were reduced from entering into Little Raccoon Creek as a result of this AMD reclamation project.

SITE: OTF0010



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

2009 NPS Report - Raccoon Creek Watershed - State Route 124 Seeps

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Water Quality Report

Water quality data was collected at the project discharge as well as multiple stations pre- and post- construction. The graphs below show changes in pH (Figure 1) and acidity (Figure 2) along the mainstem of the receiving stream upstream and downstream of the project discharge as a result of the AMD reclamation project.

As a result of the SR 124 Seeps project, the pH and net acidity has improved downstream of the reclamation site for 9.5 miles. Pre-construction data showed pH in the range of 2.9 – 6.7 downstream of the project. However, after installation of the SR 124 Seeps project, post-construction data shows pH in the range of 4.8 – 6.9 downstream of the project discharge. The net acidity concentrations decreased 92 percent at the discharge showing net alkaline conditions continuing for 9.5 miles downstream to station LRC0030.

Figure 1. Pre and Post pH

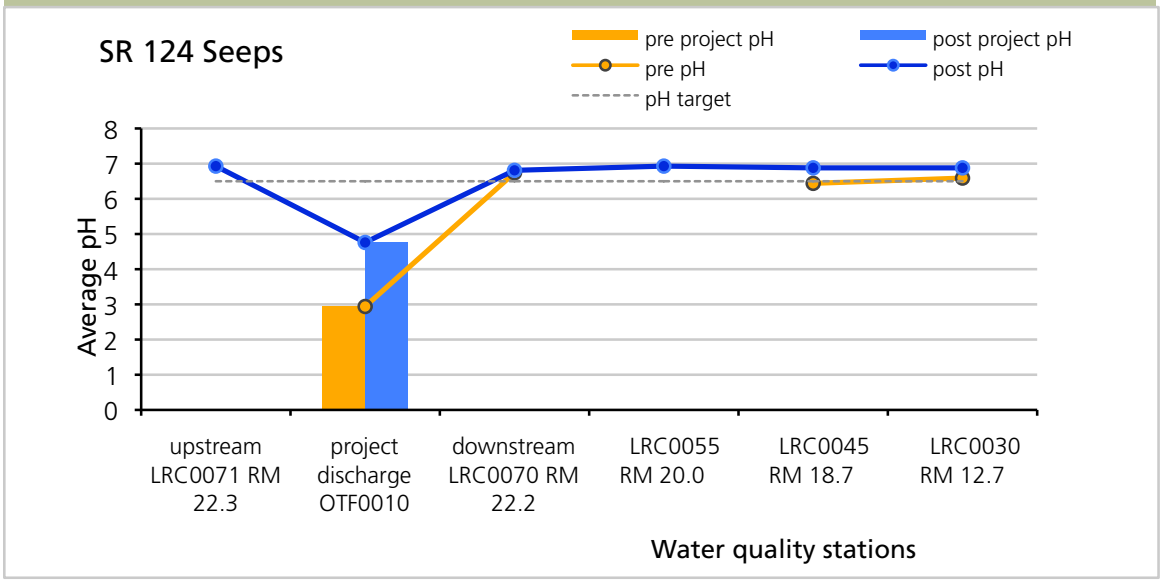
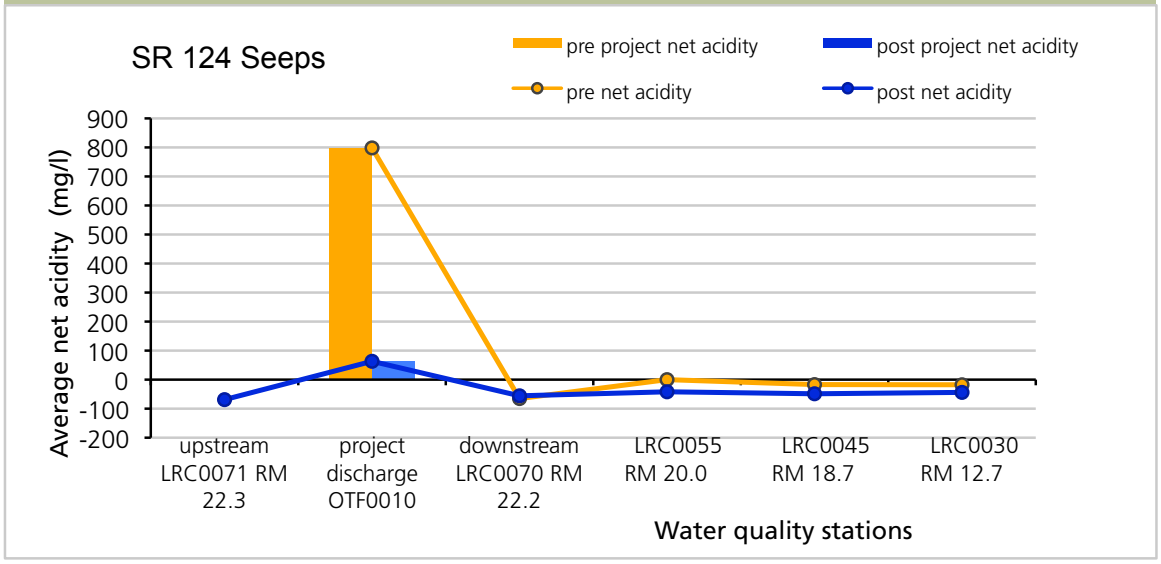


Figure 2. Pre and Post Acidity



Water Quality – load reductions

Using the Mean Annual Load Method (Stoertz, 2004) acid and metal load reduction occurring at this project were plotted and shown in Figure 3 and 4. Acidity, iron, aluminum and discharge were measured pre- and post-construction at the project discharge from 2/1/1997 to 11/27/2000 for pre-construction and from 6/19/2001 to 12/31/2009 for post-construction. *Stoertz, Mary W. and Douglas H. Green, 2004. Mean Annual Acidity Load: A Performance Measure to Evaluate Acid Mine Drainage Remediation. Ohio Department of Natural Resources Conservation and Restoration Innovations 2004 Applied Research Conference at Ohio University.*

Figure 3. Acid Load Reduction

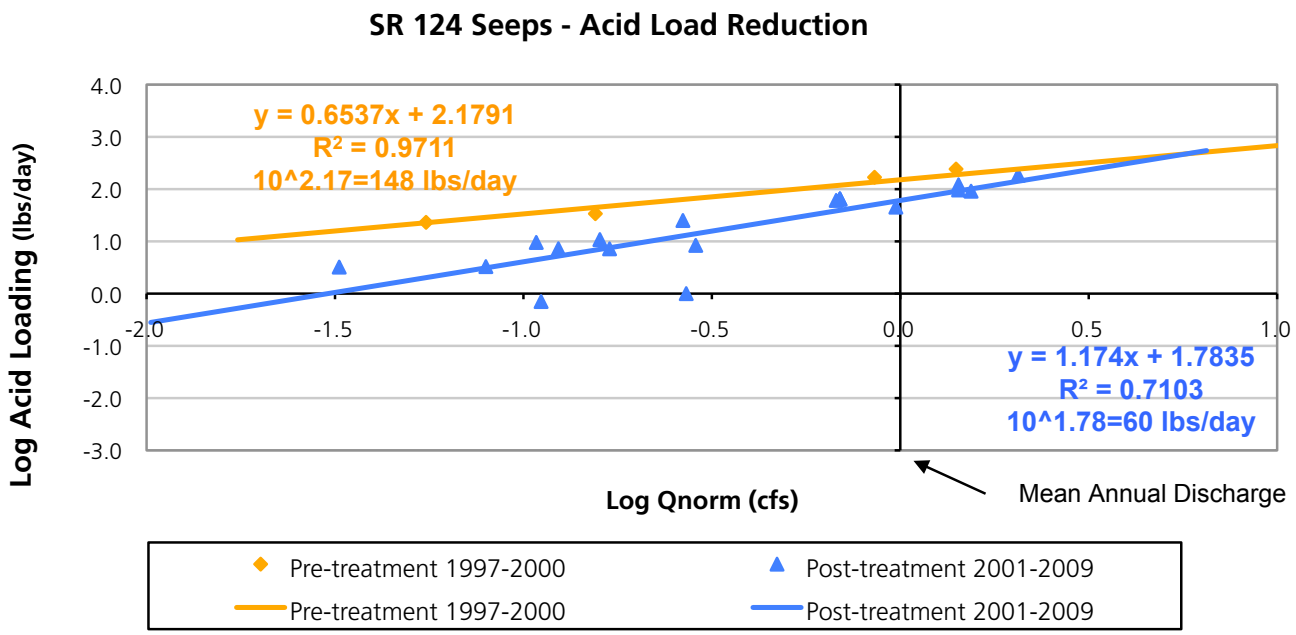
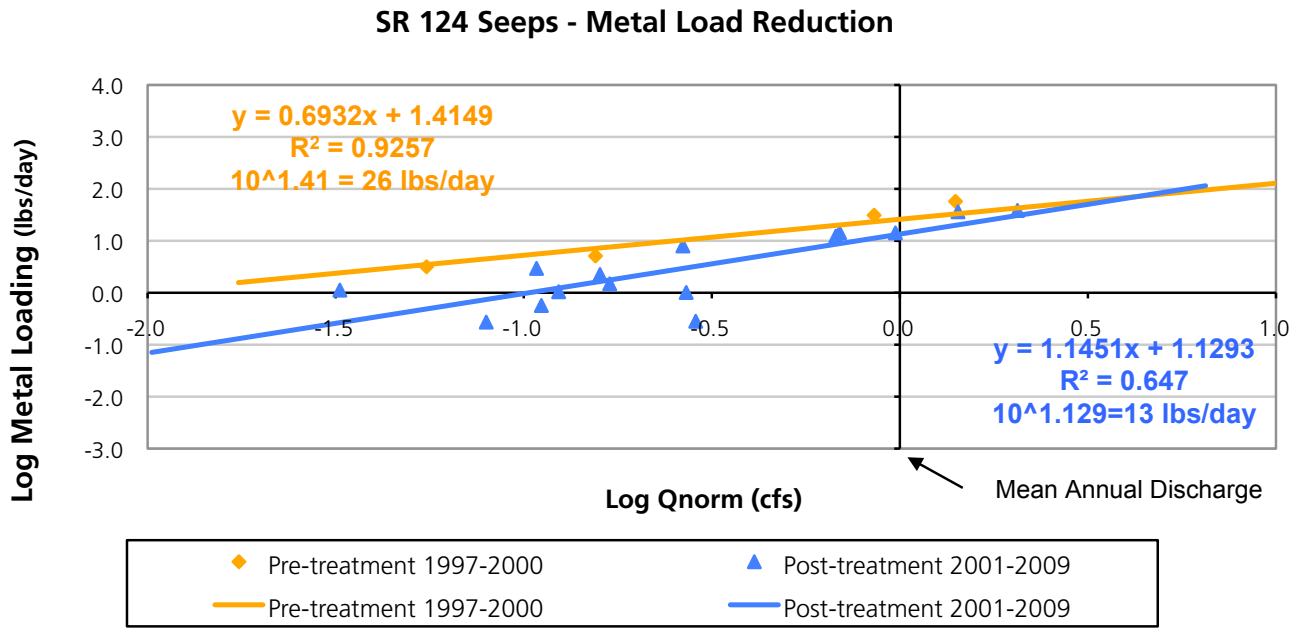


Figure 4. Dissolved Metal Load Reduction



Water Quality – load reductions

Similar to other environmental best management practices (BMPs), performance of acid mine drainage reclamation projects are also expected to decline with time. Currently, operation and maintenance plans are being designed for each existing system and for future projects. Figure 5 and 6 show the mean annual acid and metal load reduction (Stoertz, 2004) for each year (or group of years) during post-construction from the project effluent. These graphs show the rate of decline (and/or improvement) with time in the performance of the treatment system. Knowing this rate of decline will aid in the implementation of operation and maintenance plans for each site. Yearly load reductions are plotted and shown in Figure 5 and 6.

Figure 5. Yearly Acid Load Reduction

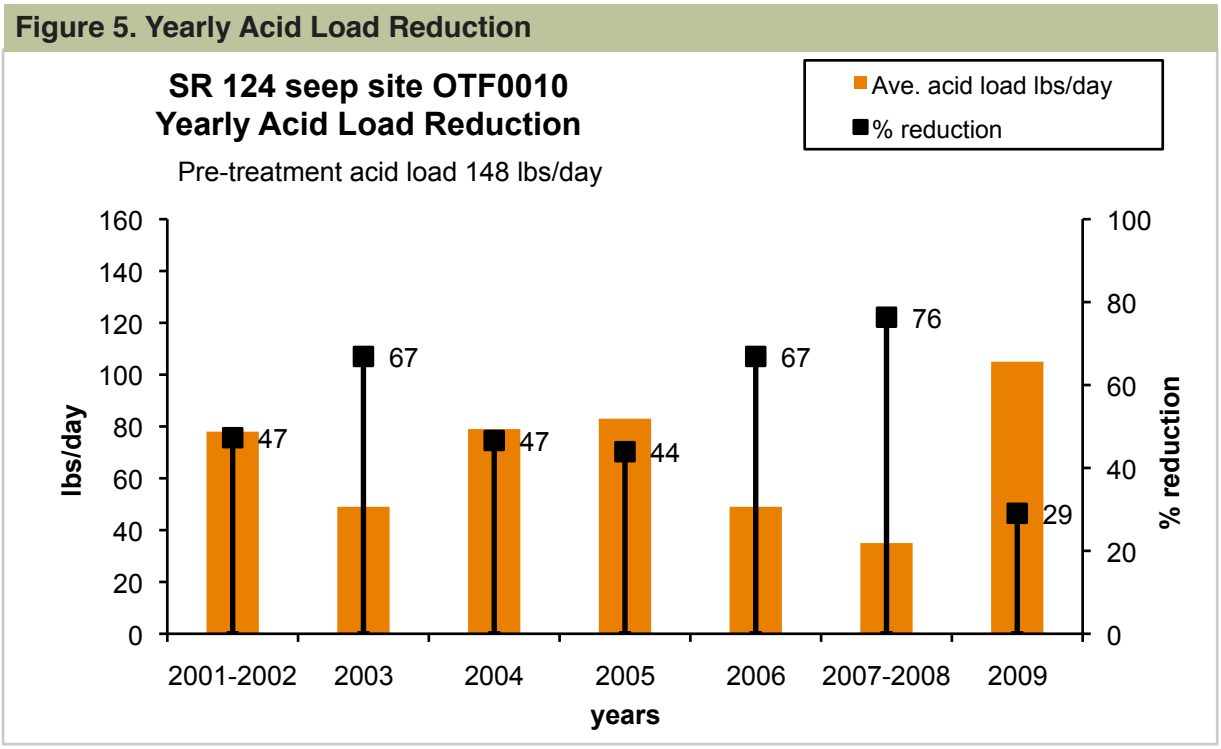
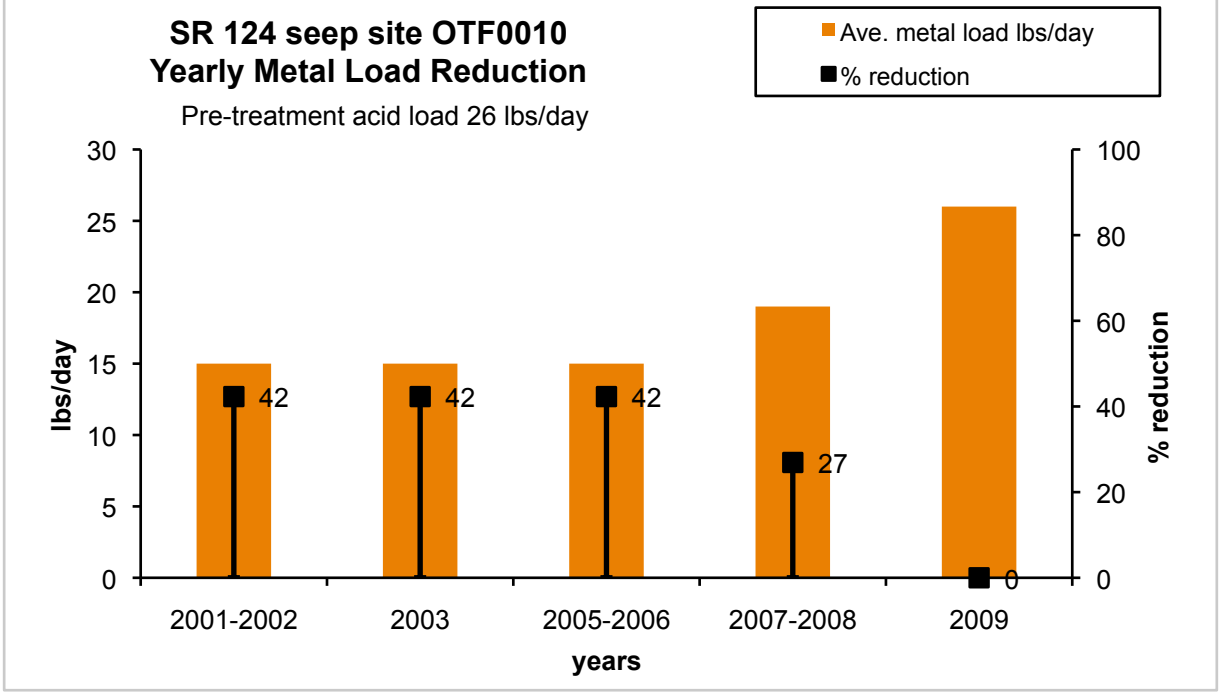


Figure 6. Yearly Metal Load Reduction



2009 NPS Report - Raccoon Creek Watershed - Flint Run East

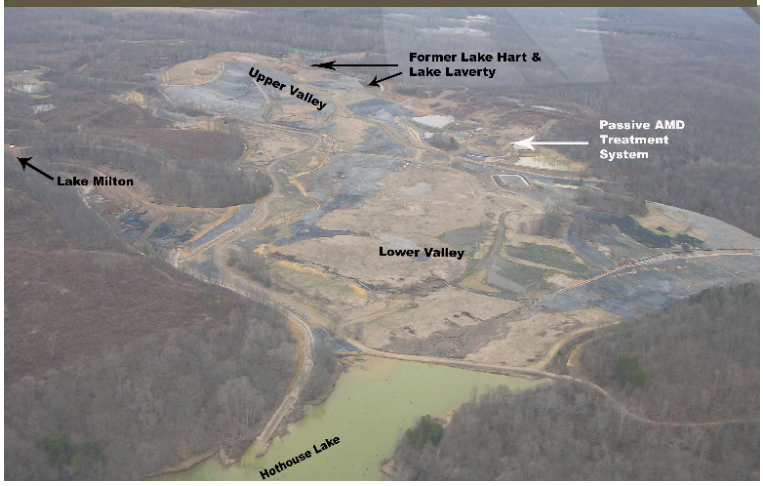
Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 8/1/2006 ODNR Project Number: Jk-MI-34

Pre-construction

Flint Run East site discharge, Photo by Ben McCament

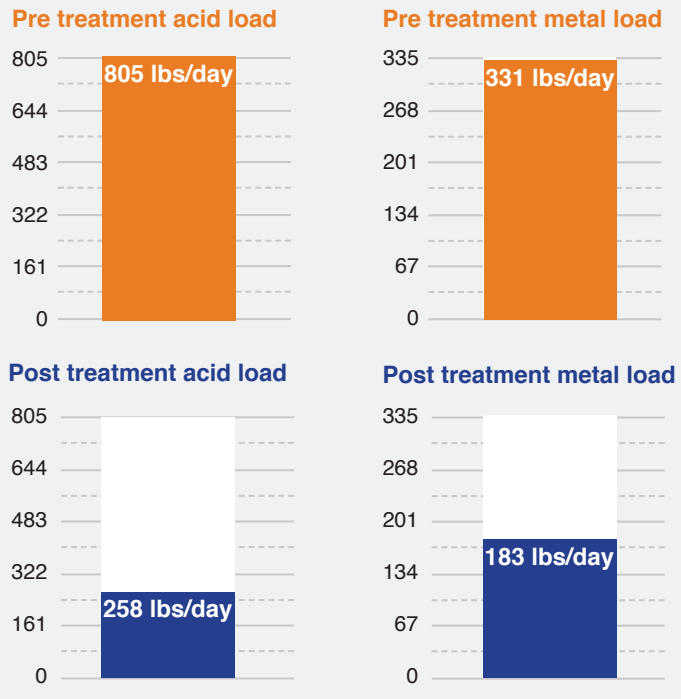
Post-construction



Air photo of Flint Run site near completion, Photo by Ben McCament

Flint Run East is located in Section 28 of Milton Township in Jackson County and lies within the 14-digit HUC unit #05090101050030. The project site is 56 acres and is located in Little Raccoon Creek next to Lake Milton. Flint Run East project is Phase I of the Flint Run Reclamation Project, Lake Milton is Phase II. The project discharge was measured at the tributary draining the Flint Run East treatment site. The Flint Run sub watershed is affected by abandoned strip mine drainage and associated unreclaimed coal refuse piles mostly from the Broken Aro mine which is in the headwaters of Flint Run. This area was the coal washing and loading facility for the Broken Aro mine. The site is very complex hydrologically, the site consists of large buried slurry impoundments and surface mining pits around the rim of the main valley. Mead-Westvaco reclaimed the main slurry pond area with paper mill sludge in the mid 1980's. AMD seeps originate in many locations associated with the slurry impoundments and the surface mine pits. The design was completed by RD Zande for a cost of $241,702. The treatment approach for this site was to dewater the strip pits and install passive acid mine drainage treatment systems. The major consideration during the design process was to reduce groundwater infiltration into the valley coal refuse pile. The goal has been met 100%. Construction was complete Aug. 1, 2006, by Berridge Reclamation for a cost of $1,456,106. The funding sources for this project were ODNR-DMRM for the design and ODNR-DMRM, EPA-319 and OSM ACSI for construction. Figure 3 to 4 (shown on page 3) estimate approximately 547 lbs/day of acid and 148 lbs/day of metals were reduced from entering into Little Raccoon Creek as a result of this AMD reclamation project.

SITE: FR0126



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

Treatment Installed	Quantity & Units
Earthwork	56 acres
Erosion Control	13,000 linear feet
Dewatering Existing Impoundments	12,827,200 gallons of water
Sediment Pond	87,400 square feet
Steel Slag Leach Bed	32,500 square feet
Fresh Water Storage Pond	84,800 square feet
Limestone Leach Bed	10,400 square feet
Wetland, passive	4,800 square feet
Succesive Alkaline Producing Systems (SAPS)	32,500 square feet
Open Limestone Channel	13,650 linear feet

2009 NPS Report - Raccoon Creek Watershed - Flint Run East

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Water Quality Report

Water quality data was collected at the project discharge as well as multiple stations pre- and post-construction. The graphs below show changes in pH (Figure 1) and acidity (Figure 2) along the mainstem of the receiving stream downstream of the project discharge as a result of the AMD reclamation project.

Initial results from the Flint Run East Project indicate, pH and net acidity have improved downstream of the reclamation site for 7.0 miles. Pre-construction data showed pH in the range of 2.7 – 6.7 at the project discharge and downstream. However, after installation of the Flint Run East Project, post-construction data shows pH in the range of 4.0 - 7.1 at the discharge, and downstream. The net acidity concentrations decreased 73 percent at the project discharge showing net alkaline conditions for 7.0 miles downstream to station (LRC0030 88% 2007, 85% 2008).

Figure 1. Pre and Post pH

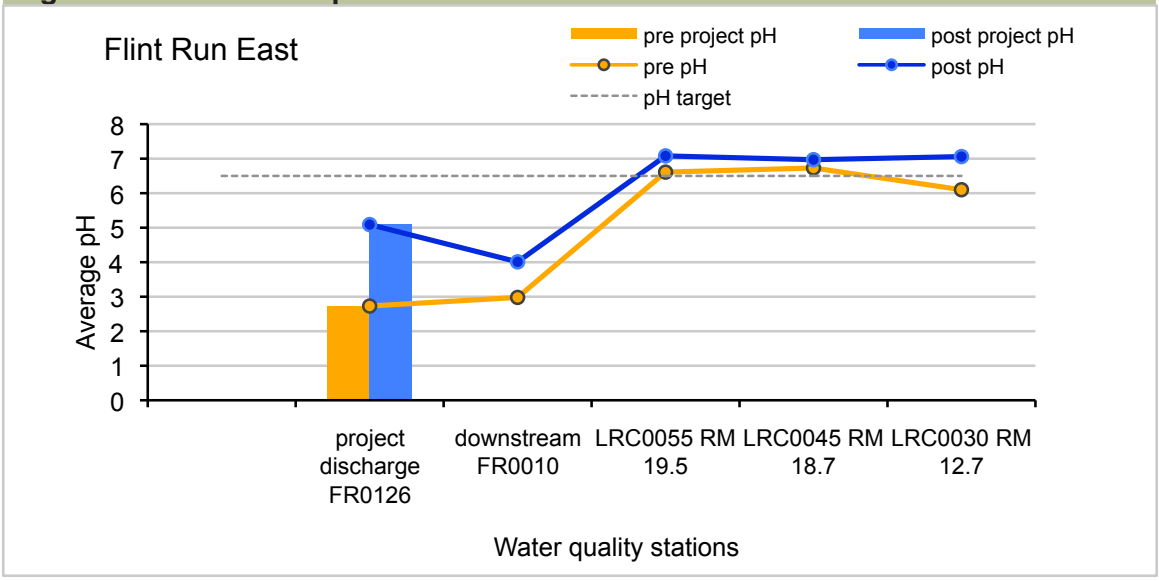
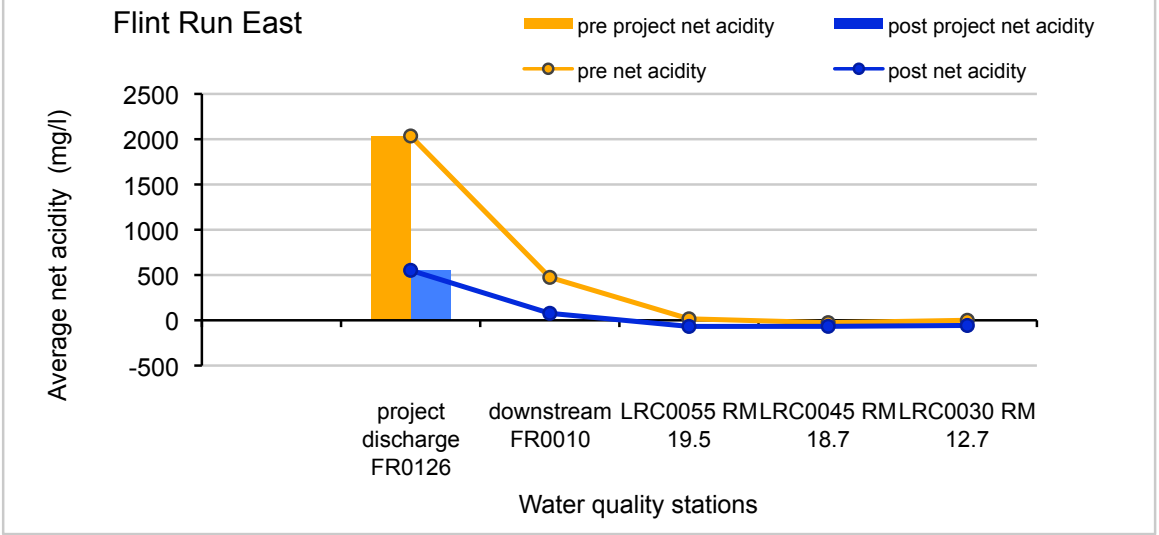


Figure 2. Pre and Post Acidity



Water Quality- load reductions

Using the Mean Annual Load Method (Stoertz, 2004) acid and metal load reduction occurring at this project were plotted and shown in Figure 3 and 4. Acidity, iron, aluminum and discharge were measured pre- and post-construction at the project discharge from 1/1/1975 to 5/31/2006 for pre-construction and from 6/1/2006 to 12/31/2009 for post-construction, with the exception for the acid load reduction graph (figure 3). Acid load reductions were calculated for 2007 - 2009, this excluded the 2006 date where initial acid load reduction were high and have since decreased. The 2007 - 2009 data portray current conditions more accurately.

Figure 3. Acid Load Reduction

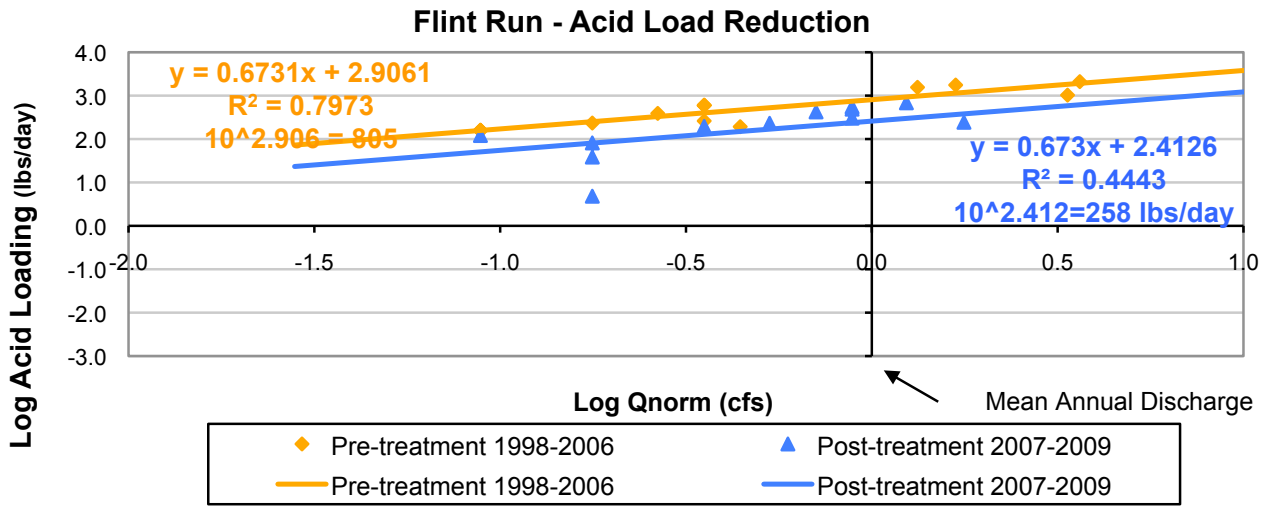
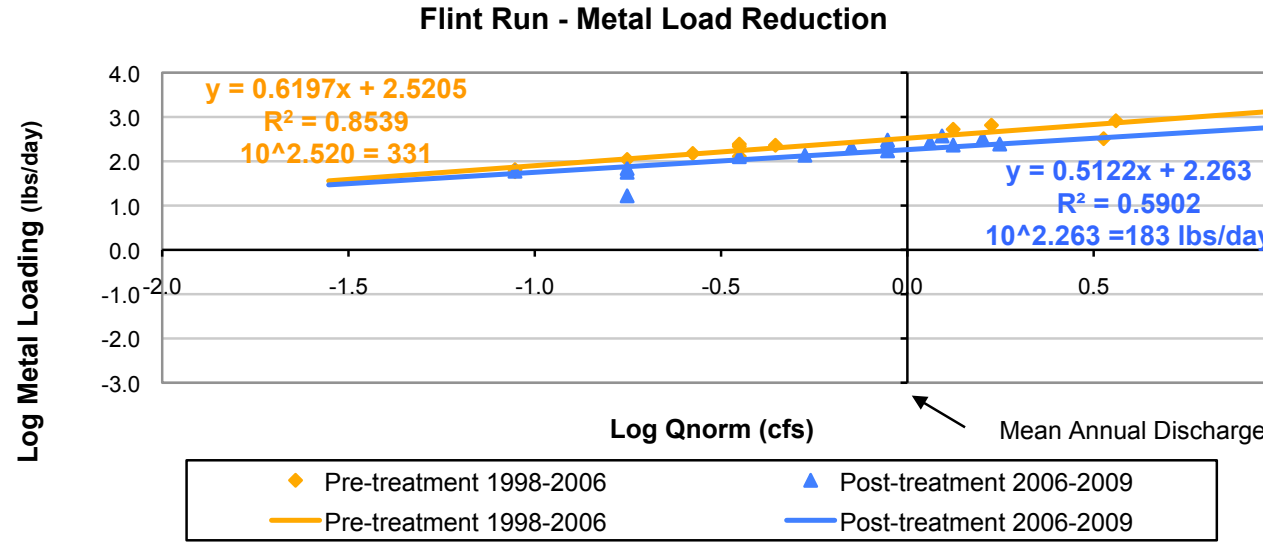


Figure 4. Dissolved Metal Load Reduction



Water Quality – load reductions

Similar to other environmental best management practices (BMPs), performance of acid mine drainage reclamation projects are also expected to decline with time. Currently, operation and maintenance plans are being designed for each existing system and for future projects. Figure 5 and 6 show the mean annual acid and metal load reduction (Stoertz, 2004) for each year (or group of years) during post-construction from the project effluent. These graphs show the rate of decline (and/or improvement) with time in the performance of the treatment system. Knowing this rate of decline will aid in the implementation of operation and maintenance plans for each site. Yearly load reductions are plotted and shown in Figure 5 and 6.

Figure 5. Yearly Acid Load Reduction

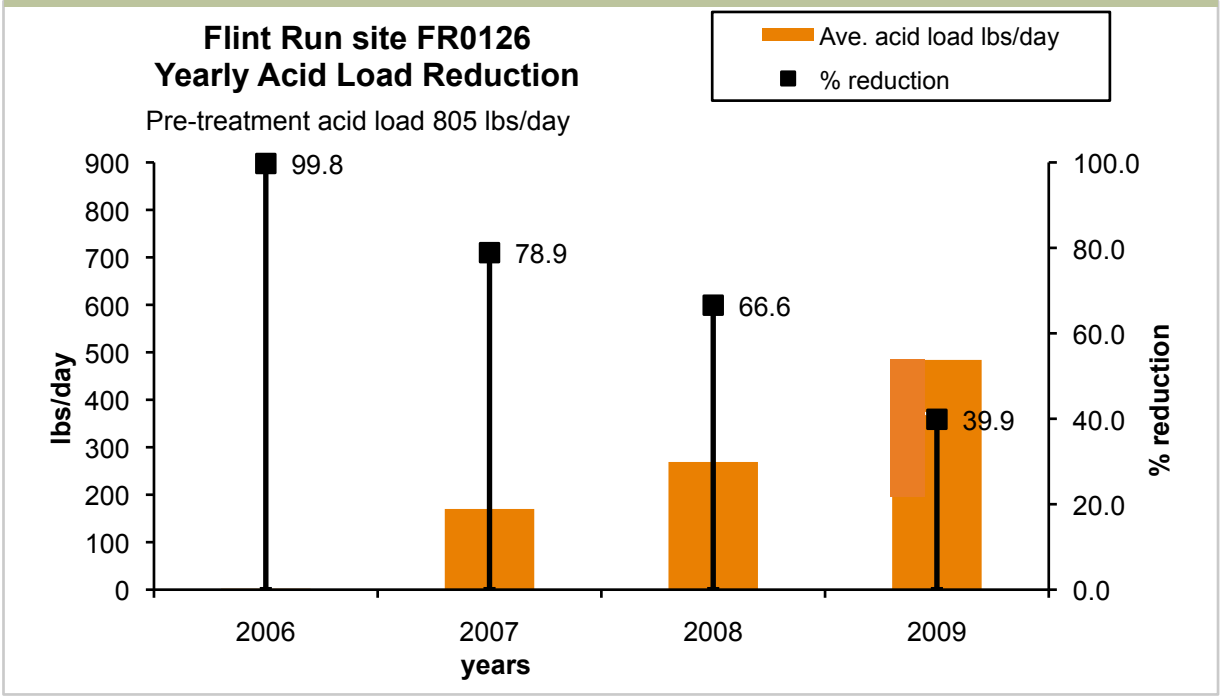
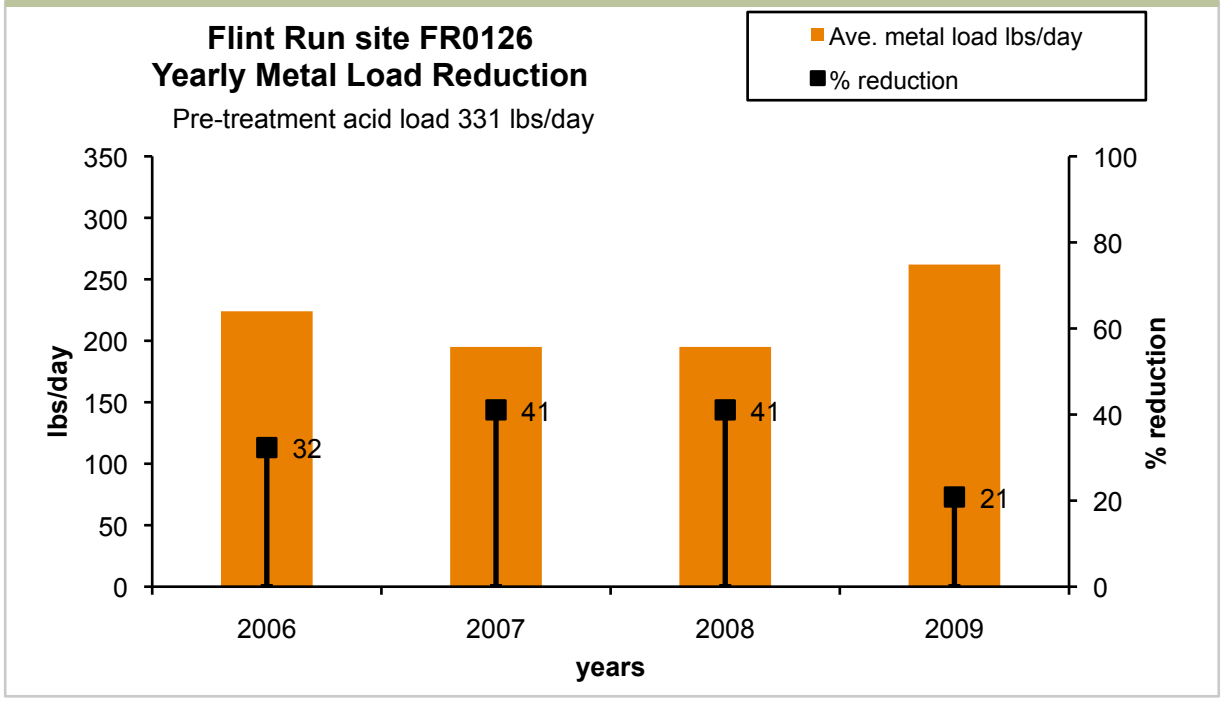
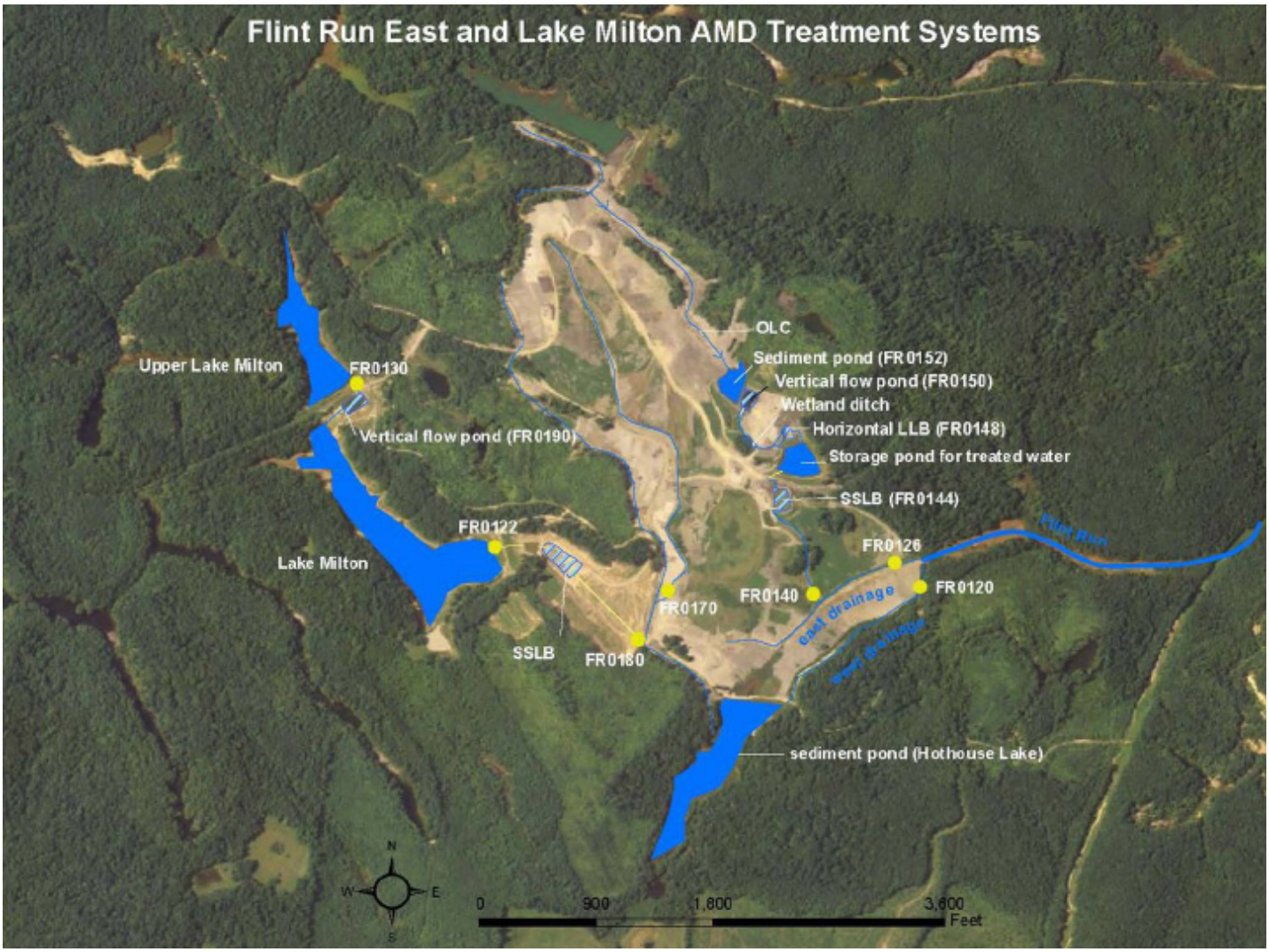


Figure 6. Yearly Metal Load Reduction



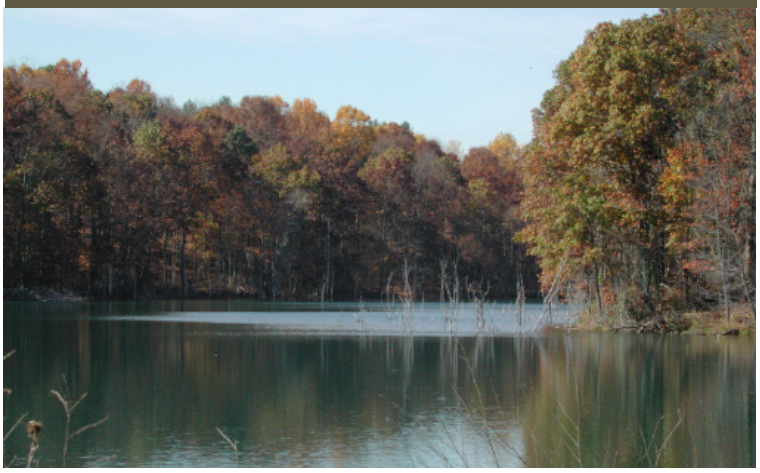

Flint Run East and Lake Milton AMD Treatment Systems
Upper Lake Milton
FR0130
Vertical flow pond (FR0190)
Lake Milton
FR0122
SSLB
FR0180
FR0170
OLC
Sediment pond (FR0152)
Vertical flow pond (FR0150)
Wetland ditch
Horizontal LLB (FR0148)
Storage pond for treated water
SSLB (FR0144)
FR0126
FR0140
FR0120
Flint Run
east drainage
west drainage
sediment pond (Hothouse Lake)
N
W
E
S
0
900
1,800
3,600
Feet

2009 NPS Report - Raccoon Creek Watershed - Lake Milton

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 9/5/2006 ODNR Project Number: Jk-MI-113

Pre-construction



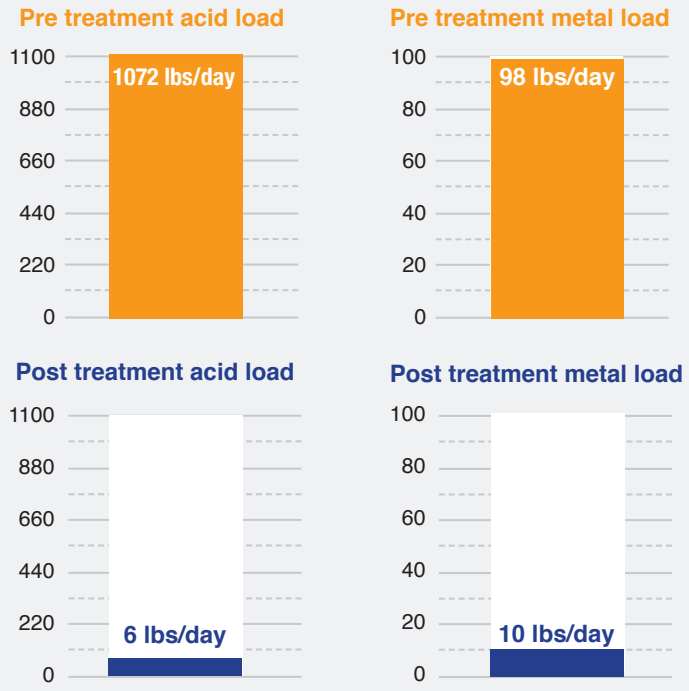
Lake Milton - 25 acre acidic lake, Photo by Ben McCament

Post-construction

Steel slag bed downstream Lake Milton, Photo by Ian Hughes

Lake Milton is located in Section 28 of Milton Township in Jackson County and lies within the 14-digit HUC unit #05090101050030. The project site is 155 acres and is located in Little Raccoon Creek next to the Flint Run East Project. The Lake Milton Project is Phase II of the Flint Run Reclamation Project. The project discharge was measured at the outlet from Hothouse Lake. Lake Milton is part of a manmade drainage system that was used during mining operations for coal washing by the Broken Aro mine. Lake Milton is adjacent to the Flint Run East site and is a 15 acre lake with a small watershed area. AMD originates in spoil areas near Upper Lake Milton (separated by railroad embankment) before flowing into Lake Milton. Additional AMD is generated after Lake Milton discharges into coal slurry waste in the valley downstream of the lake dam. Lake Milton drains into Hothouse Lake before entering into Flint Run. The design was completed by Bergmann Associates and GAI Consultants Inc. for a cost of $416,000. The treatment approach for this site was to repair the Lake Milton, dam and to install a Successive Alkaline Producing System (SAPS) and a steel slag leach bed. The major consideration during the design process was the crucial need to treat the acid mine drainage in Upper Lake Milton to drain to Lake Milton before running into the steel slag bed downstream of Lake Milton. The goal of the design is to reduce 600 lbs/day of acid loading. Problems occured with the valves in 2007, therefore this project only worked intermittently until Sept. 2007. Construction was complete September 5, 2006 by Stockmeister Enterprises Inc. for a cost of $961,536. The funding sources for this project were ODNR-MRM, EPA-319 and OSM ACSI for both the design and construction. Figures 3 to 4 (shown on page 3) estimate approximately 1066 lbs/day of acid and 88 lbs/day of metals were reduced from entering into Little Raccoon Creek.

SITE: FR0120



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

Treatment Installed	Quantity & Units
Water Treatment in Lake Milton	50 million gallons
Open Limestone Channel	2,300 linear feet
Steel Slag Leach Bed	74,000 square feet
Succesive Alkaline Producing Systems (SAPS)	16,000 square feet
Repair Dam with Slurry Wall	75,000 square feet

2009 NPS Report - Raccoon Creek Watershed - Lake Milton

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Water Quality Report

Water quality data was collected at the project discharge as well as multiple stations pre-construction. The graphs below show pH (Figure 1) and acidity (Figure 2) along the mainstem of the receiving stream downstream of the project discharge. As a result of the Lake Milton project the pH and net acidity has improved downstream of the reclamation site for 7.0 miles. Pre-construction data shows pH in the range of 3.0-6.7 downstream of the project. However, after installation of the Lake Milton Project, post-construction data shows pH in the range of 4.2-7.8 downstream of the project discharge. The net acidity concentrations decreased, showing net alkaline concentration for 7.0 miles downstream to station LRC0030.

Figure 1. Pre and Post pH

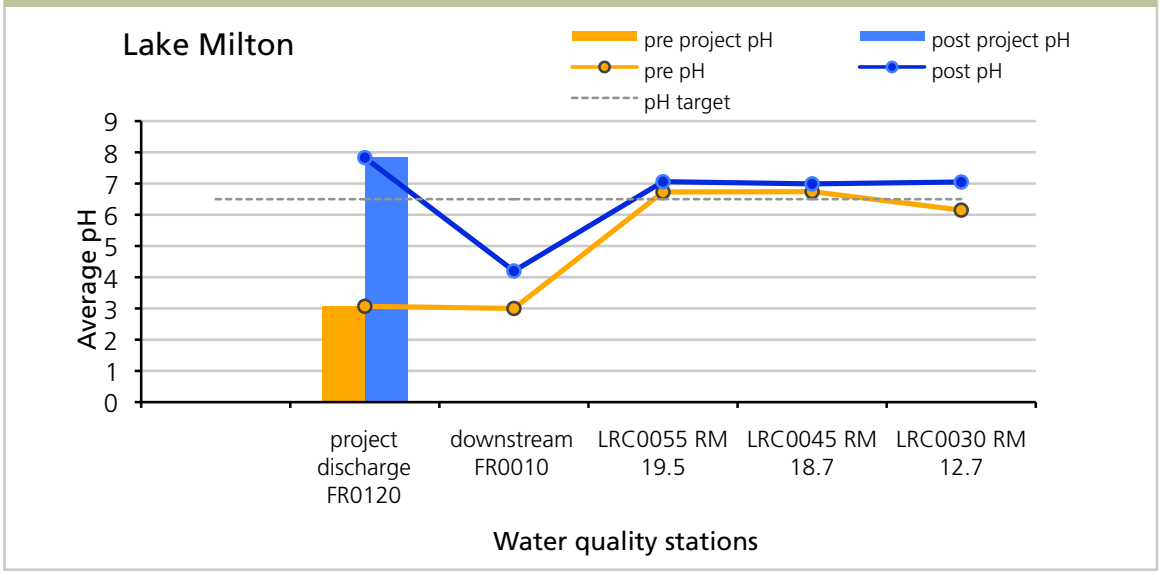
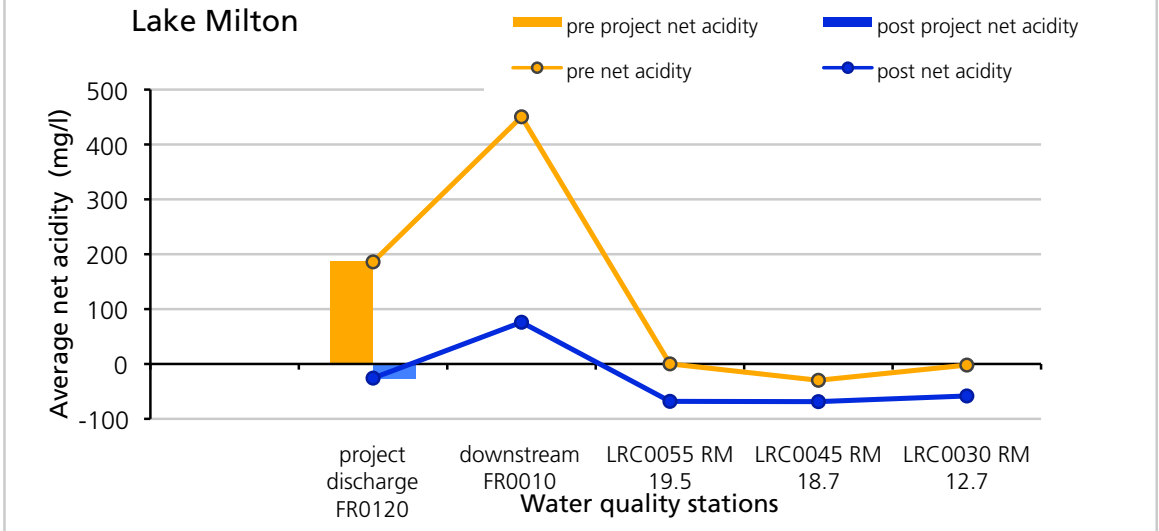


Figure 2. Pre and Post Acidity



Water Quality – load reductions

Using the Mean Annual Load Method (Stoertz, 2004) acid and metal load reduction occurring at this project were plotted and shown in Figure 3 and 4. Acidity, iron, aluminum and discharge were measured pre- and post-construction at the project discharge from 7/28/1998 to 8/9/2005 for pre-construction and from 10/16/2006 to 12/31/2009 for post-construction.

Figure 3. Acid Load Reduction

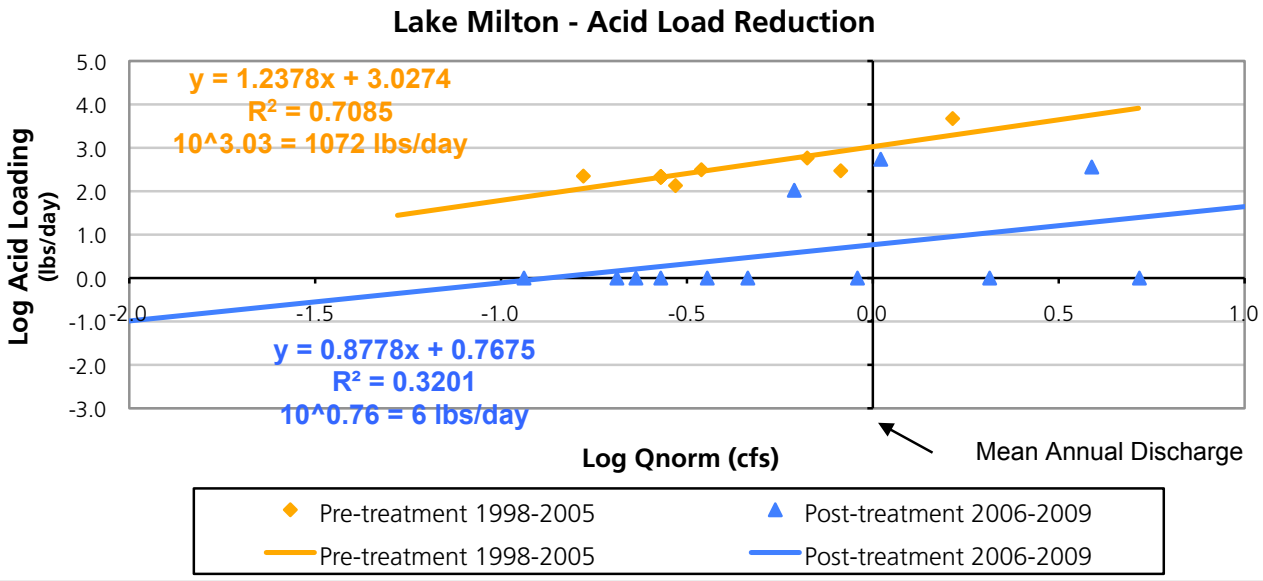
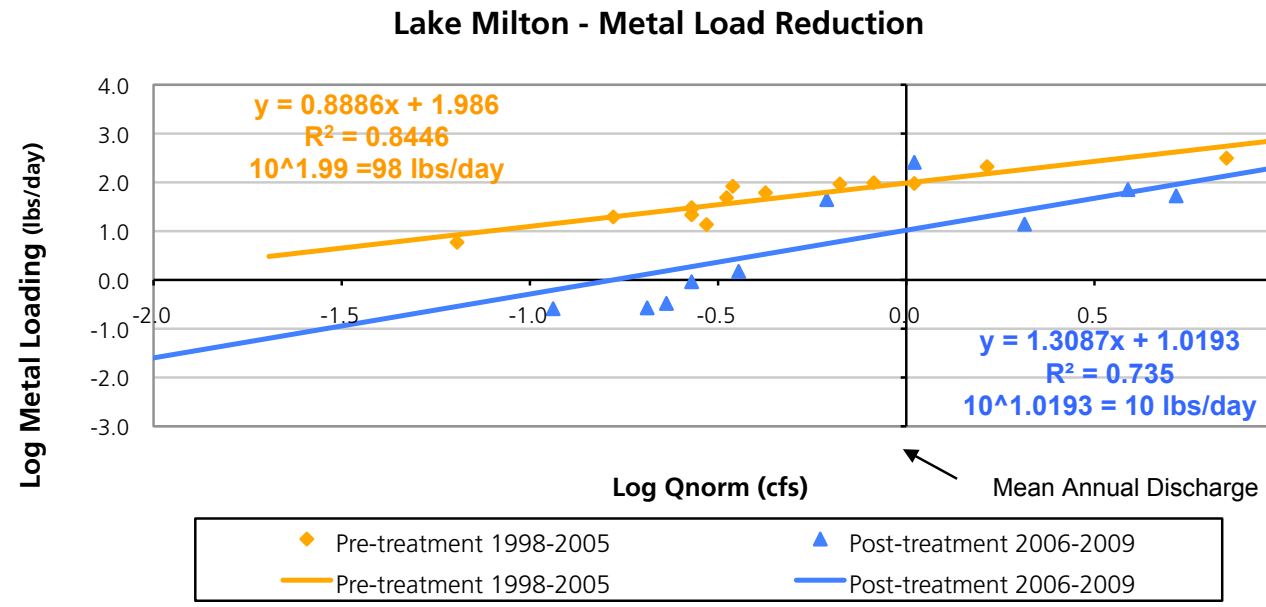


Figure 4. Dissolved Metal Load Reduction



Similar to other environmental best management practices (BMPs), performance of acid mine drainage reclamation projects are also expected to decline with time. Currently, operation and maintenance plans are being designed for each existing system and for future projects. Figure 5 and 6 show the mean annual acid and metal load reduction (Stoertz, 2004) for each year (or group of years) during post-construction from the project effluent. These graphs show the rate of decline (and/or improvement) with time in the performance of the treatment system. Knowing this rate of decline will aid in the implementation of operation and maintenance plans for each site. Yearly load reductions are plotted and shown in Figure 5 and 6.

Figure 5. Yearly Acid Load Reduction

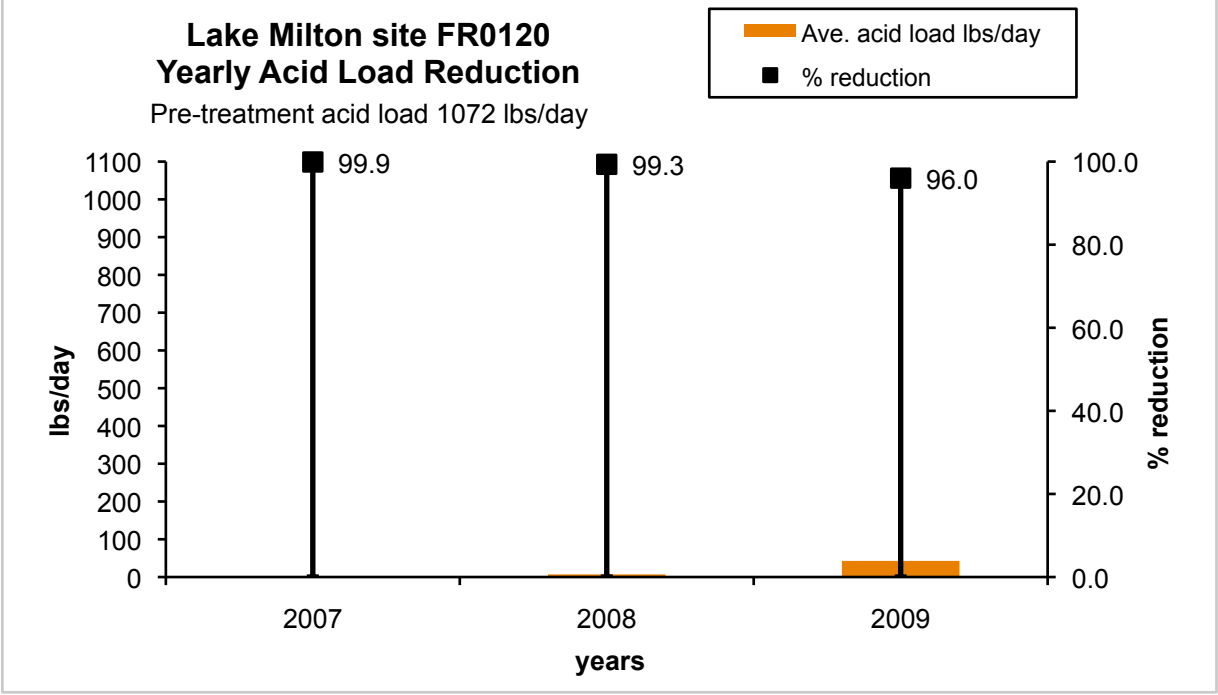
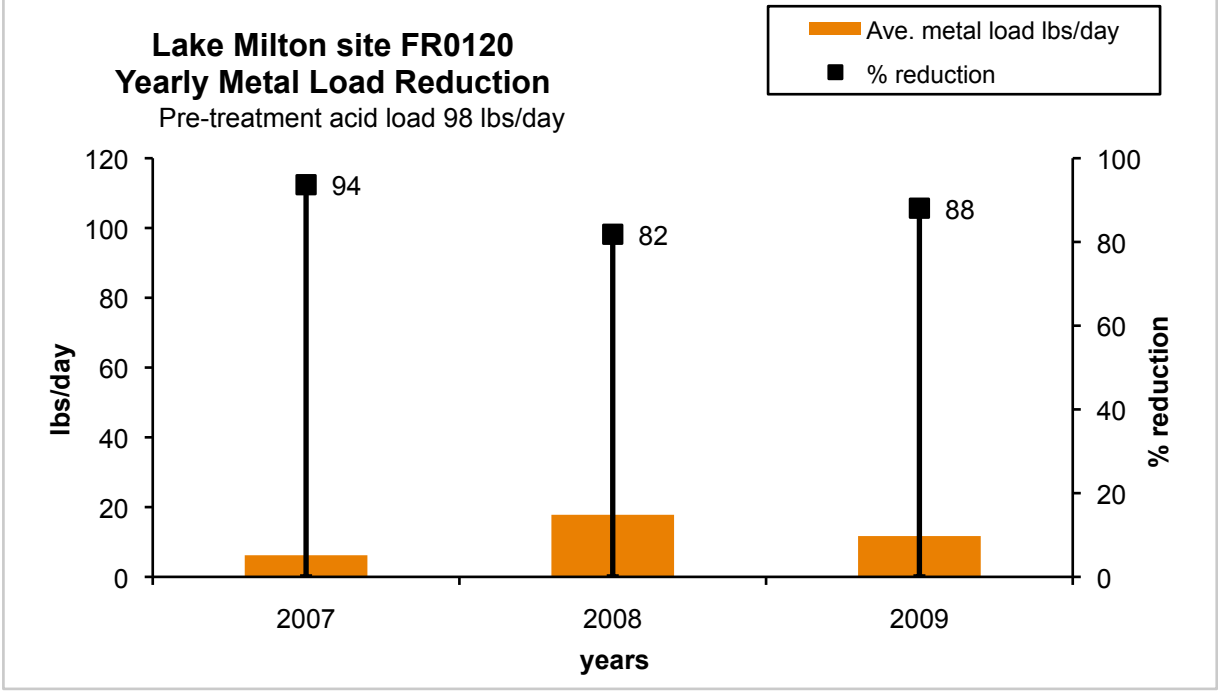


Figure 6. Yearly Metal Load Reduction



2009 NPS Report - Raccoon Creek Watershed - Buckeye Furnance

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 6/20/1999 ODNR Project Number: Jk-MI-18

Pre-construction

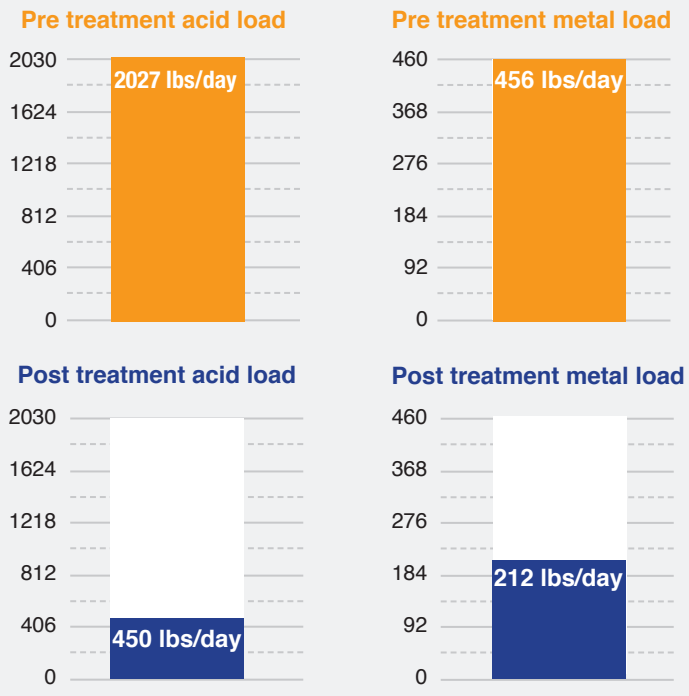
Mine waste in valley, Photo by Raccoon Creek Partnership

Post-construction

Successive Alkaline Producing System (SAPS), Photo by Ben McCament

Buckeye Furnace and Buffer Run Project is located in Section 25 of Milton Township in Jackson County and lies within the 14-digit HUC unit #05090101050030. The site is 65 acres and is located in the Little Raccoon Creek subwatershed. Deep mining of the area resulted in continuous AMD discharge from underground mines to Buffer Run, a tributary to Little Raccoon Creek. This area was also strip mined and used for a wash plant facility for a deep mine operation, resulting is several unreclaimed coal refuse areas and slurry ponds draining to Buffer Run. The design was completed by BBC&M Engineering Inc. for $125,000. The treatment approach for this site was to eliminate strip pits, reclaim the gob pile, and install a Successive Alkaline Producing System (SAPS) a passive treatment system. The major considerations for this project was mostly source control and but also constructing a passive treatment system. The goal of the design was to reduce 75 percent of the acidity discharging into Little Raccoon Creek. The acidity load has been reduced by 78 percent. Construction was complete June 20, 1998, by Earth Tech Inc. for a cost of $1,090,530. The funding source for the project design was ODNR-DMRM, and for construction the sources were ODNR-DMRM, OEPA and OSM. Figures 3 and 4 (shown on page 3) estimate approximately 1577 lbs/day of acid and 244 lbs/day of metals were reduced from entering into Little Raccoon Creek as a result of this AMD reclamation project.

SITE: BR0010



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

2009 NPS Report - Raccoon Creek Watershed - Buckeye Furnance

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Water Quality Report

Water quality data was collected at the project discharge as well as multiple stations pre- and post-construction. The graphs below show changes in pH (Figure 1) and acidity (Figure 2) along the mainstem of the receiving stream upstream and downstream of the project discharge as a result of the AMD reclamation project. As a result of the Buckeye Furnace and Buffer Run project, the pH and net acidity has improved downstream of the reclamation site for 18 miles. Pre-construction data shows pH in the range of 3.2 – 6.4 downstream of the project. However, after installation of the Buckeye Furnace and Buffer Run reclamation project, post-construction data shows pH in the range of 3.9 – 7.0 downstream of the project discharge. The net acidity concentrations decreased by 46 percent, showing net alkaline conditions continuing for 18 miles downstream to the mouth of Little Raccoon Creek station LRC0010. This percent acidity decrease is up two percent from last years report (44%), and 4% from 2007 NPS report.

Figure 1. Pre and Post pH

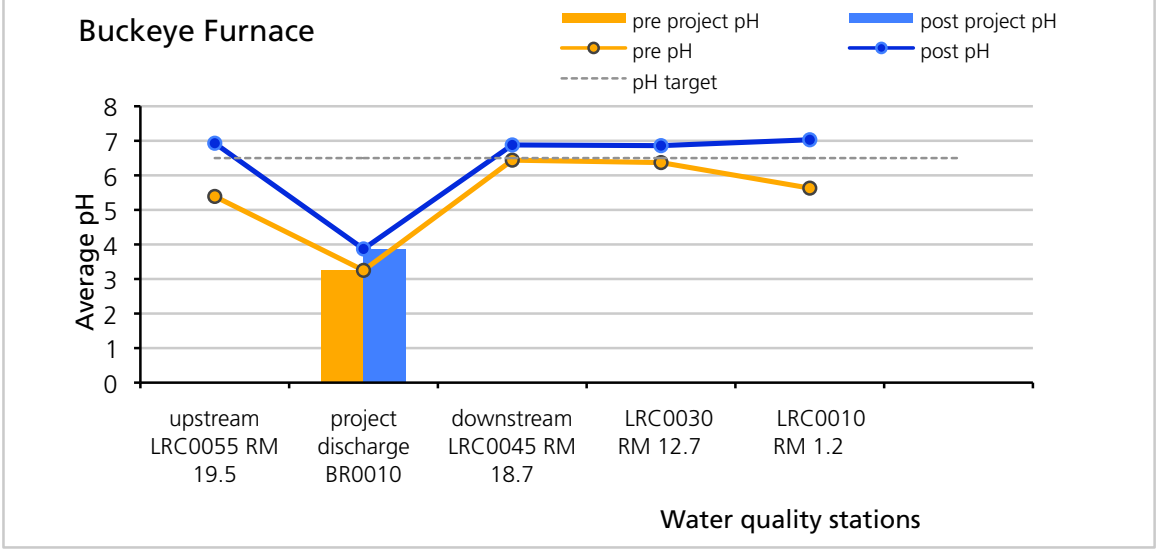
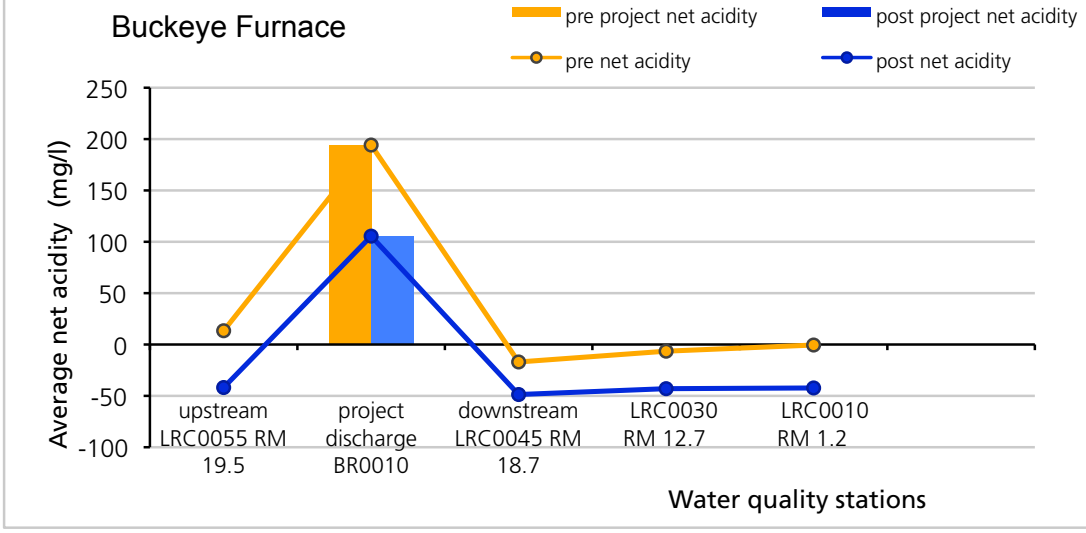


Figure 2. Pre and Post Acidity



Water Quality – load reductions

Using the Mean Annual Load Method (Stoertz, 2004), acid and metal load reduction occurring at this project were plotted and shown in Figure 3 and 4. Acidity, iron, aluminum and discharge were measured pre- and post-construction at the project discharge from 1/1/1996 to 3/25/1998 for pre-construction and from 6/23/1999 to 12/31/2009 for post-construction.

Figure 3. Acid Load Reduction

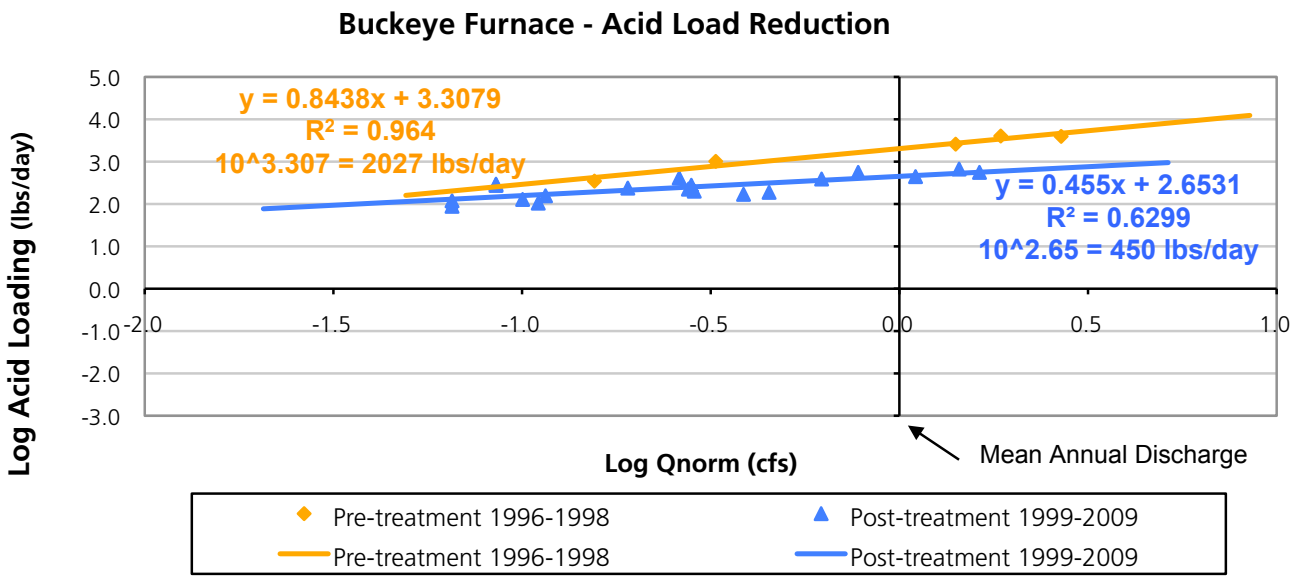
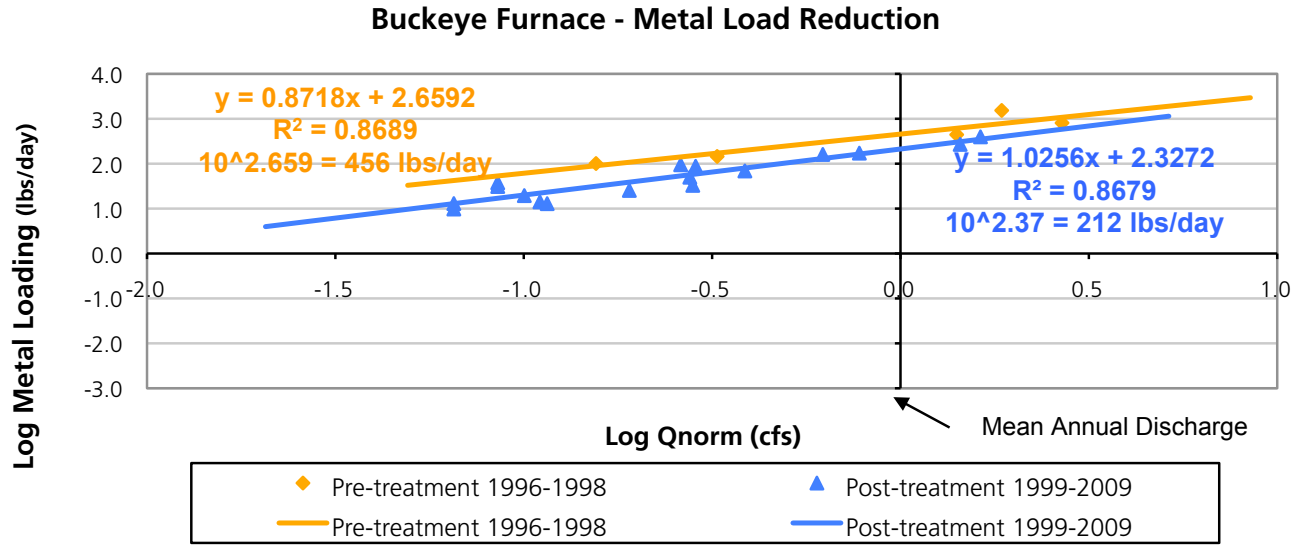


Figure 4. Dissolved Metal Load Reduction



Similar to other environmental best management practices (BMPs), performance of acid mine drainage reclamation projects are also expected to decline with time. Currently, operation and maintenance plans are being designed for each existing system and for future projects. Figure 5 and 6 show the mean annual acid and metal load reduction (Stoertz, 2004) for each year (or group of years) during post-construction from the project effluent. These graphs show the rate of decline (and/or improvement) with time in the performance of the treatment system. Knowing this rate of decline will aid in the implementation of operation and maintenance plans for each site. Yearly load reductions are plotted and shown in Figure 5 and 6.

Figure 5. Yearly Acid Load Reduction

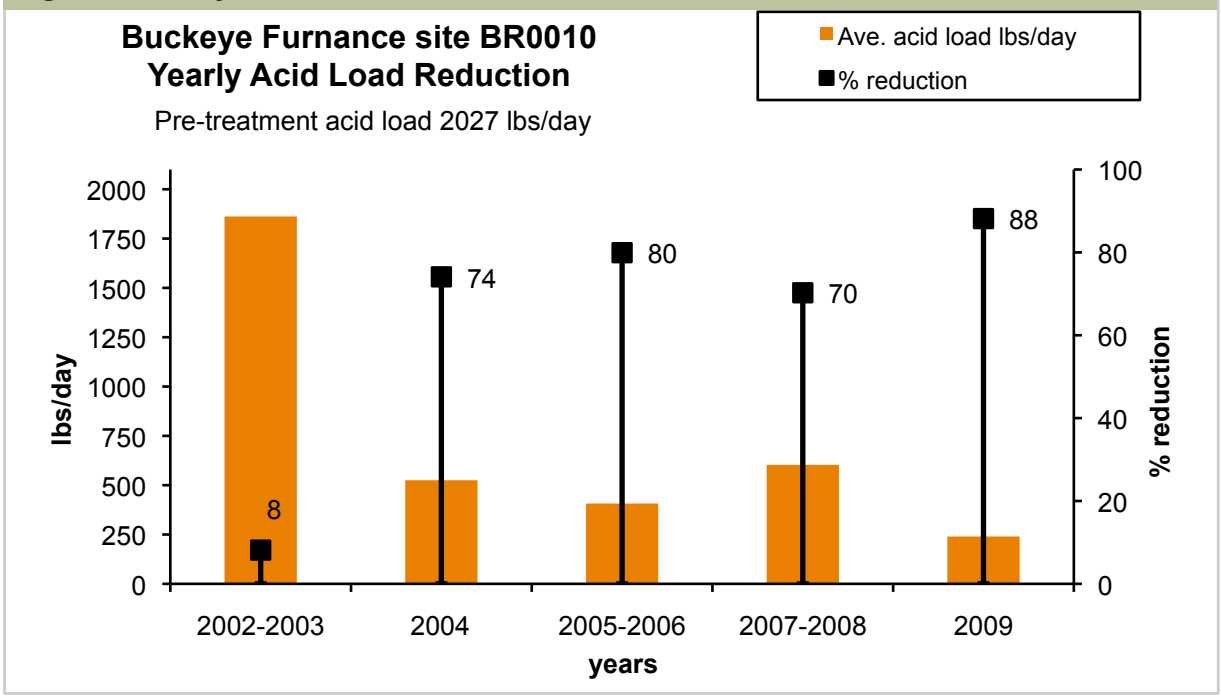
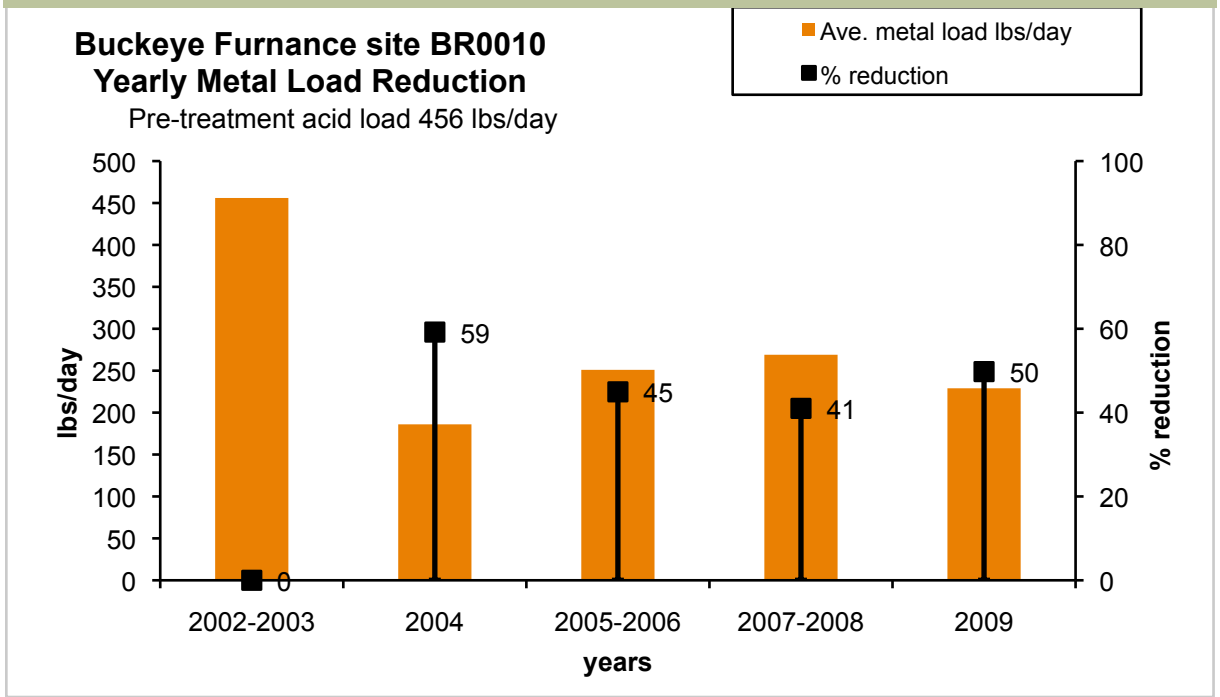


Figure 6. Yearly Metal Load Reduction



2009 NPS Report - Raccoon Creek Watershed - East Branch Phase I

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 12/31/2007 ODNR Project Number: HC-ST-13

Pre-construction

East Branch EB200 Nov. 2003, Photo by Brett Laverty

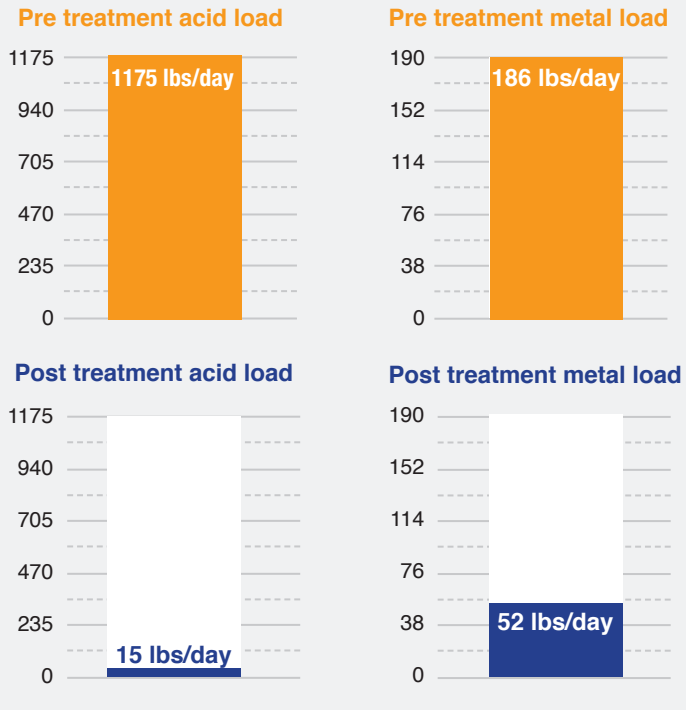
Post-construction

Site #3 steel slag leech bed full of water 2-7-08, Photo by Amy Mackey

East Branch Phase I Reclamation Project is located in Section 14 and 15 of Starr Township in Hocking County and lies within the 14 digit HUC unit #05090101020010. There are six separate sites spread out over three headwater drainages of the East Branch of Raccoon Creek, project footprint of the six sites is approximately 27 acres. East Branch is the largest contributor of acid mine drainage to the headwaters of Raccoon Creek. Large areas of strip mined land, some has been reclaimed under the 1972 Act, coupled with few deep mine discharges resulting in seeps, contribute to the AMD which affects East Branch and its tributaries. The AMD is diffuse throughout the area due to the extensiveness of surface mining and has required a basin wide approach that focuses on reducing acid and metal load to Raccoon Creek. The design was completed by ATC Associates Inc. for $65,438. The treatment approach for this site was to install six steel slag leach beds (16,251 sq. ft), 1,100 linear feet of open limestone channels, reclaim 4.8 acres of gob piles, and install two passive settling ponds with limestone berms (42,000 square feet). The goal of the design was to reduce acid at the mouth of the East Branch (EB010). Construction was complete December 31, 2008 by Tucson Inc. for a cost of $911,287. The funding source for this the project design was Ohio EPA 319 grant and for construction the sources were ODNR-DMRM and Ohio EPA 319. Figure 3 and 4 (shown on page 3 of this report) estimate approximately 1160 lbs/day of acid and 134 lbs/day of metals were reduced from entering into East Branch and Raccoon Creek as a result of this AMD reclamation project.

Note: EB210 site does not take into account 1 SLB site #8 (EB160)

SITE: EB210



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

2009 NPS Report - Raccoon Creek Watershed - East Branch Phase I

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Water quality report

Water quality data was collected at the project discharge as well as multiple stations pre-construction and post-construction. The graphs below show changes in pH (Figure 1) and acidity (Figure 2) along the mainstem of the receiving stream upstream and downstream of the project discharge as a result of the AMD reclamation project of the project discharge as a result of the AMD reclamation project. East Branch Phase I Reclamation project pre-construction monitoring show pH and net acidity at East Branch river mile 6.33, downstream to the mouth of East Branch, and along the mainstem of Raccoon Creek, shown above. Pre-construction data shows pH in the range of 4.5–6.2 at river mile 6.33 of East Branch and downstream of the project on Raccoon Creek. Post-construction data at EB210 downstream to Raccoon Creek show pH in the range of 5.8-6.6.The net acidity concentrations decreased by 86 percent, showing net alkaline conditions downstream in Raccoon Creek mainstream (7.3 miles).

Figure 1. Pre and Post pH

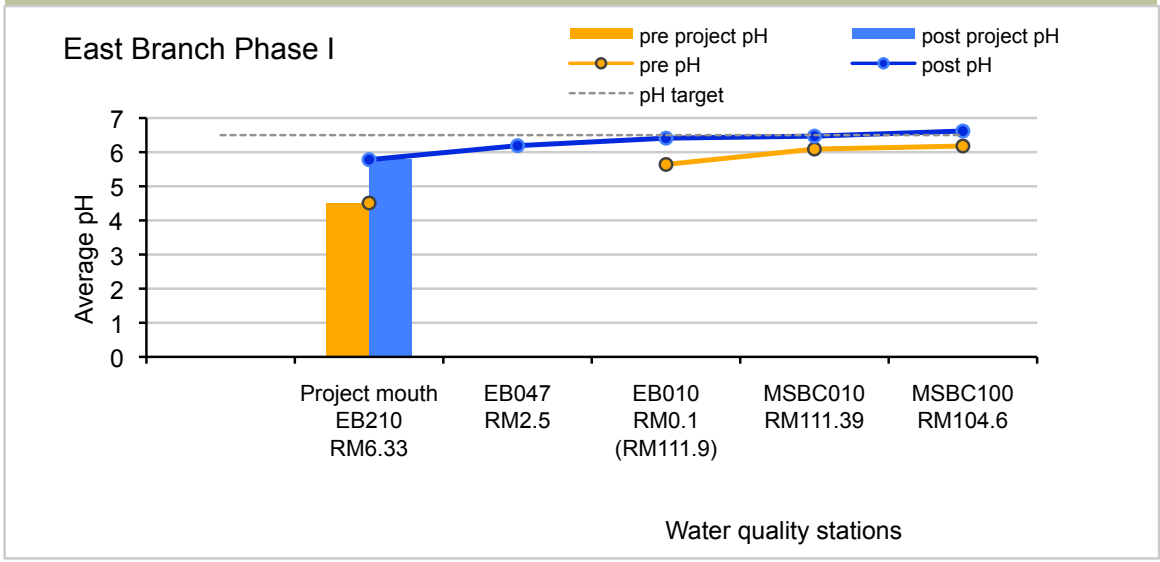
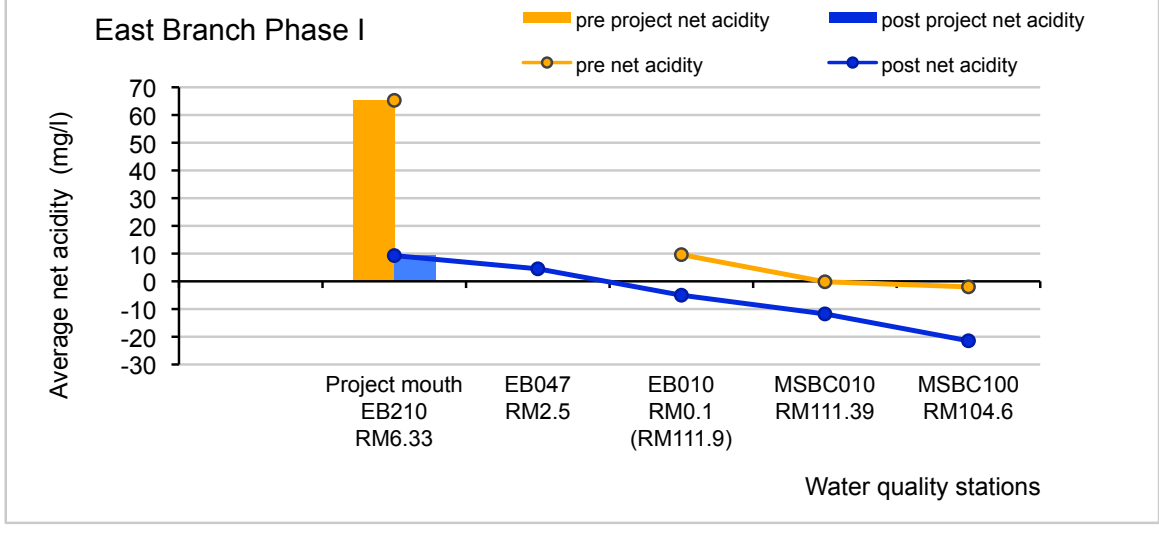


Figure 2. Pre and Post Acidity



Water Quality – load reductions

Using the Mean Annual Load Method (Stoertz, 2004) acid and metal load reduction occurring at this project were plotted and shown in Figure 3 and 4. Acidity, iron, aluminum and discharge were measured pre- and post-construction at the project discharge from 6/1/1996 to 11/1/2004 for pre-construction and from 2/18/2008 to 12/31/2009 for post-construction.

Figure 3. Acid Load Reduction

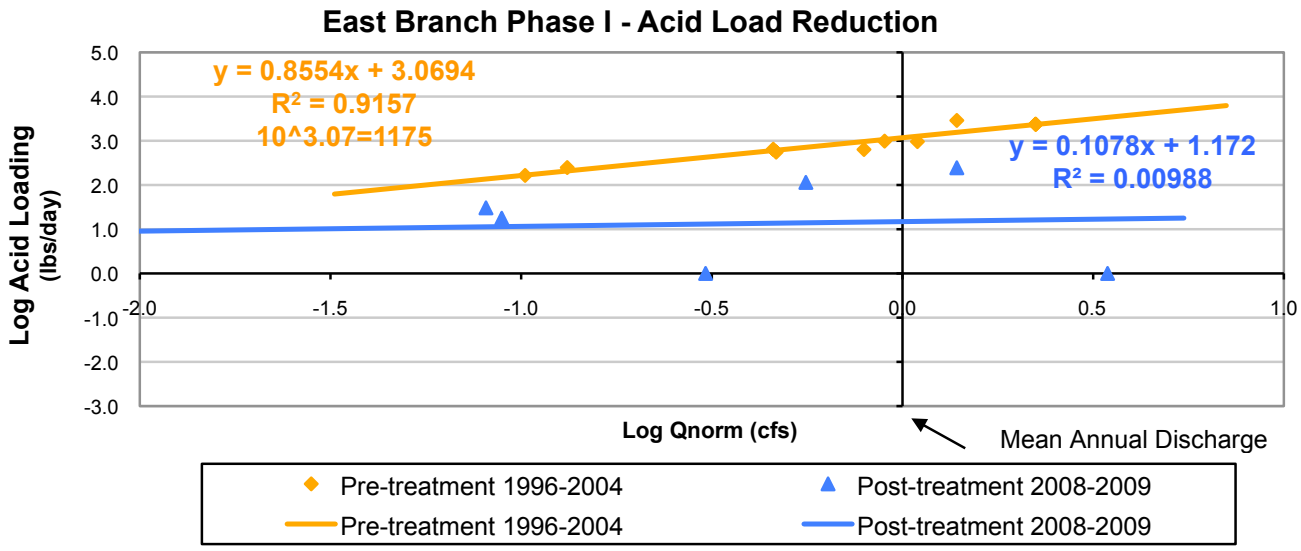
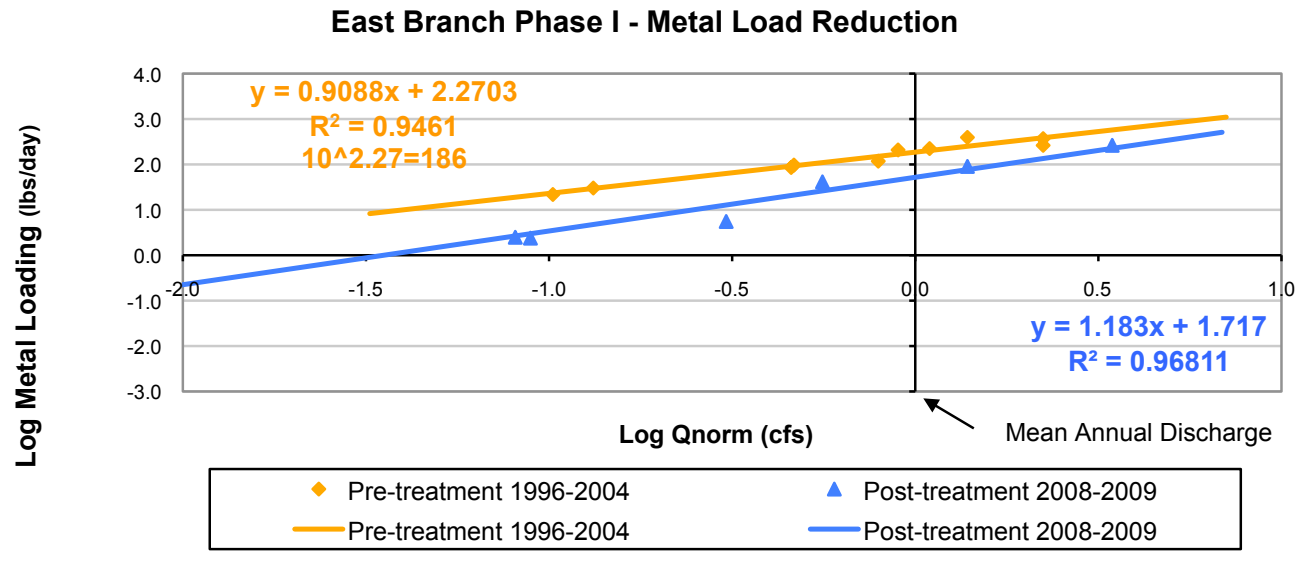


Figure 4. Dissolved Metal Load Reduction



Similar to other environmental best management practices (BMPs), performance of acid mine drainage reclamation projects are also expected to decline with time. Currently, operation and maintenance plans are being designed for each existing system and for future projects. Figure 5 and 6 show the mean annual acid and metal load reduction (Stoertz, 2004) for each year (or group of years) during post-construction from the project effluent. These graphs show the rate of decline (and/or improvement) with time in the performance of the treatment system. Knowing this rate of decline will aid in the implementation of operation and maintenance plans for each site. Yearly load reductions are plotted and shown in Figure 5 and 6.

Figure 5. Yearly Acid Load Reduction

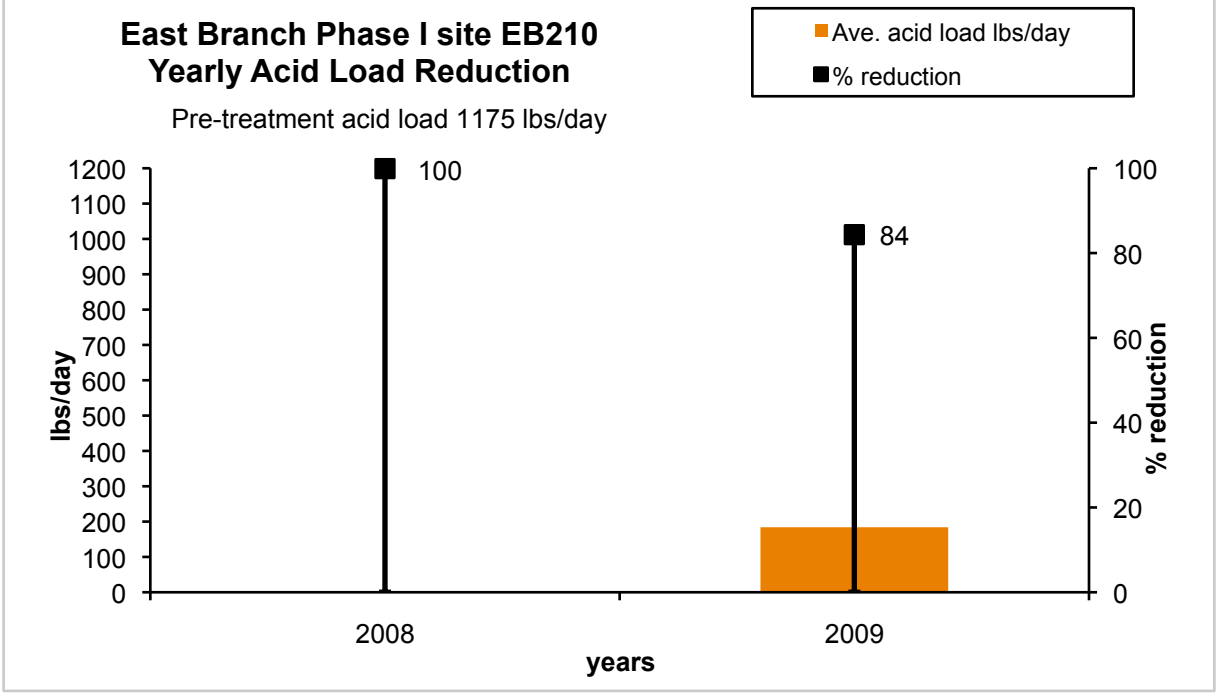
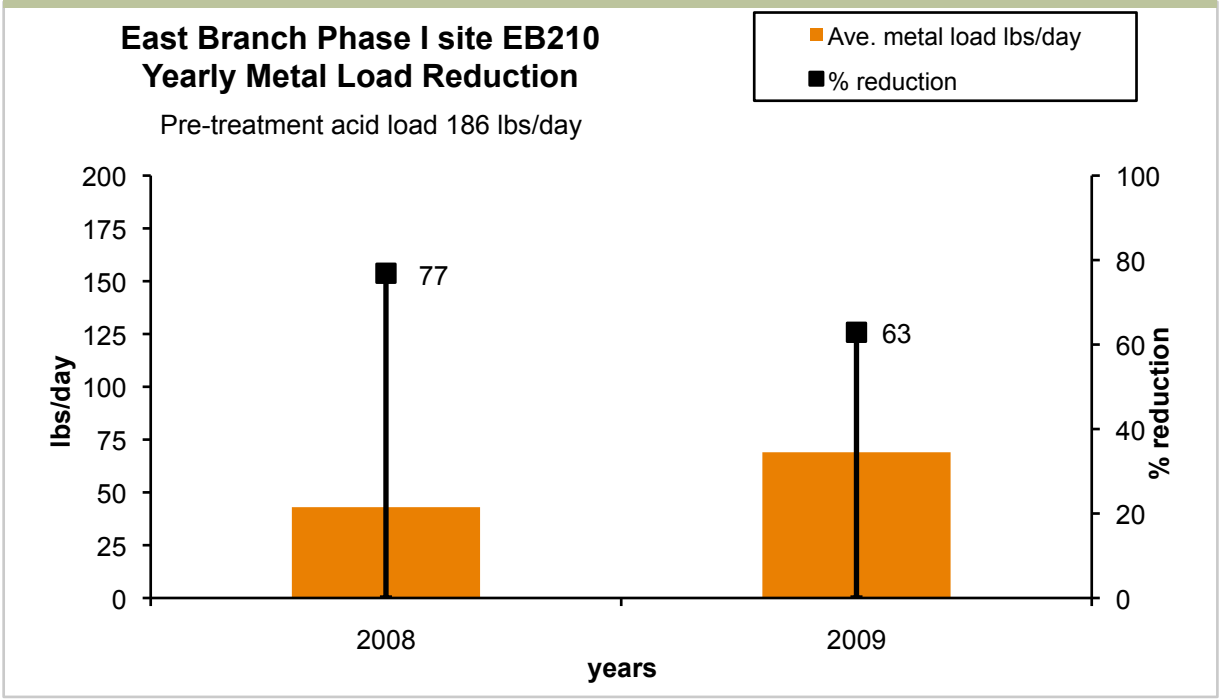
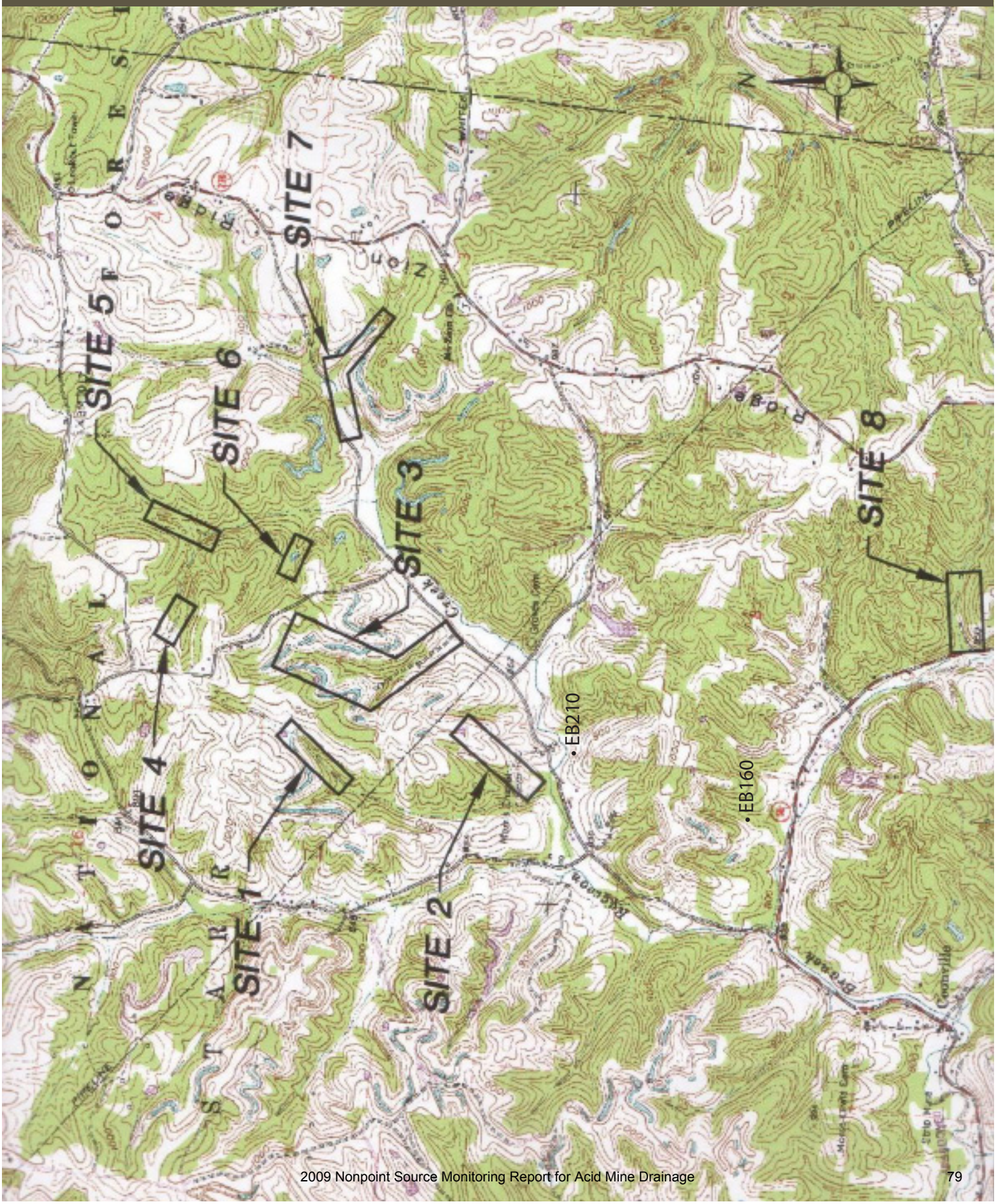


Figure 6. Yearly Metal Load Reduction



2009 NPS Report - Raccoon Creek Watershed - East Branch Phase I

Generated by Non-Point Source Monitoring System
www.watersheddata.com



2009 NPS Report - Raccoon Creek Watershed - Pierce Run

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Expected completion fall 2010 ODNR Project Number: VN-Vn-06

Pre-construction

Oreton Seep, the major acid mine drainage discharge Photo by Ben McCament

Pierce Run Reclamation Project is located in Section 19 of Vinton Township in Vinton County and lies within the 14 digit HUC unit #05090101040020. The Oreton Seep is located in the former town of Oreton along SR 160 in Vinton County and is the most consistent and largest acid loader within the Pierce Run watershed. The source of the seep is a 116 acre underground coal mine (Clarion 4a seam) which was abandoned by the Oreton Mining Company in October of 1924. The seep appears to originate from a collapsed abandoned entry in an upper valley of a small unnamed tributary. The design was completed by ATC Associates Inc. and ODNR-DMRM. The treatment approach for this site is to install one large steel slag leach bed. The goal of the design is to reduce acid at the mouth of the Pierce Run (PR0010) before entering into Raccoon Creek. The project goal will be evaluated in 2010 annual report. Construction is expected to be complete Fall 2010 by Seals Construction for a cost of $588,943. Funding source for the project design was Ohio EPA 319 grant and for construction the sources were ODNR-DMRM, Ohio EPA 319, and OSM. After one year of evaluation the acid and metal load reduction will be reported in the 2010 annual report.

2009 NPS Report - Raccoon Creek Watershed - Pierce Run

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Water Quality Report

Water quality data was collected at the project discharge as well as multiple stations pre-construction. The graphs below show changes in pH (Figure 1) and acidity (Figure 2) along the mainstem of the receiving stream upstream and downstream of the project discharge as a result of the AMD reclamation project. Post construction monitoring will begin winter 2011, results will be reported in 2010 annual report.

Data analysis

Pierce Run Reclamation project pre-construction monitoring show pH and net acidity at the mouth of Pierce Run and along the mainstem of Raccoon Creek, shown above. Pre-construction data shows pH in the range of 5.5 – 6.9 at the mouth of Pierce Run and downstream along the mainstem of Raccoon Creek. Post-construction data will be reported in 2010 annual report.

Figure 1. Pre and Post pH

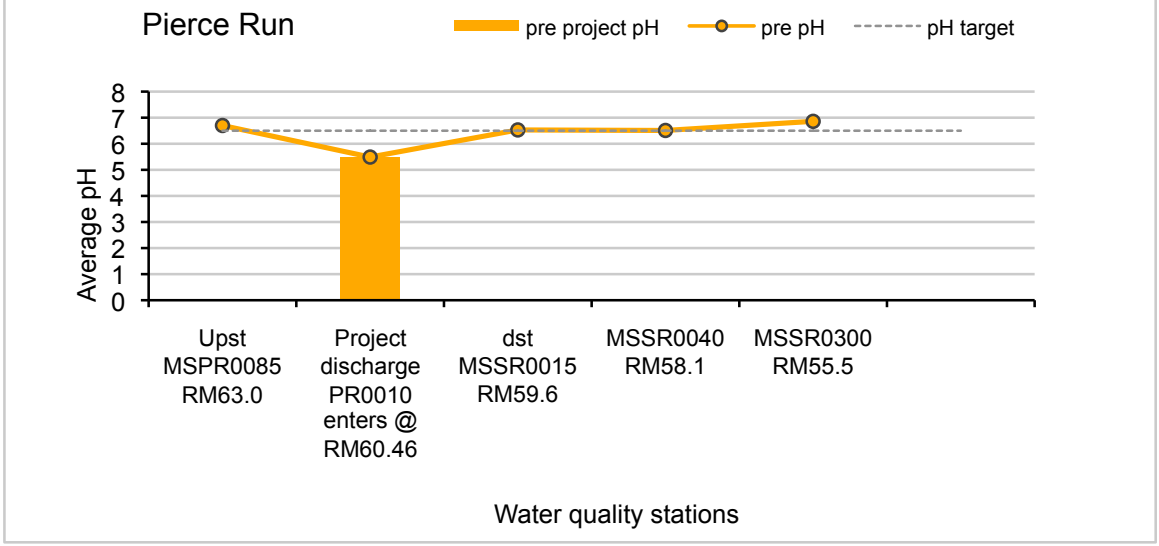
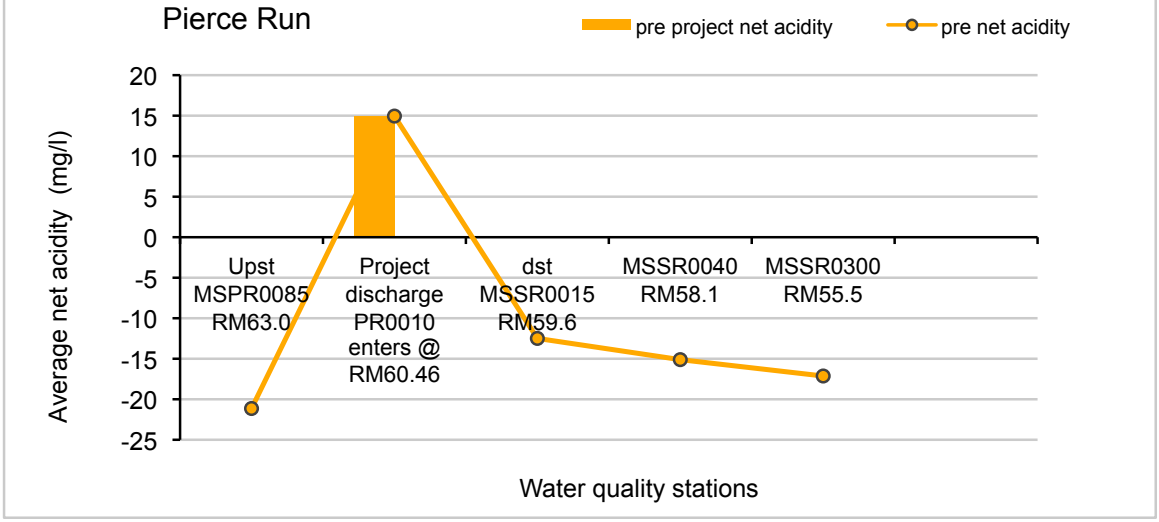


Figure 2. Pre and Post Acidity



2009 NPS Report - Raccoon Creek Watershed - East Branch Phase II

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Expected completion fall 2010 ODNR Project Number: HC-St-14

Pre-construction

Kern Hollow SLB site, Photo by Amy Mackey

East Branch Phase II is located in Section 14 of Starr Township in Hocking County and lies within the 14 digit HUC unit #05090101020010 just southeast of Union Furnace. The East Branch Phase II project discharge, site EB190, is located just upstream of Laurel Run Road bridge. East Branch Phase II project consists of constructing three steel slag beds in the project area: Kern Hollow, Northwood, and Forrest, all of which are on Wayne National Forest property. The design was completed by ODNR-DMRM in-house. The treatment approach for this site is to install three steel slag leach beds to add alkalinity to East Branch. The goal of the design is to reduce approximately 900 lbs/day of acid load at the site EB190. The project goal will be evaluated in 2010 annual report after construction is complete. Construction is expected to be complete Fall 2010 by Stimmel Construction for a cost of $712,883.30. Funding source for the project design and construction is ODNR-DMRM and OSM. After construction the acid and metal load reduction will be reported in the 2010 annual report.

2009 NPS Report - Raccoon Creek Watershed - East Branch Phase II

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Water Quality Report

Water quality data was collected at the project discharge as well as multiple stations pre-construction. The graphs below show changes in pH (Figure 1) and acidity (Figure 2) along the mainstem of the receiving stream upstream and downstream of the project discharge as a result of the AMD reclamation project. Post construction monitoring will begin winter 2011, results will be reported in 2010 annual report.

Data analysis

East Branch Phase II pre-construction monitoring show pH and net acidity at the site EB190, Figure 1. Pre-construction data shows pH in the range of 4.79 – 6.5 at site EB190 and downstream along the mainstem of Headwaters to Raccoon Creek. Post-construction data will be reported in 2010 annual report.

Figure 1. Pre and Post pH

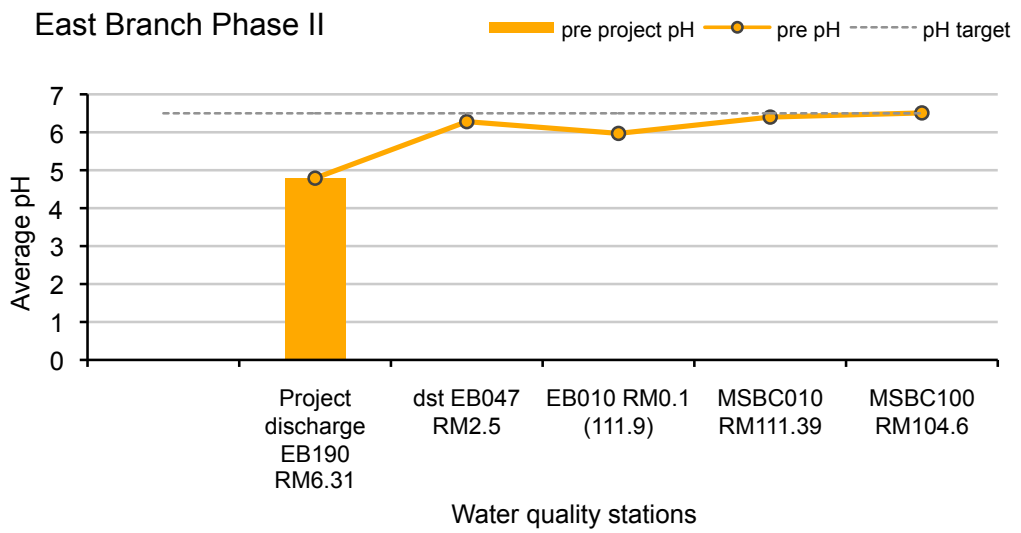
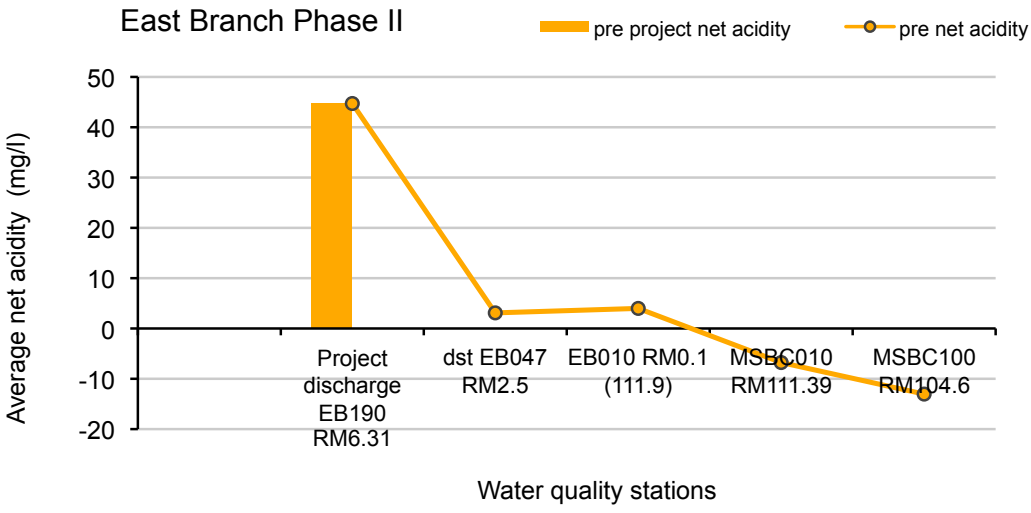


Figure 2. Pre and Post Acidity



Section III – AMD project reports

Monday Creek Watershed comprehensive acid mine drainage projects progress report for 2009.

Section III contains individual AMD project reports displaying photos of the project site, a description of the project, water quality data at the site and its impact to the receiving stream, and acid/metal loading reductions as a result of the project.

List of acid mine drainage reclamation projects reported on in the 2009 NPS monitoring report:

1. Grimmett Hollow
2. Jobs Hollow Doser
3. Rock Run Gob Pile
4. Big Four Hollow
5. Snake Hollow
6. Lost Run Phase I
7. Lost Run Phase II
8. Shawnee Steel Slag

Archived

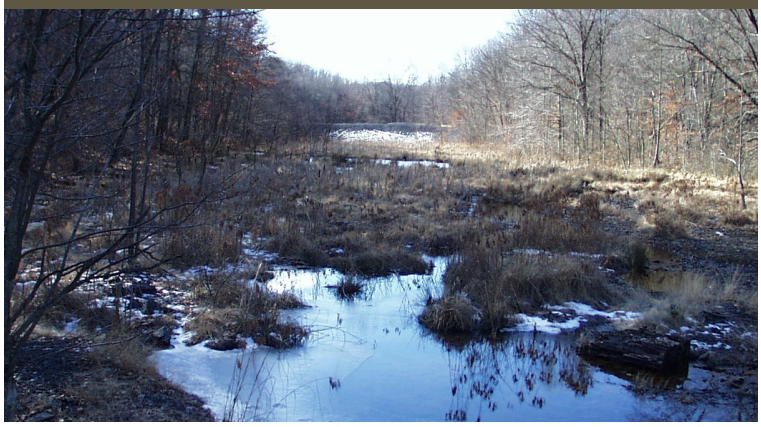
9. Lost Run Subsidence Closures archived in 2009
10. Essex Doser archived in 2008
11. Rock Run 24 archived in 2007

2009 NPS Report - Monday Creek Watershed - Grimmett Hollow

Generated by Non-Point Source Monitoring System
www.watersheddata.com

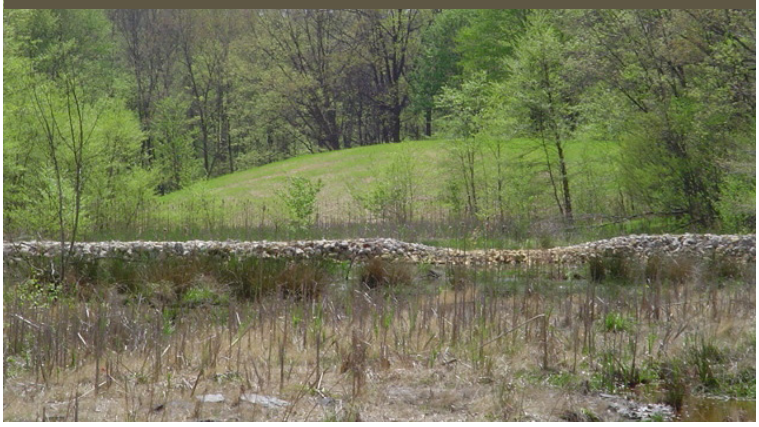
Project Status: Complete: 12/31/2003 ODNR Project Number: PR-SI-14

Pre-construction



Grimmett Hollow, Photo by Monday Creek Restoration Project

Post-construction



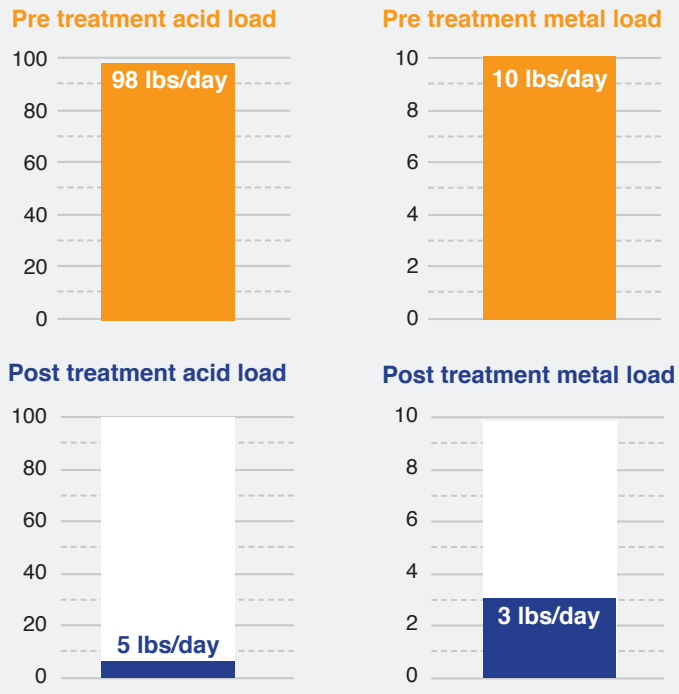
Grimmett Hollow, Photo by Monday Creek Restoration Project

Grimmett Hollow is located in Section 4 of Salt Lick Township in Perry County and lies within the 14-digit HUC unit #05030204060010. The project site is five acres and located on Grimmett's Property in the headwaters of Jobs Hollow, the project discharge is measured at the bridge on CR223. This area was affected by abandoned strip mining, deep mining, and a remnant gob pile. The valley contained a wetland that received water from both strip pits and deep mines in the area. The gob pile was situated in the stream channel downstream of the wetland.

The design was completed by Red Wing Engineering for $19,000. The treatment approach for this site was to enhance an existing 1.3-acre wetland with two rock dams (300 linear feet), incorporated with alkaline material (LKD) as well as install (500 linear feet) open limestone channels (OLC) at seep locations and regrade, soil and vegetate a gob pile (0.15 acres).

A stream was routed away from the gob pile via the open limestone channel. The goal of the design was to decrease acidity by 13.6 tons per year. The project goal was met by 100 percent. Major considerations encountered during the design process were the diffuseness of the AMD sources from above drainage underground mines, numerous seep discharges in the basin, gob pile and spoil deposited in wetland, and a stream flowing through the gob pile. Construction was complete Dec. 31, 2003 by Perry Reclaiming Inc. for a cost of $160,000. The funding sources for this project were ODNR-MRM and EPA-319 for both design and construction. Figure 3 and 4 (shown on page 3) estimate approximately 93 lbs/day of acid and 7 lbs/day of metals were prevented from entering into Jobs Hollow and Monday Creek as a result of this AMD reclamation project.

Site: JH09020



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

Water Quality Report

Water quality data was collected at the project discharge as well as multiple stations pre- and post-construction. The graphs below show changes in pH (Figure 1) and acidity (Figure 2) along the mainstem of the receiving stream upstream and downstream of the project discharge as a result of the AMD reclamation project.

As a result of the Grimmett Hollow Project, pH and net acidity have improved downstream of the reclamation site for 0.75 miles at which the Jobs Doser discharges into the stream. Pre-construction data showed pH in the range of 3.1 – 3.5 at the project discharge and downstream. However, after installation of the Grimmett Hollow Project, post-construction data shows average pH in the range of 6.3 – 7.9 at the discharge and downstream. The net acidity concentrations decreased 100 percent at the project discharge showing net alkaline conditions for 0.75 miles downstream to station JH00500.

Figure 1. Pre and Post pH

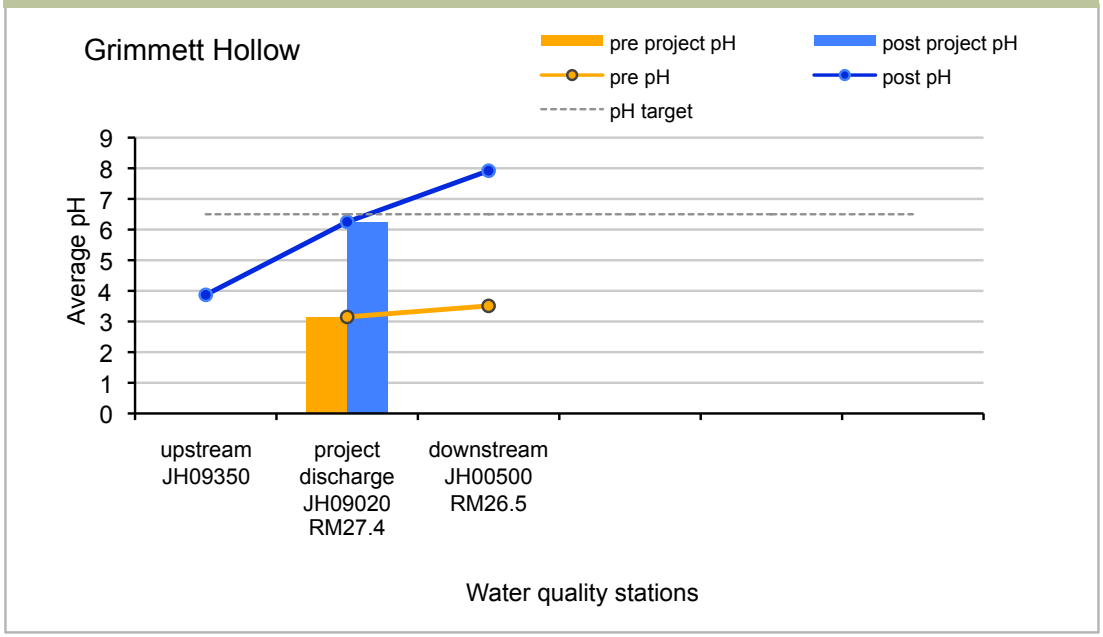
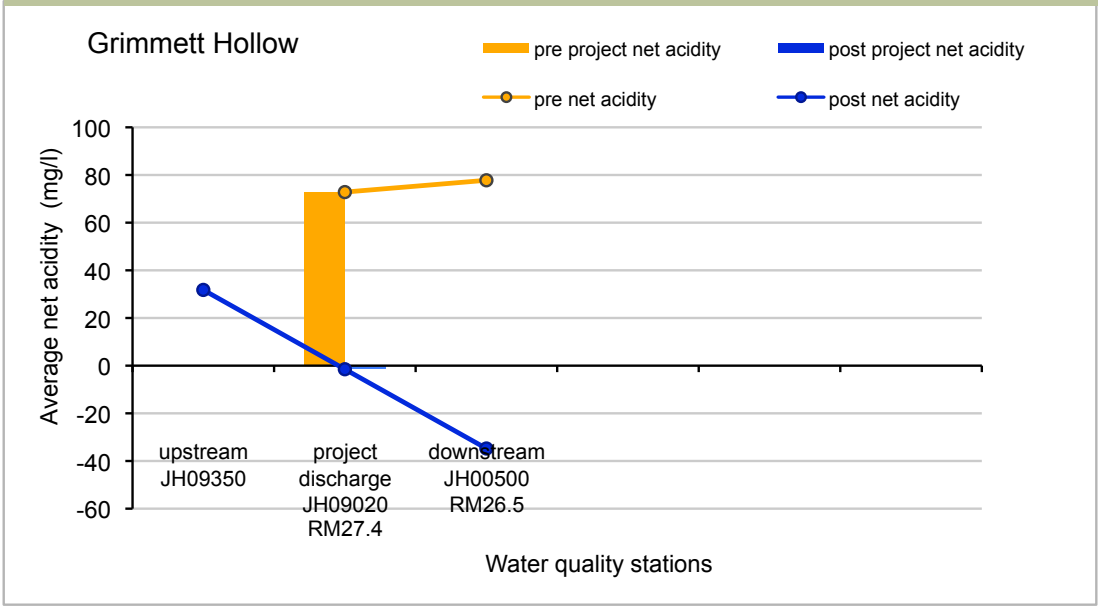


Figure 2. Pre and Post Acidity



Water Quality – load reductions

Using the Mean Annual Load Method (Stoertz, 2004), acid and metal load reduction occurring at this project were plotted and shown in Figure 3 and 4. Acidity, iron, aluminum and discharge were measured pre- and post-construction at the project discharge from 10/1/1997 to 7/31/2003 for pre-construction and from 1/1/2004 to 12/31/2009 for post-construction.

Stoertz, Mary W. and Douglas H. Green, 2004. Mean Annual Acidity Load: A Performance Measure to Evaluate Acid Mine Drainage Remediation. Ohio Department of Natural Resources Conservation and Restoration Innovations 2004 Applied Research Conference at Ohio University.

Figure 3. Acid Load Reduction

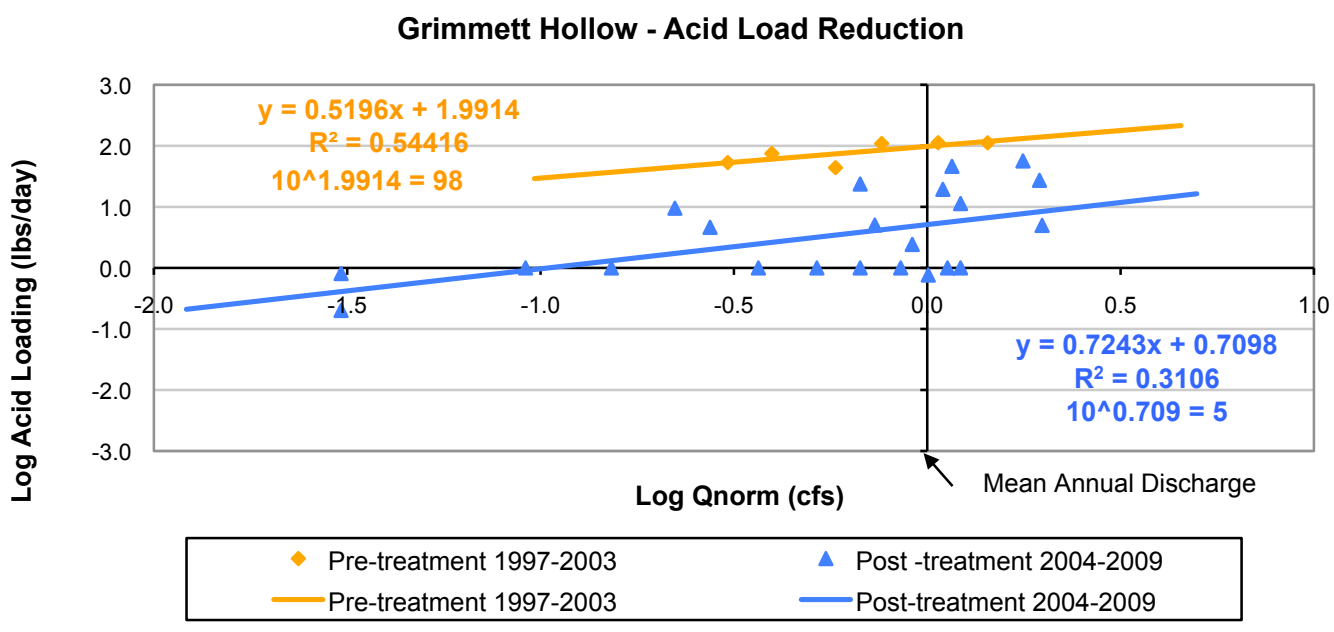
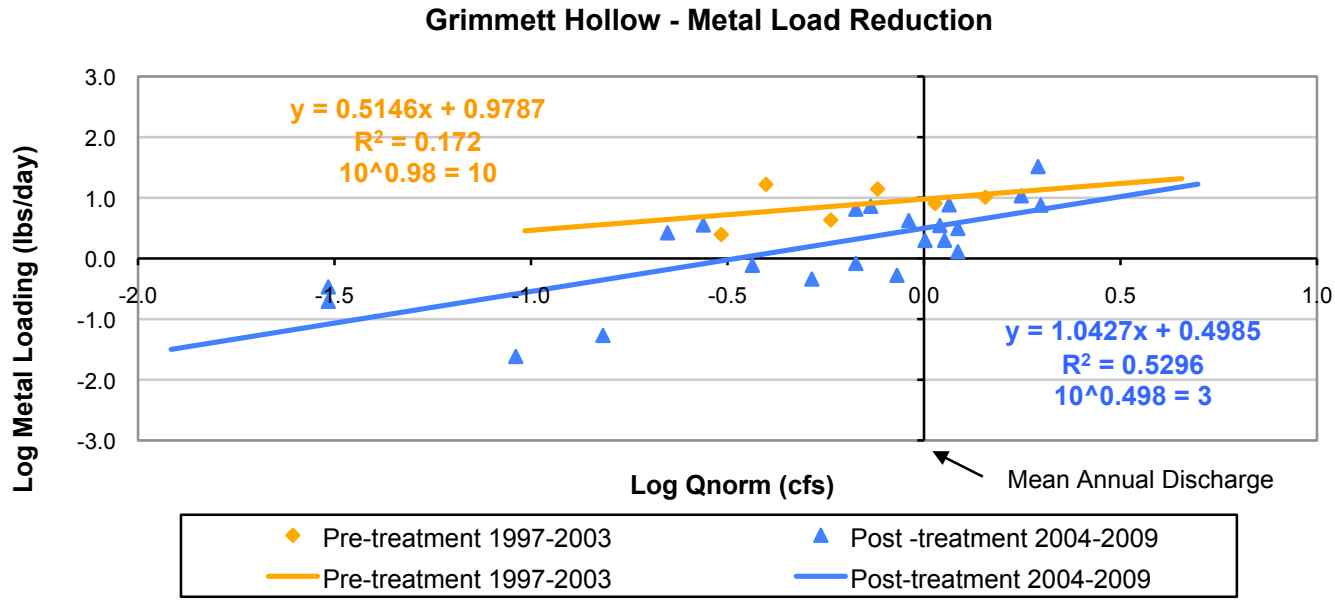


Figure 4. Metal Load Reduction



Similar to other environmental best management practices (BMPs), performance of acid mine drainage reclamation projects are also expected to decline with time. Currently, operation and maintenance plans are being designed for each existing system and for future projects. Figure 5 and 6 show the mean annual acid and metal load reduction (Stoertz, 2004) for each year (or group of years) during post-construction from the project effluent. These graphs show the rate of decline (and/or improvement) with time in the performance of the treatment system. Knowing this rate of decline will aid in the implementation of operation and maintenance plans for each site. Yearly load reductions are plotted and shown in Figure 5 and 6.

Figure 5. Yearly Acid Load Reduction

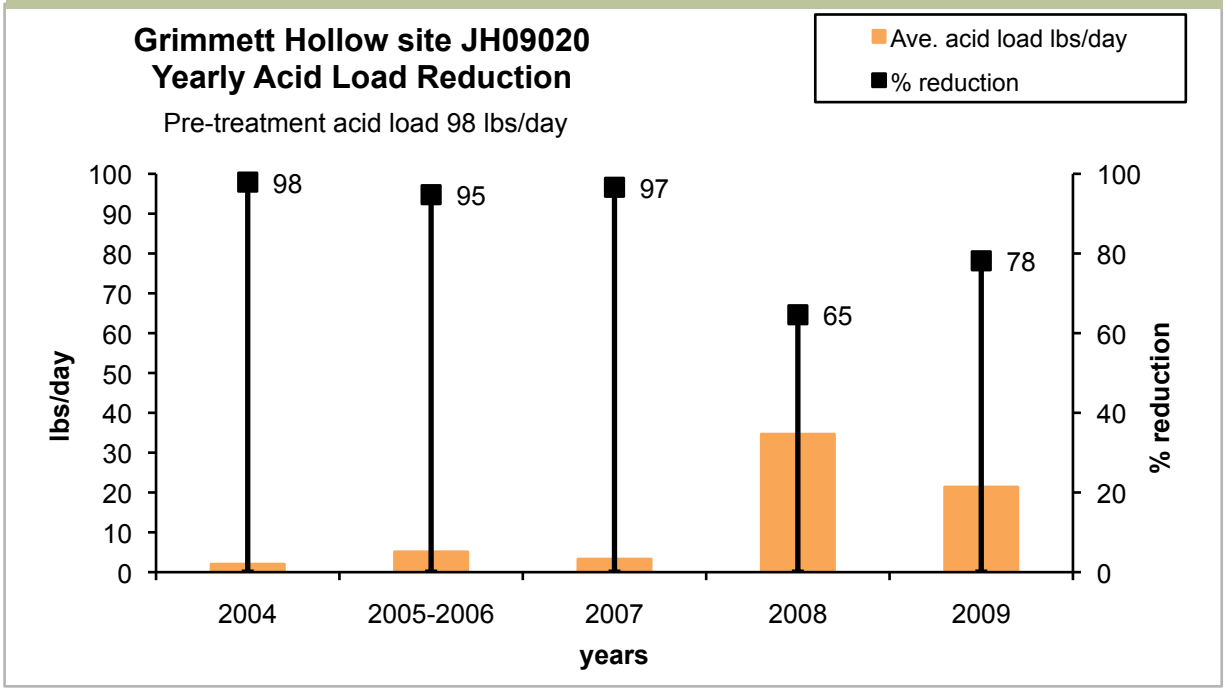
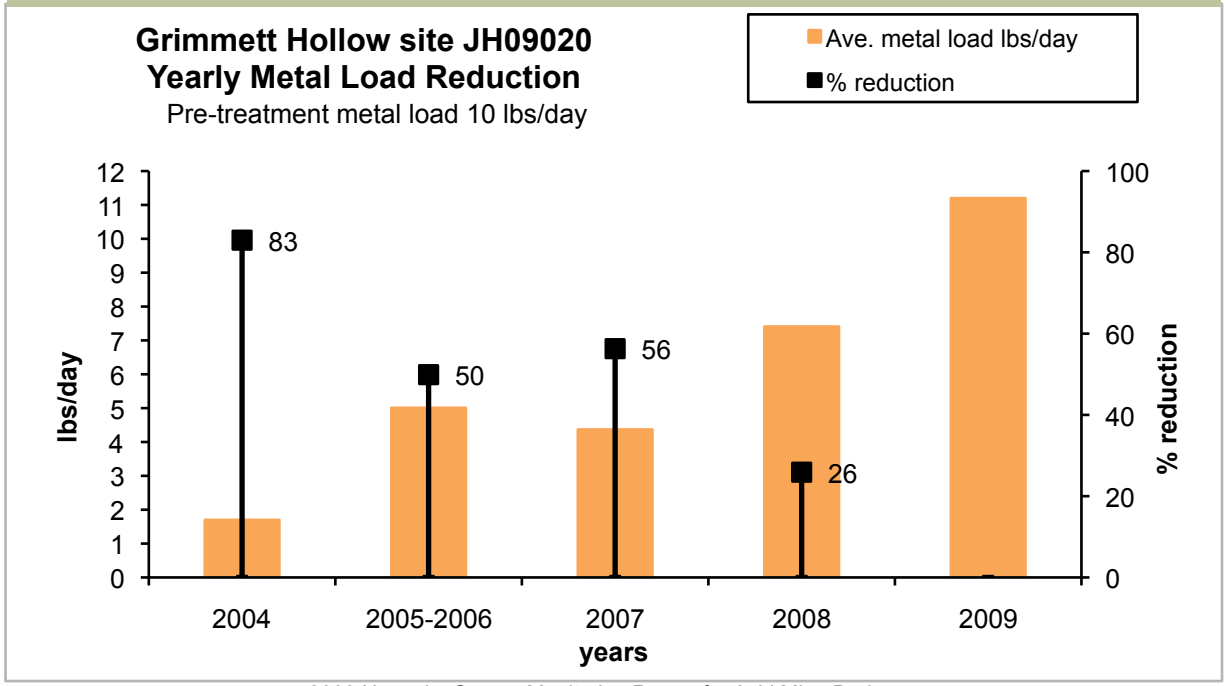


Figure 6. Yearly Metal Load Reduction



2009 NPS Report - Monday Creek Watershed - Jobs Hollow Doser

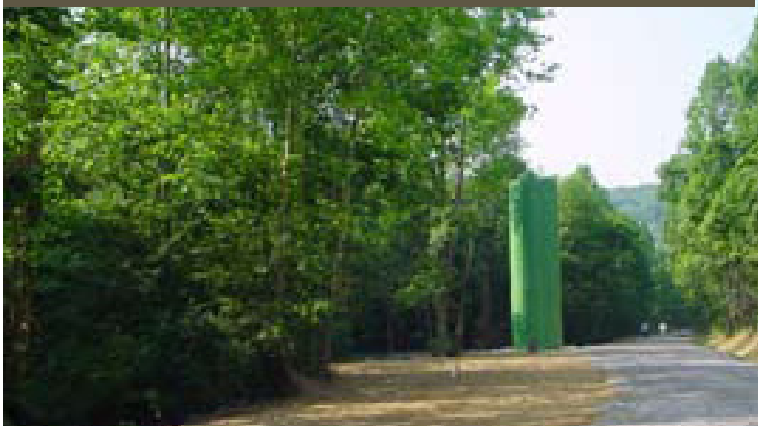
Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 7/20/04 ODNR Project Number: PR-SI-13

Pre-construction

Jobs Hollow, Photo by Monday Creek Restoration Project

Post-construction

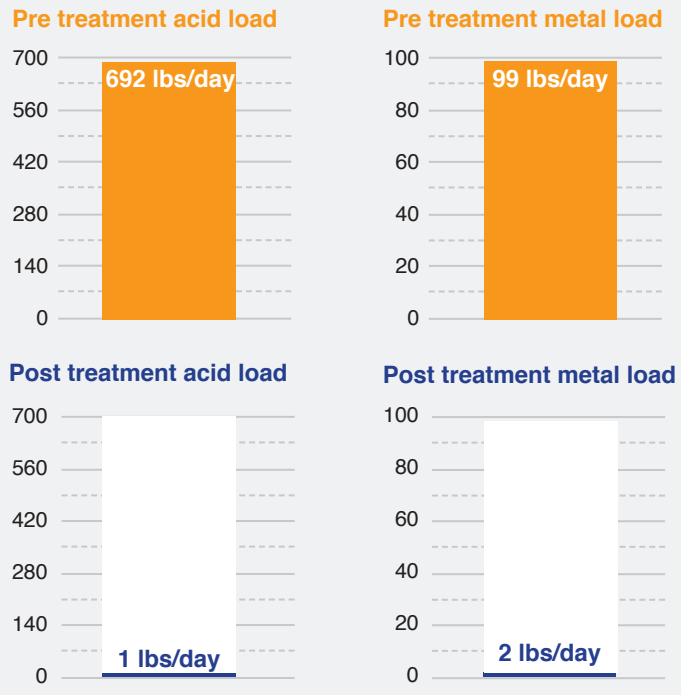


Jobs Hollow Doser, Photo by Monday Creek Restoration Project

Jobs Hollow Doser is located in Section 5 of Salt Lick Township in Perry County and lies within the 14-digit HUC unit #05030204060010. The site is located in the headwaters of Monday Creek Watershed downstream of Jobs Hollow at the bridge on Portie Flamingo Road (CR 12). This basin contains approximately 13 small tributaries, most of which are affected by acid mine drainage. The major contributors of acidity are from diffuse deep mine seeps and numerous gob piles. Due to the diffuse and abundant AMD sources and their inaccessibility, a doser was the most practical and efficient method for treatment.

The design was completed by ATC Associates for $66,916.50. The treatment approach for this site was to install a lime doser. The goal of the design was to decrease acid load from the headwaters of Monday Creek by 54 percent. The project goal was met 100 percent. One major consideration encountered during the design process was that the dosing unit is located adjacent to an intermittent tributary of Monday Creek. Therefore a retention pool was created to create a constant supply of water to the doser. Construction was complete July, 20, 2004 by Tuson Inc. for a cost of 319,066.50. Funding sources for this project were ODNR-MRM, OSM-ACSI and OEPA-319 for design and ODNR-DMRM and OSM-ACSI for construction. Figure 3 and 4, estimate approximately 691 lbs/day of acid was reduced from entering into Monday Creek as a result of this AMD reclamation project (shown on page 3). Dissolved metal load reduction occurring at this site was approximately 97lbs/day. The metals precipitate as a result of the high pH water and become part of the substrate.

Site: JH00500



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

2009 NPS Report - Monday Creek Watershed - Jobs Hollow Doser

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Water Quality Report

Water quality data was collected at the project discharge as well as multiple stations pre- and post- construction. The graphs below show changes in pH (Figure 1) and acidity (Figure 2) along the mainstem of the receiving stream upstream and downstream of the project discharge as a result of the AMD reclamation project.

As a result of the Jobs Hollow Doser project, the pH and net acidity have improved downstream of the reclamation site for 10 miles. Pre-construction data showed pH in the range of 3.5 – 5.9 downstream of the project. However, after installation of the Jobs Hollow Doser, post-construction data shows pH in the range of 6.5 – 8.4 downstream of the project discharge. The net acidity concentrations decreased100 percent showing net alkaline conditions continuing for 10 miles downstream.

Figure 1. Pre and Post pH

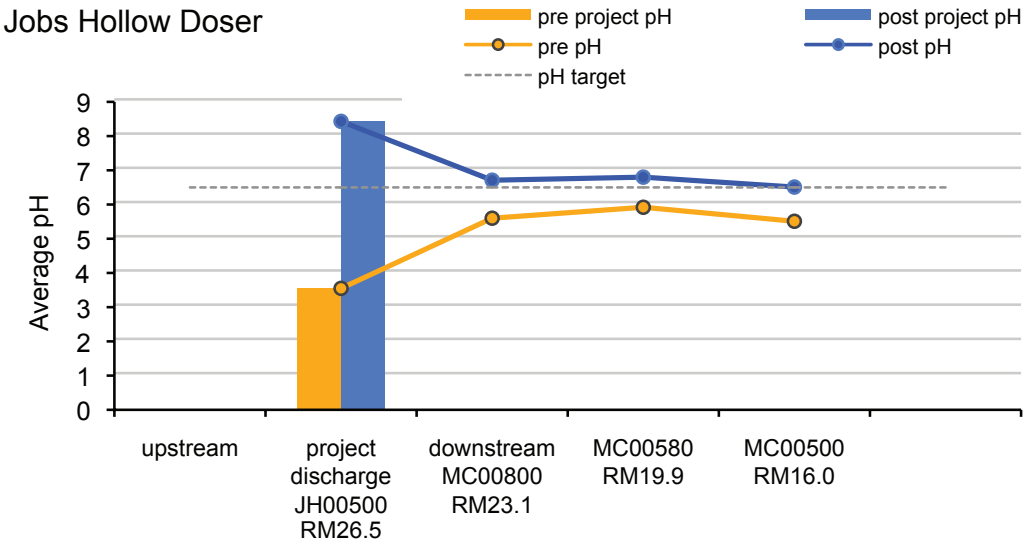
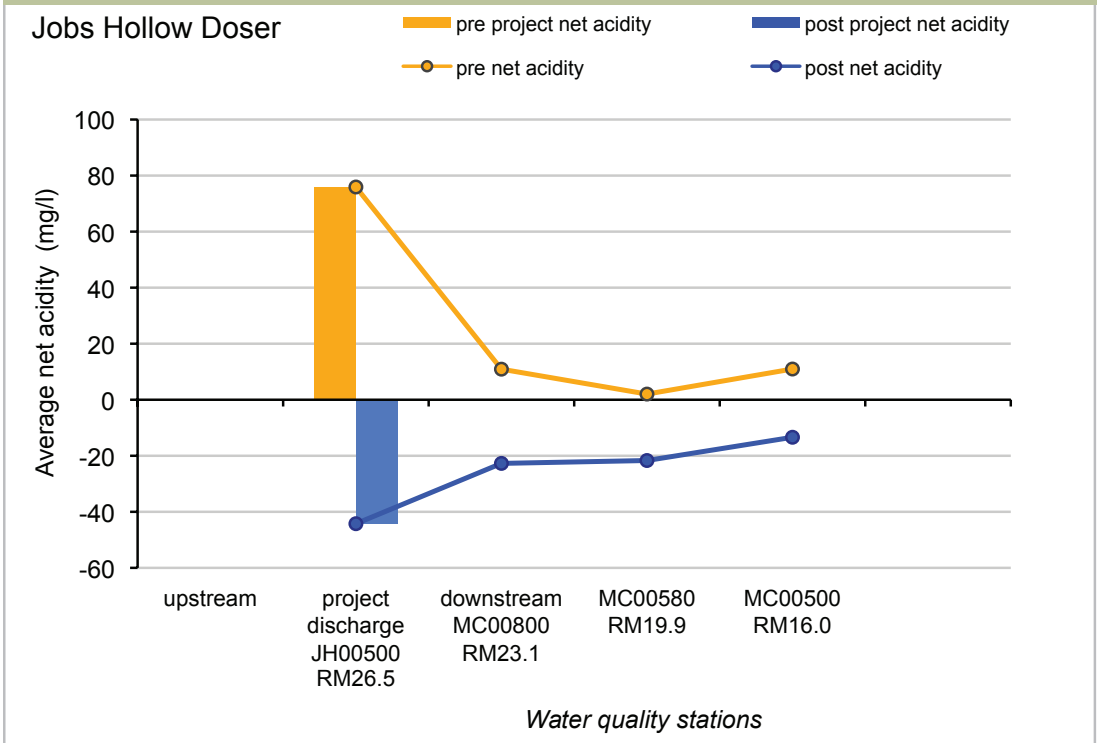


Figure 2. Pre and Post Acidity



Water Quality – load reductions

Using the Mean Annual Load Method (Stoertz, 2004), acid and metal load reduction occurring at this project were plotted and shown in Figure 3 and 4. Acidity, iron, aluminum and discharge were measured pre- and post-construction at the project discharge from 10/1/1997 to 5/1/2004 for pre-construction and from 6/1/2005 to 12/31/2009 for post-construction.

Stoertz, Mary W. and Douglas H. Green, 2004. Mean Annual Acidity Load: A Performance Measure to Evaluate Acid Mine Drainage Remediation. Ohio Department of Natural Resources Conservation and Restoration Innovations 2004 Applied Research Conference at Ohio University.

Figure 3. Acid Load Reduction

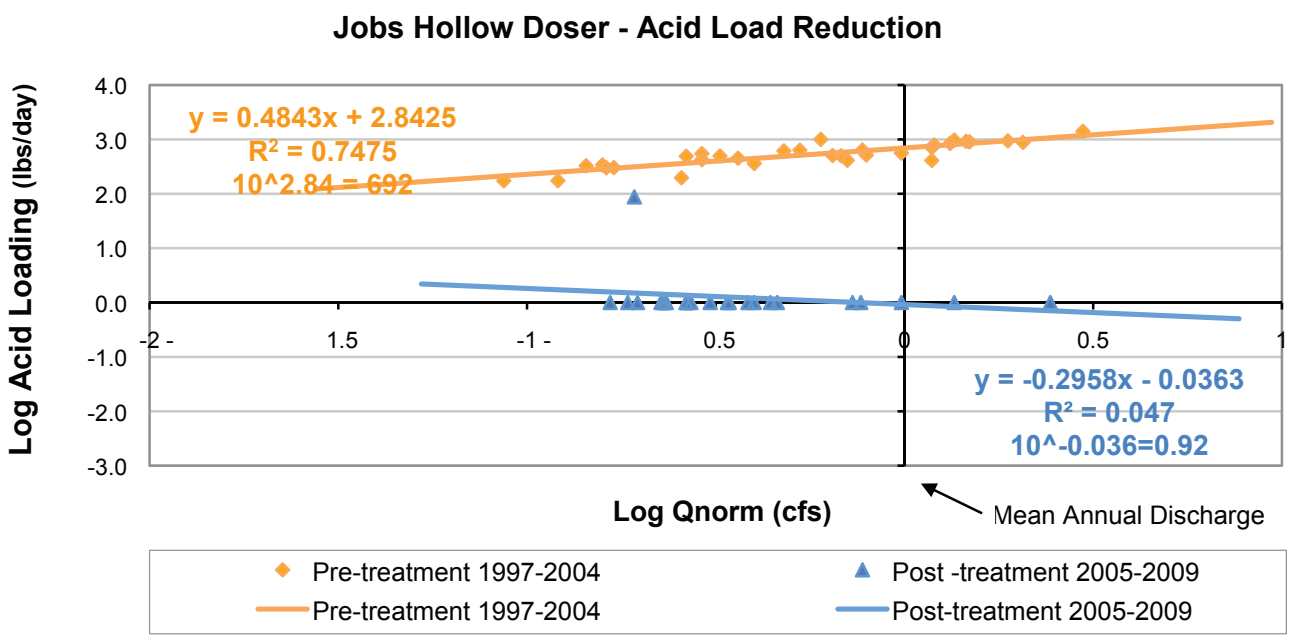
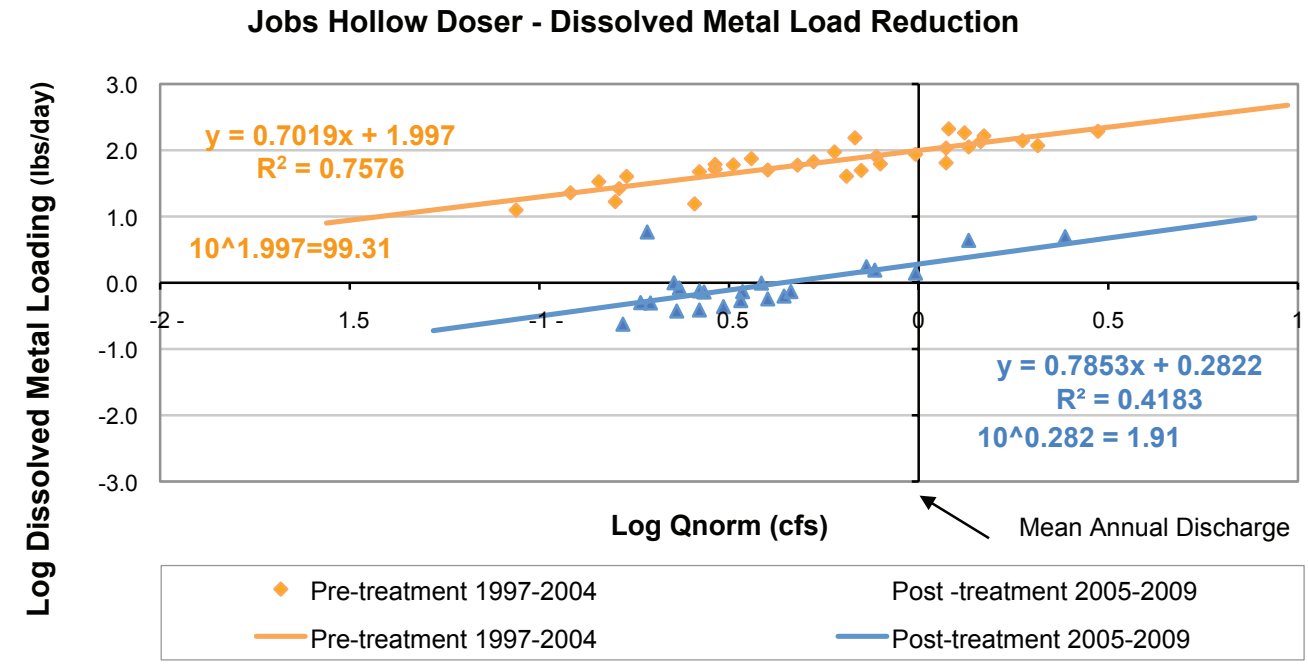


Figure 4. Metal Load Reduction



Similar to other environmental best management practices (BMPs), performance of acid mine drainage reclamation projects are also expected to decline with time. Currently, operation and maintenance plans are being designed for each existing system and for future projects. Figure 5 and 6 show the mean annual acid and metal load reduction (Stoertz, 2004) for each year (or group of years) during post-construction from the project effluent. These graphs show the rate of decline (and/or improvement) with time in the performance of the treatment system. Knowing this rate of decline will aid in the implementation of operation and maintenance plans for each site. Yearly load reductions are plotted and shown in Figure 5 and 6.

Figure 5. Yearly Acid Load Reduction

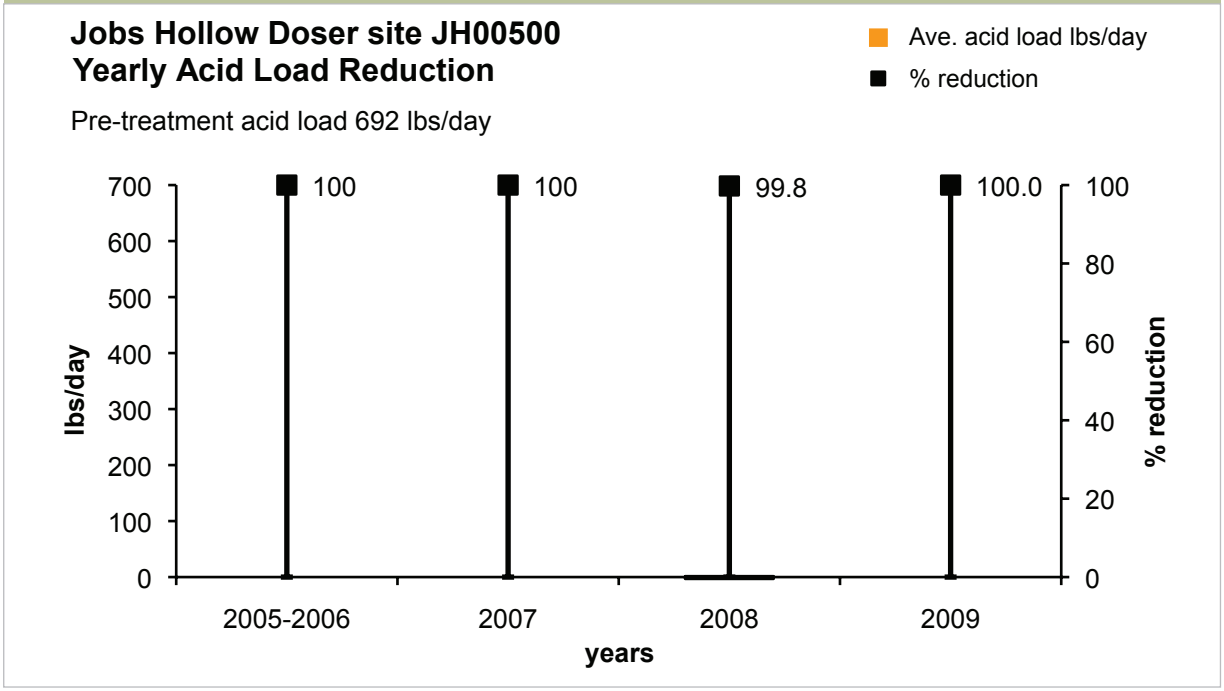
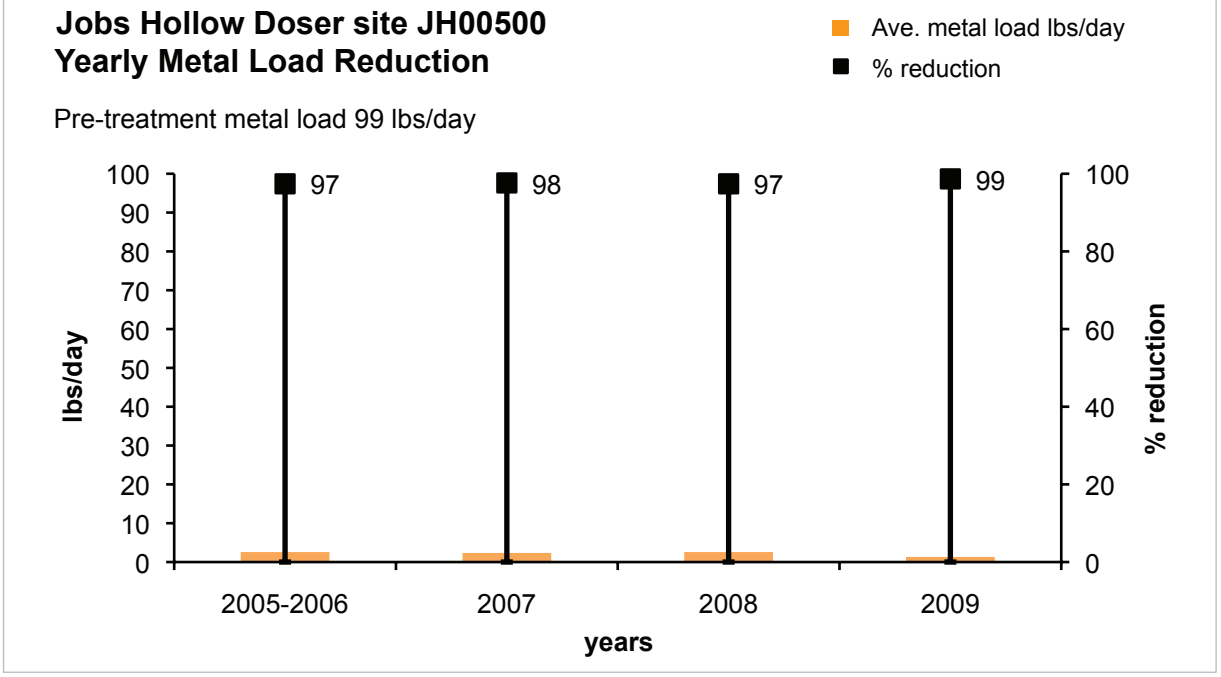


Figure 6. Yearly Metal Load Reduction



2009 NPS Report - Monday Creek Watershed - Rock Run Gob Pile

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 9/1/1999 ODNR Project Number: PR-Co-08

Pre-construction

Rock Run Gob Pile, Photo by Monday Creek Restoration Project

Post-construction

Rock Run Gob Pile, Photo by Monday Creek Restoration Project

Rock Run Gob Pile which was actually a slurry impoundment is located in Section 20 of Coal Township in Perry County and lies within the 14 digit HUC unit #05030204060010. The Rock Run Gob Pile is stretched over 17 acres and was located on the north side of the Rock Run tributary. The design was completed by ODNR-DMRM and Damariscotta for $15,000. The treatment approach for this site was to cover the 17 acre gob pile using standard reclamation methods, covering the gob with a layer of flue gas desulfurization, and installing a 3,200 Sq. ft. Successive Alkalinity Producing System (SAPS) was used to treat the acid mine drainage emitting from a deep mine at the back of the property. The goal of the design was to reclaim the gob pile and reduce metals and acid loadings from the mine drainage. The project goal was met by reducing acidity to net alkaline conditions at station RR02100 and increasing the pH. Major considerations encountered during the design process was the mine drainage exiting the SAPS (approximately 10% of the water exiting the site) couldn't be separated from the gob pile reclaim. The valley was too small to accommodate and separate the run off from the SAPS treatment cells so a OLC was lined to carry the drainage off site after treatment. Construction was complete 9/1/1999 by Stimmel Brothers Construction for a cost of $274,500. The funding sources for this project were for both the design and construction: ODNR-DMRM, EPA-319, and OSM-ACSI. Load reductions are not calculated due to lack of pre-construction data, see figure 3 & 4.

2009 NPS Report - Monday Creek Watershed - Rock Run Gob Pile

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Water Quality Report

Water quality data was collected at the project discharge as well as multiple stations pre and post construction. The graphs below show changes in pH (Figure 1) and acidity (Figure 2) along the mainstem of the receiving stream upstream and downstream of the project discharge as a result of the AMD reclamation project.

As a result of the Rock Run Gob Pile Project, pH and net acidity have improved further downstream at site MC00800 approximately 0.75 miles. At the first station downstream of Rock Run Gob Pile, water quality didn't show improvement due to other sources of acid mine drainage entering into the Rock Run tributary. Pre-construction data shows pH in the range of 3.1 – 5.2 at the project discharge and downstream. However after reclamation of the Rock Run Gob Pile Project, post-construction data shows pH in the range of 3.7– 6.3 at the discharge and downstream. The net acidity concentration decreased resulting in net alkaline water at the project discharge.

Stoertz, Mary W. and Douglas H. Green, 2004. Mean Annual Acidity Load: A Performance Measure to Evaluate Acid Mine Drainage Remediation. Ohio Department of Natural Resources Conservation and Restoration Innovations 2004 Applied Research Conference at Ohio University.

Figure 1. Pre and Post pH

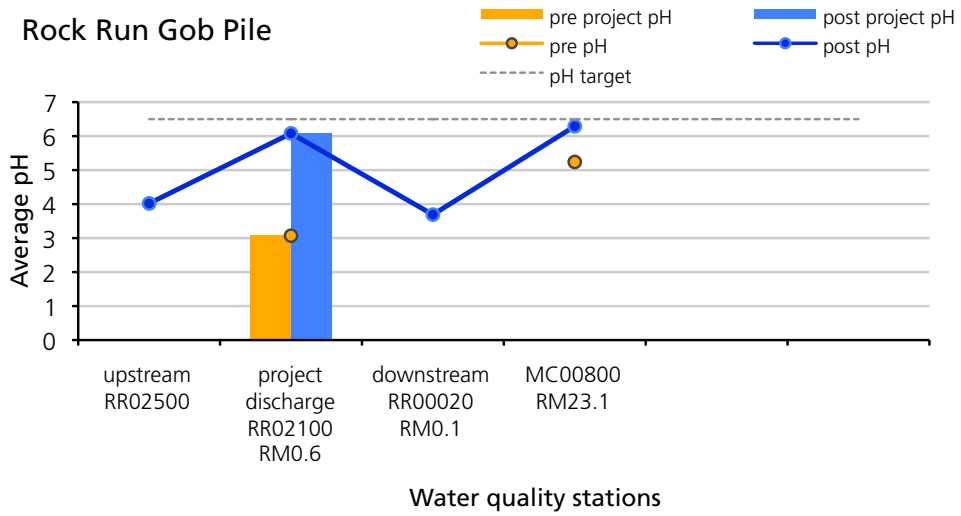
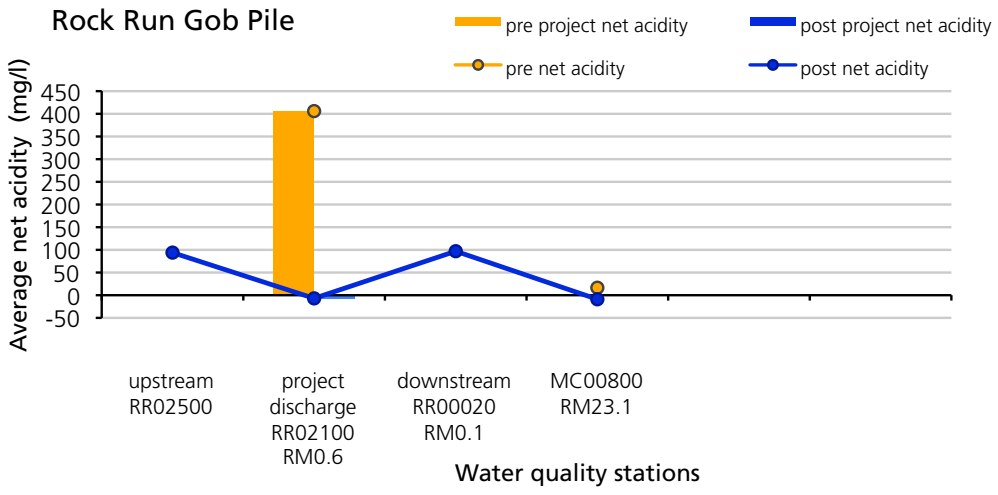


Figure 2. Pre and Post Acidity



Water Quality – load reductions

Using the Mean Annual Load Method (Stoertz, 2004), acid and metal load reduction occurring at this project were plotted and shown in Figure 3 and 4. Acidity, iron, aluminum and discharge were measured pre-, and post-construction at the project discharge, 8/31/1998 for pre-construction and from 10/1/1999 to 12/31/2009 for post-construction. Only one sample was recorded during the pre-construction time period. (year 2008, no data collected). Site ID: RR02100

Stoertz, Mary W. and Douglas H. Green, 2004. Mean Annual Acidity Load: A Performance Measure to Evaluate Acid Mine Drainage Remediation. Ohio Department of Natural Resources Conservation and Restoration Innovations 2004 Applied Research Conference at Ohio University.

Figure 3. Acid Load Reduction

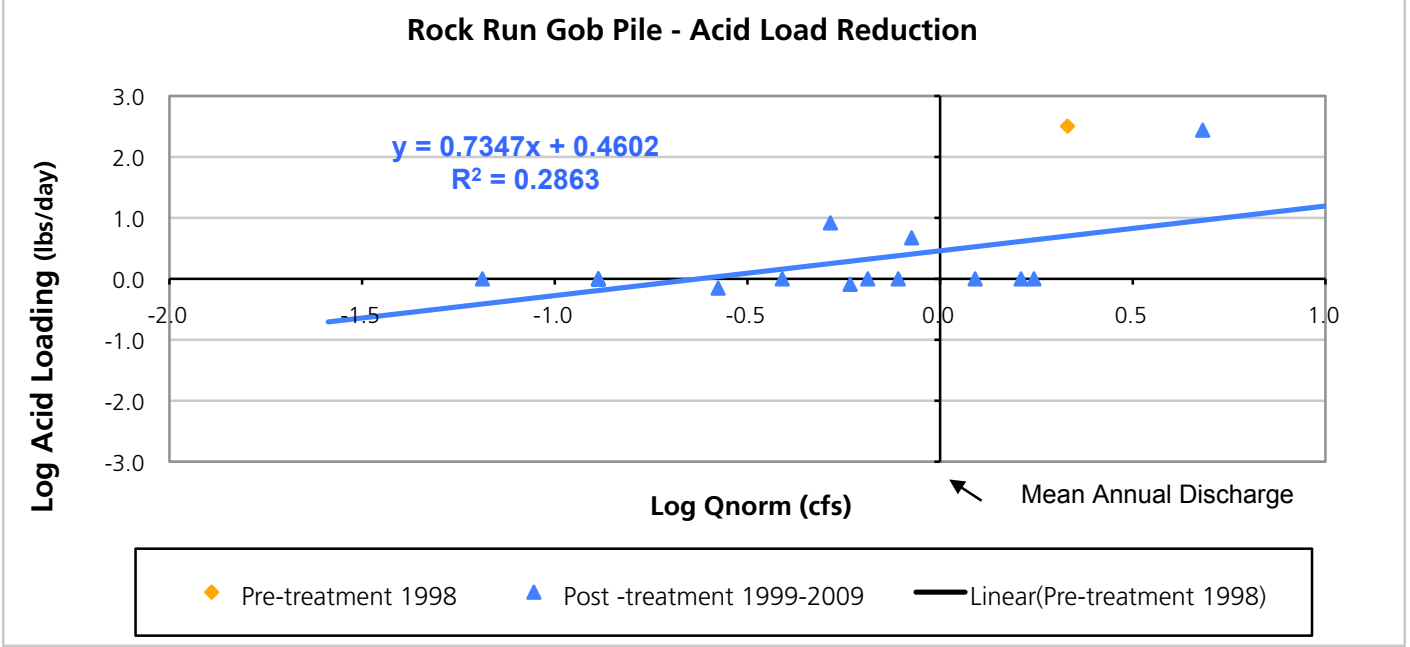
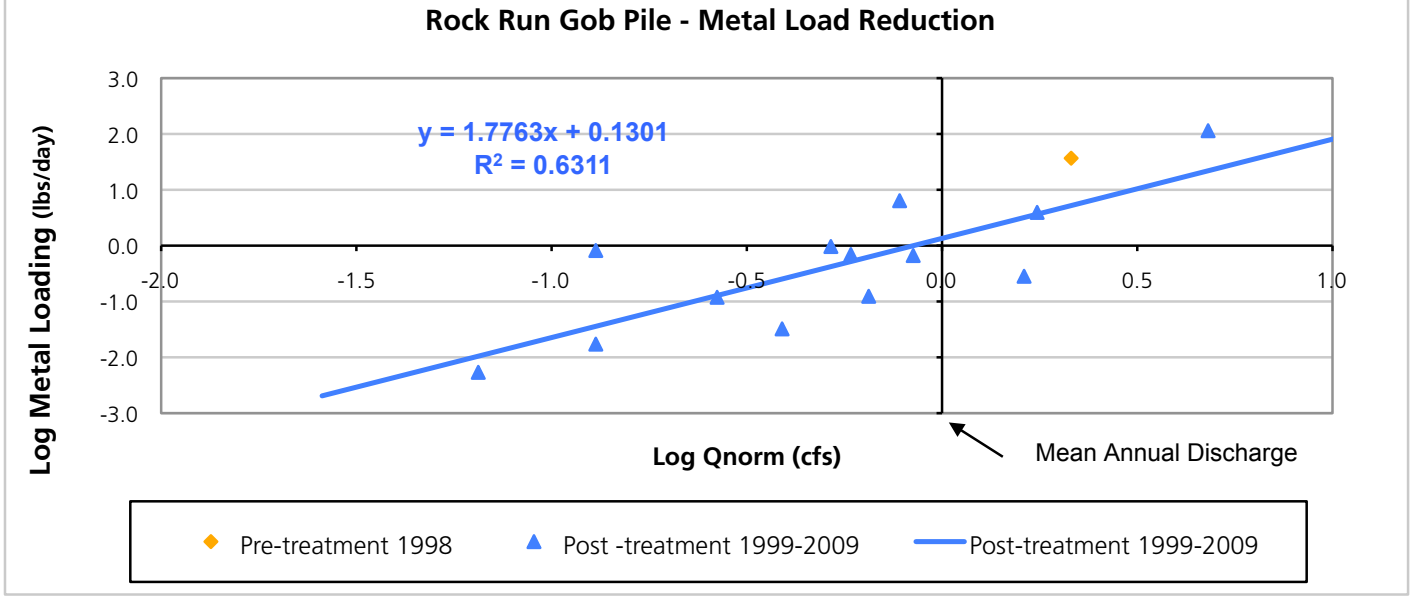
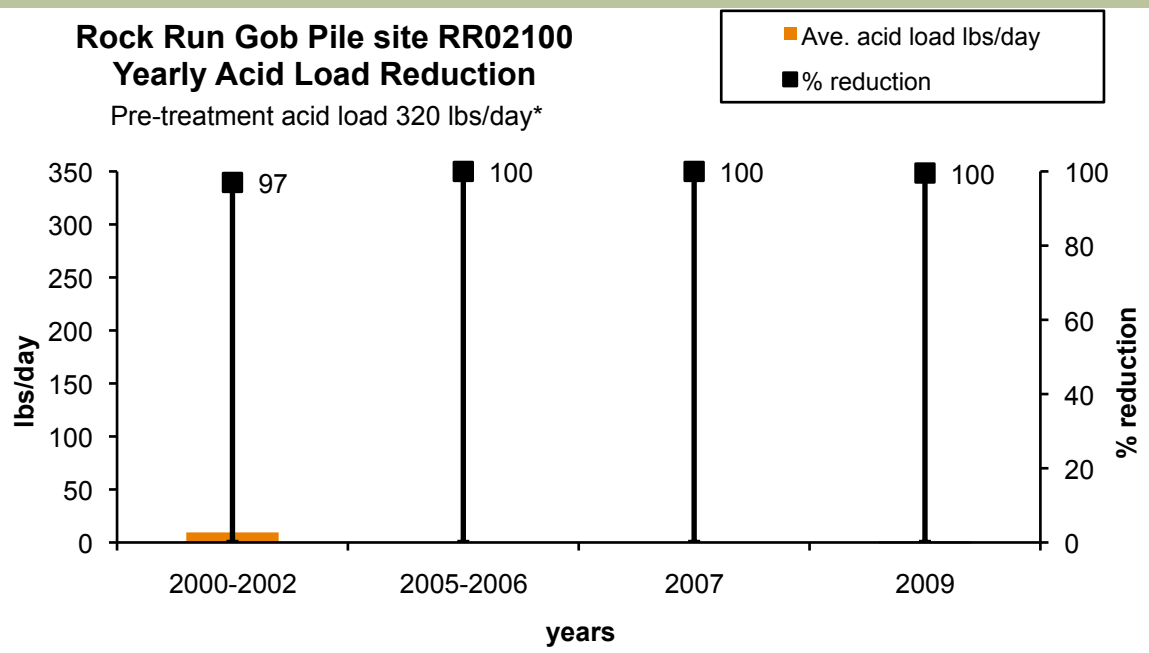


Figure 4. Metal Load Reduction



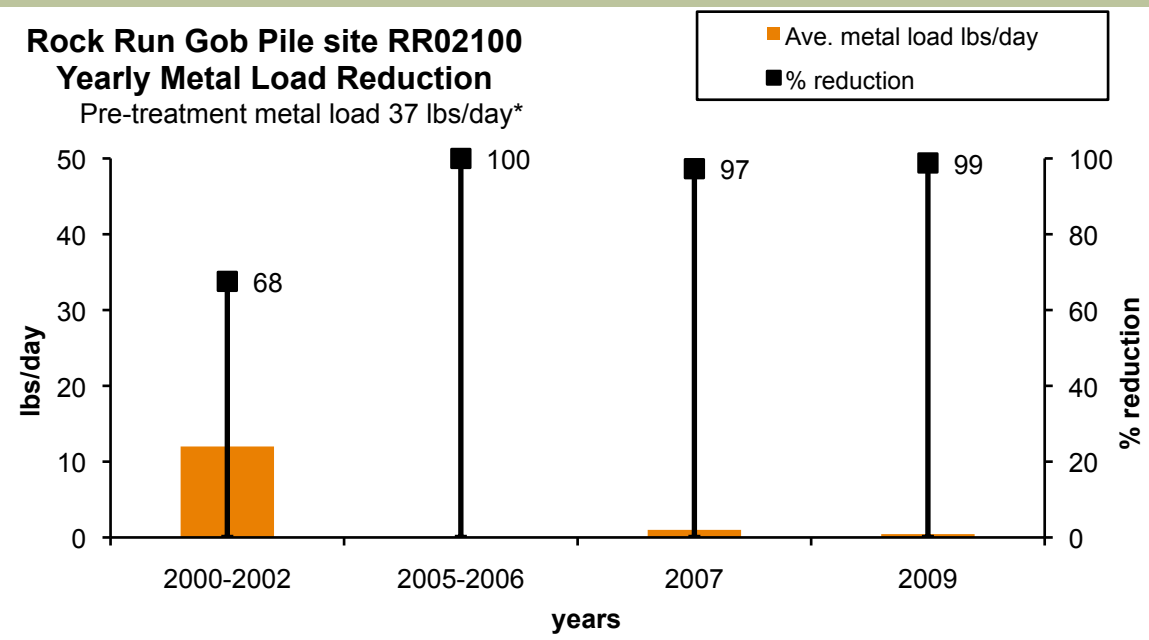
Similar to other environmental best management practices (BMPs), performance of acid mine drainage reclamation projects are also expected to decline with time. Currently, operation and maintenance plans are being designed for each existing system and for future projects. Figure 5 and 6 show the mean annual acid and metal load reduction (Stoertz, 2004) for each year (or group of years) during post-construction from the project effluent. These graphs show the rate of decline (and/or improvement) with time in the performance of the treatment system. Knowing this rate of decline will aid in the implementation of operation and maintenance plans for each site. Yearly load reductions are plotted and shown in Figure 5 and 6.

Figure 5. Yearly Acid Load Reduction



* pre-treatment value based on one sample taken 3/30/1998

Figure 6. Yearly Metal Load Reduction



* pre-treatment value based on one sample taken 3/30/1998

2009 NPS Report - Monday Creek Watershed - Big Four Hollow

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 10/29/2004 ODNR Project Number: HC-Wr-20

Pre-construction

Big Four Hollow, Photo by Monday Creek Restoration Project

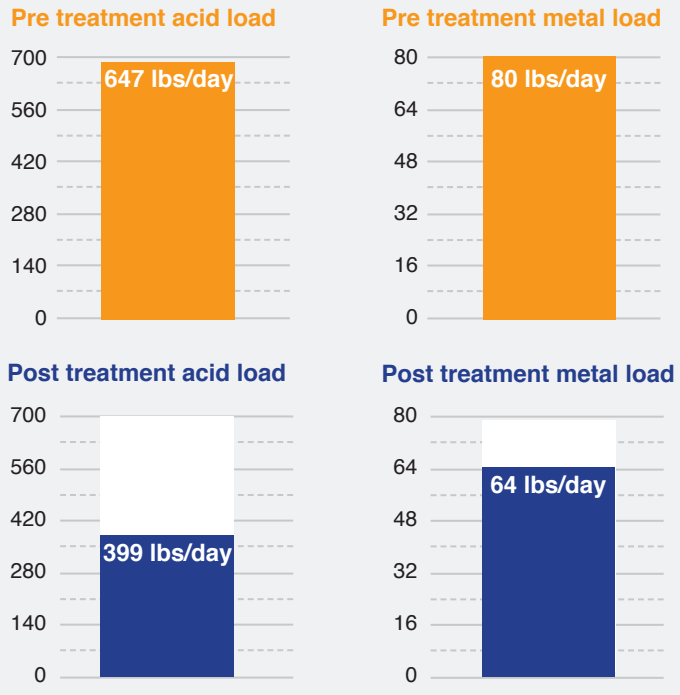
Post-construction

Big Four Hollow, Photo by Monday Creek Restoration Project

Big Four Hollow is located in Section 14 of Ward Township in Hocking County and lies within the 14-digit HUC unit #05030204060030. The project site covers 285 acres of a 410 acre sub-watershed (Big Four Hollow) draining to Monday Creek. Big Four Hollow is underlain by deep mines and has been surface mined around the hills where the coal crop was accessible causing many AMD seeps to discharge in the basin.

The design was completed by USFS and TN & A for $19,000. The treatment approach for this site was to install two limestone leach beds (3000 sq. ft) and approximately 1,400 linear feet of limestone channel (OLC). The goal of the project was to decrease acidity concentrations by 82% at station BF00400. However only 37% of the acidity concentration has been decreased at site BF00100. Construction was complete Sept. 17, 2001, by Pangea for a cost of $320,000. The funding sources for this project were USFS for the design and MCRP, ODNR-DMRM and USFS for construction. Figure 3 and 4 (shown on page 3) estimate approximately 248 lbs/day of acid and 16 lbs/day of metals were prevented from entering into Monday Creek as a result of this AMD reclamation project. This project was designed to reduce acidity, not metals, however the natural wetland at the mouth of Big Four Hollow retains some metals.

Site: BF00100



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

2009 NPS Report - Monday Creek Watershed - Big Four Hollow

Generated by Non-Point Source Monitoring System
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Water Quality Report

Water smples were collected at the project discharge as well as multiple stations pre- and post-construction. The graphs below show changes in pH (Figure 1) and acidity (Figure 2) along the mainstem of the receiving stream upstream and downstream of the project discharge as a result of the AMD reclamation project.

As a result of the Big Four Hollow Project, pH and net acidity have improved downstream for approximately 3.72 miles. Pre-construction data showed pH in the range of 3.6 – 6.7 at the project discharge and downstream. However, after installation of the Big Four Hollow Project, post-construction data shows pH in the range of 4.1 – 6.6 at the discharge and downstream. The net acidity concentration decreased 37 percent at the project discharge.

Figure 1. Pre and Post pH

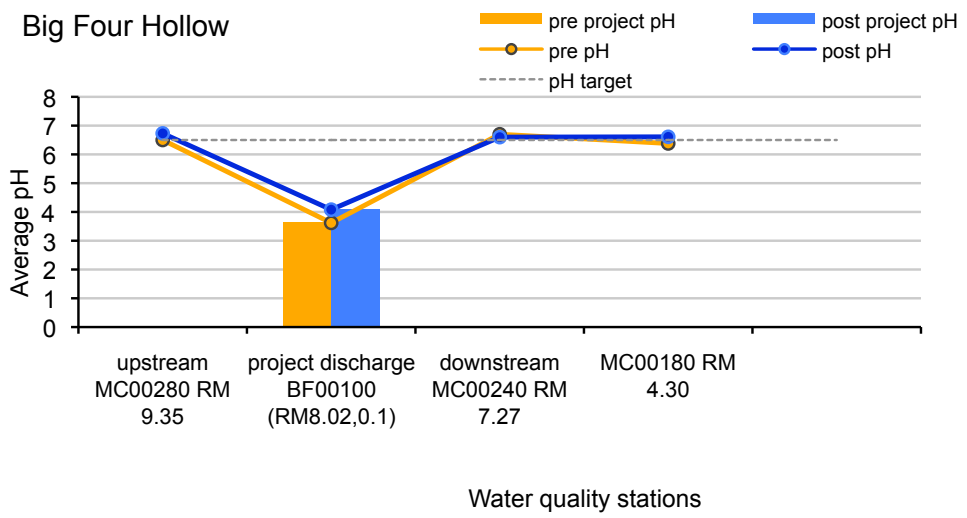
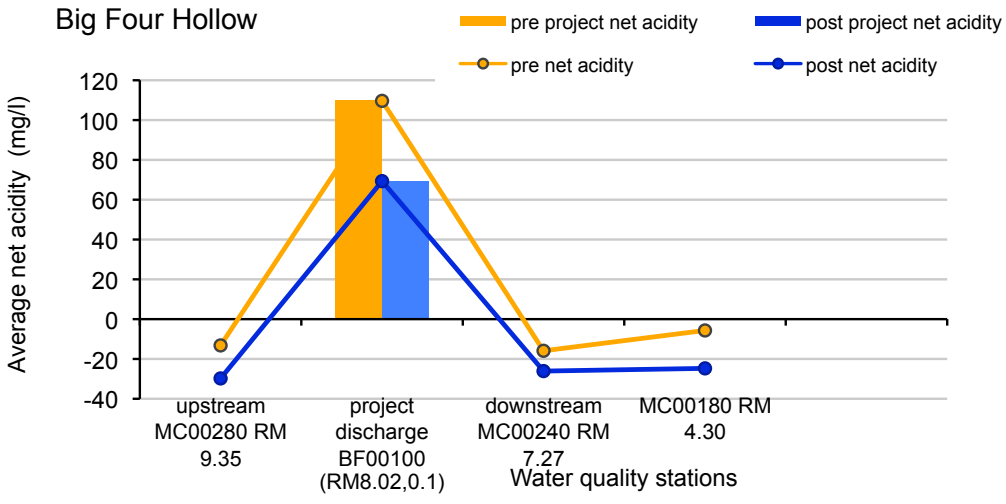


Figure 2. Pre and Post Acidity



Water Quality – load reductions

Using the Mean Annual Load Method (Stoertz, 2004), acid and metal load reduction occurring at this project were plotted and shown in Figure 3 and 4. Acidity, iron, aluminum and discharge were measured pre- and post-construction at the project discharge from 2/21/1998 to 4/8/2002 for pre-construction and from 10/19/2005 to 12/31/2009 for post-construction. Stoertz, Mary W. and Douglas H. Green, 2004. Mean Annual Acidity Load: A Performance Measure to Evaluate Acid Mine Drainage Remediation. Ohio Department of Natural Resources Conservation and Restoration Innovations 2004 Applied Research Conference at Ohio University.

Figure 3. Acid Load Reduction

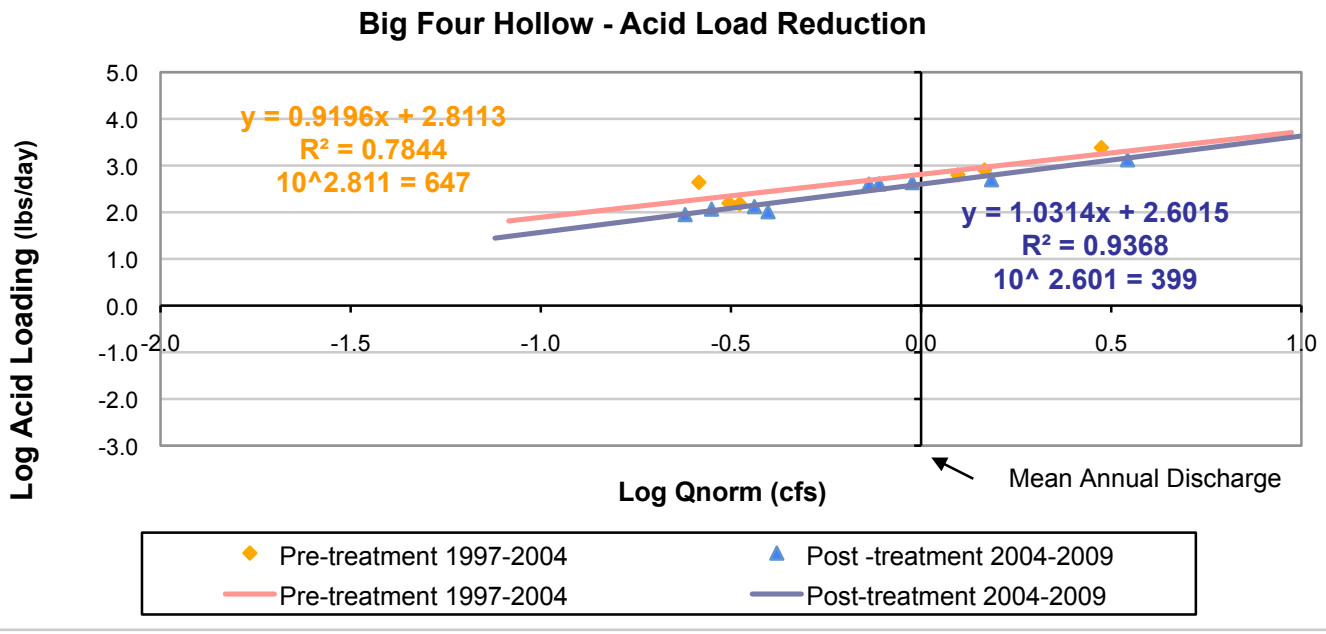
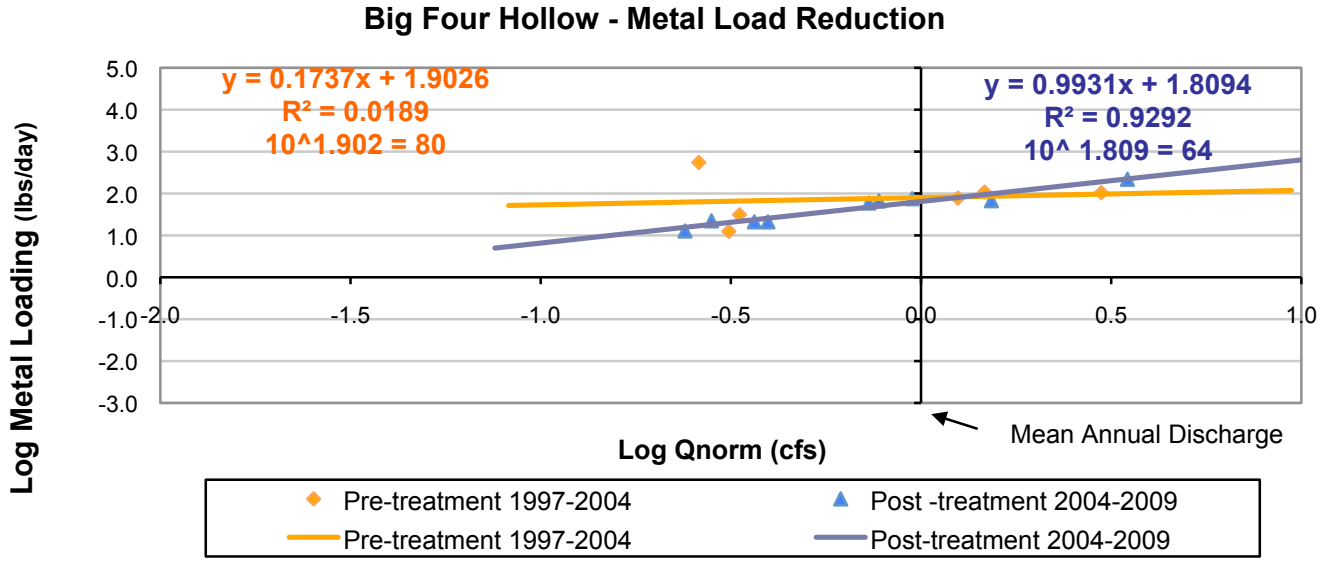


Figure 4. Metal Load Reduction



Similar to other environmental best management practices (BMPs), performance of acid mine drainage reclamation projects are also expected to decline with time. Currently, operation and maintenance plans are being designed for each existing system and for future projects. Figure 5 and 6 show the mean annual acid and metal load reduction (Stoertz, 2004) for each year (or group of years) during post-construction from the project effluent. These graphs show the rate of decline (and/or improvement) with time in the performance of the treatment system. Knowing this rate of decline will aid in the implementation of operation and maintenance plans for each site. Yearly load reductions are plotted and shown in Figure 5 and 6.

Figure 5. Yearly Acid Load Reduction

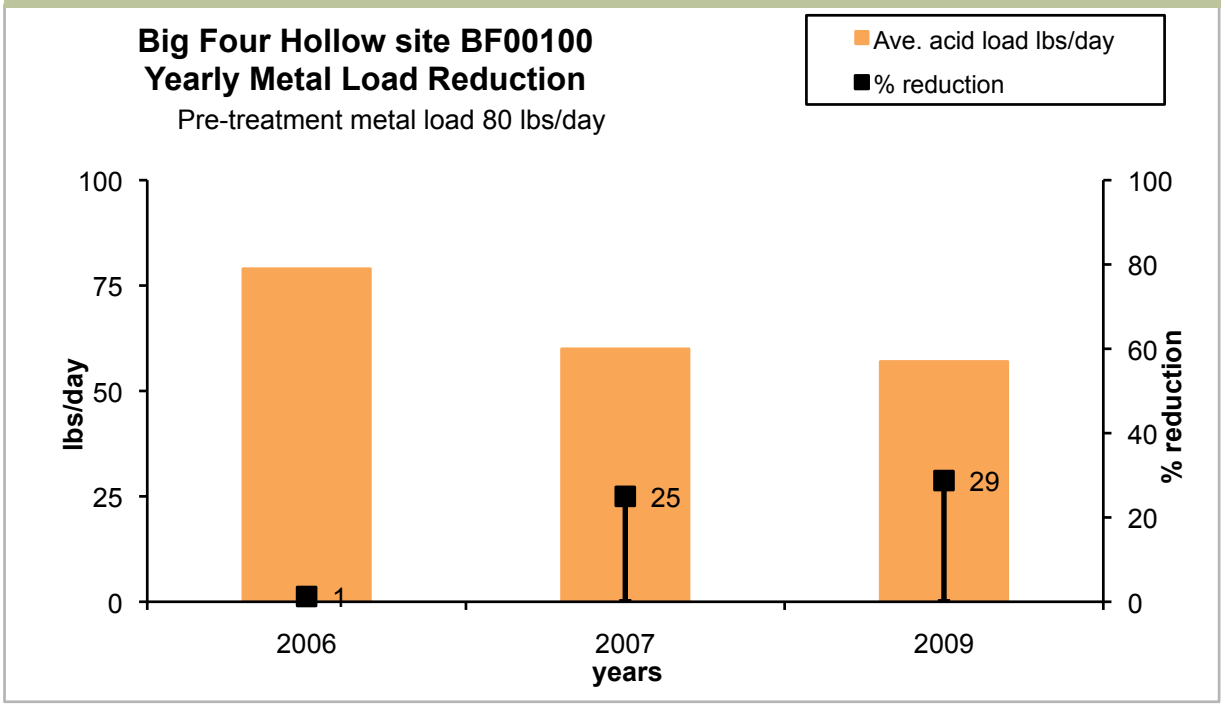
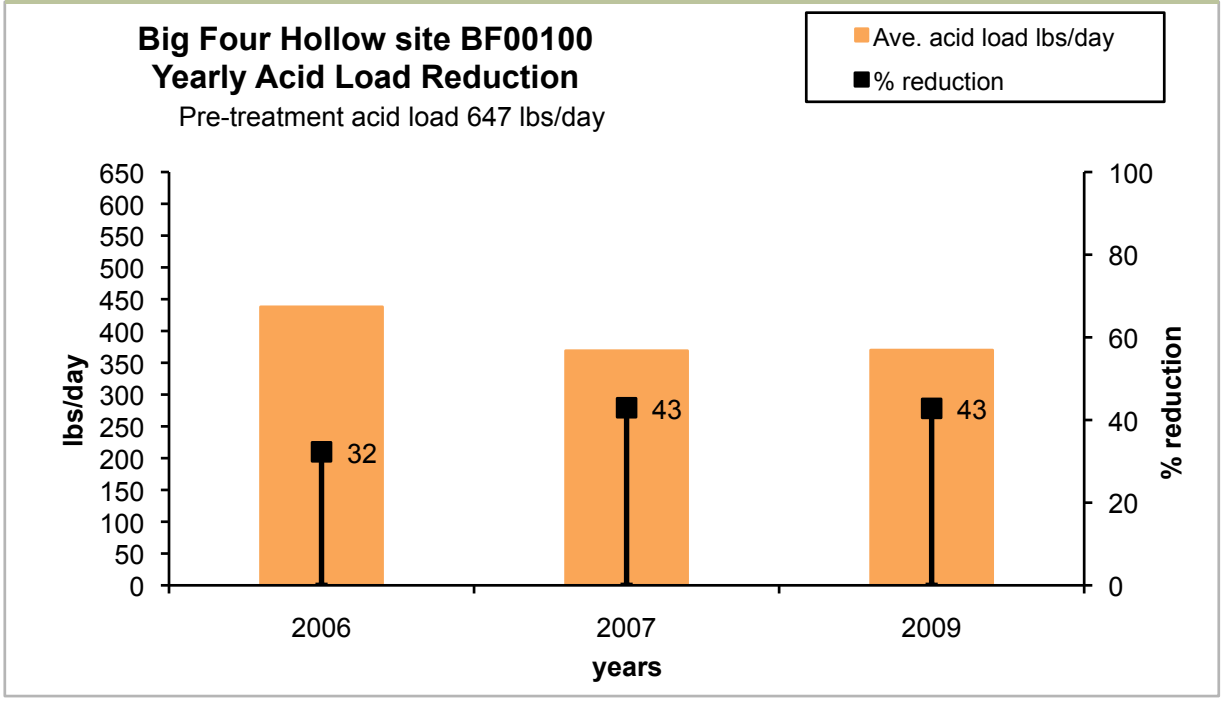


Figure 6. Yearly Metal Load Reduction



2009 NPS Report - Monday Creek Watershed - Snake Hollow

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 12/31/2004 ODNR Project Number: HC-Wr-19

Pre-construction

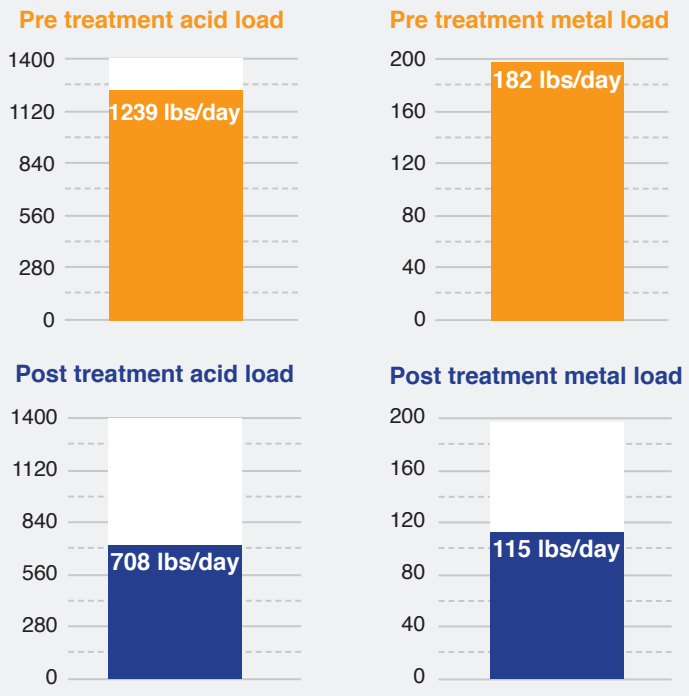
Snake Hollow, Photo by Monday Creek Restoration Project

Post-construction

Snake Hollow, Photo by Monday Creek Restoration Project

Snake Hollow is located in Section 18 of York Township in Athens County and lies within the 14-digit HUC unit #05030204060030. The site encompasses the entire Snake Hollow subwatershed, approximately 500 acres in size. Snake Hollow is a tributary to Monday Creek. Numerous deep mine discharge sites are located on the hillsides around the headwaters and along the stream. The area was stripped at the outcroppings along the ridges where the coal portals from the deep mining had originally been. The design was completed by the U.S. Forest Service (Wayne National Forest). The treatment approach for this site was to construct approximately two miles of limestone channels (OLC) and two slag leach beds, close nine subsidence holes and two portals and enhance the existing one acre wetland with limestone rock dams. The goal of the design was to reduce acid and metals concentrations discharging into Monday Creek. Figures 3 and 4 (shown on page 3) estimate approximately 531 lbs/day of acid and 67 lbs/day of metals were prevented from entering into Monday Creek as a result of this AMD reclamation project which was the goal of the project. A major consideration encountered during the design was the documented capture of the Indiana Bat. During the design process, access road costs doubled. Construction was complete Dec. 31, 2004, by Environmental Quality Management for a cost of $740,000. The funding sources were ODNR-DMRM and USFS for both design and construction.

Site: SH00100



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

2009 NPS Report - Monday Creek Watershed - Snake Hollow

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Water Quality Report

Water samples were collected at the project discharge as well as multiple stations pre- and post-construction. The graphs below show changes in pH (Figure 1) and acidity (Figure 2) along the mainstem of the receiving stream upstream and downstream of the project discharge as a result of the AMD reclamation project.

As a result of the Snake Hollow Project, pH and net acidity have improved downstream at site MC00180 approximately 0.25 miles. Pre-construction data showed pH in the range of 3.1 – 6.4 at the project discharge and downstream. After installation of the Snake Hollow Project, post-construction data shows pH in the range of 3.7 – 6.7 at the discharge and downstream. The net acidity concentration decreased 45 percent at the project discharge, which resulted in net alkaline conditions (-24 mg/l) on the mainstem of Monday Creek at the downstream station MC00180.

Figure 1. Pre and Post pH

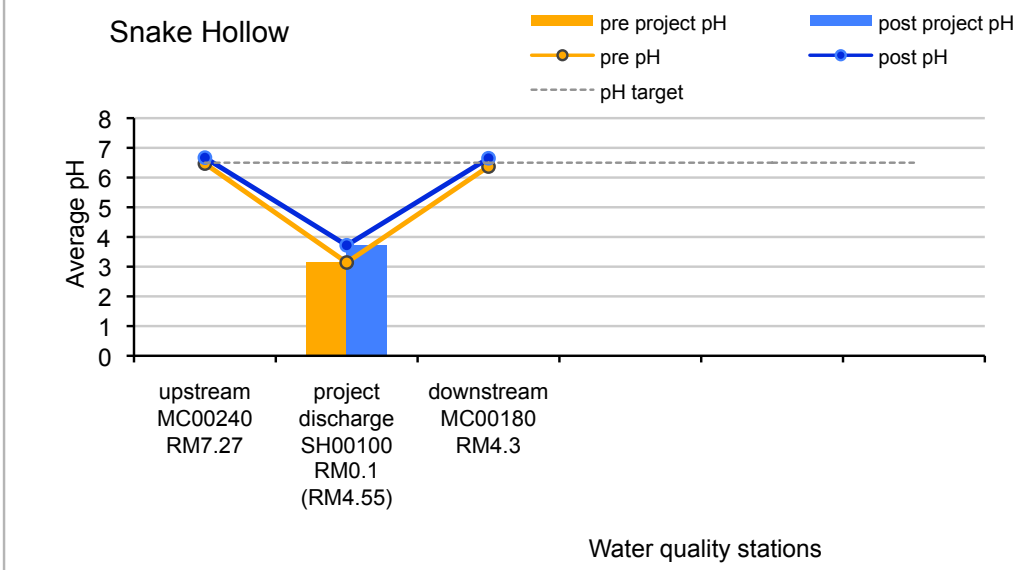
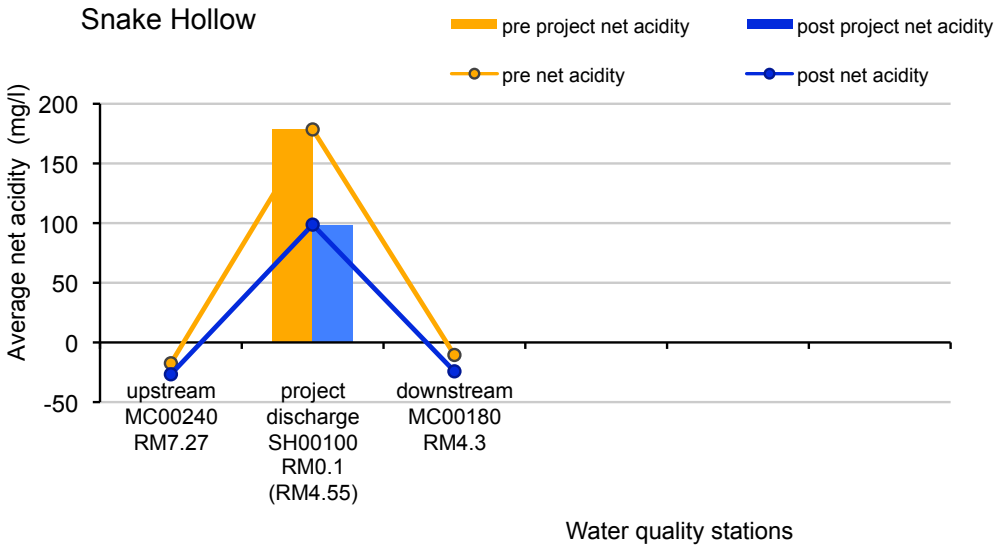


Figure 2. Pre and Post Acidity



Water Quality – load reductions

Using the Mean Annual Load Method (Stoertz, 2004), acid and metal load reduction occurring at this project were plotted and shown in Figure 3 and 4. Acidity, iron, aluminum and discharge were measured pre-, and post-construction at the project discharge from 2/26/1998 to 9/11/2001 for pre-construction and from 1/3/2005 to 12/31/2009 for post-construction. *Stoertz, Mary W. and Douglas H. Green, 2004. Mean Annual Acidity Load: A Performance Measure to Evaluate Acid Mine Drainage Remediation. Ohio Department of Natural Resources Conservation and Restoration Innovations 2004 Applied Research Conference at Ohio University.*

Figure 3. Acid Load Reduction

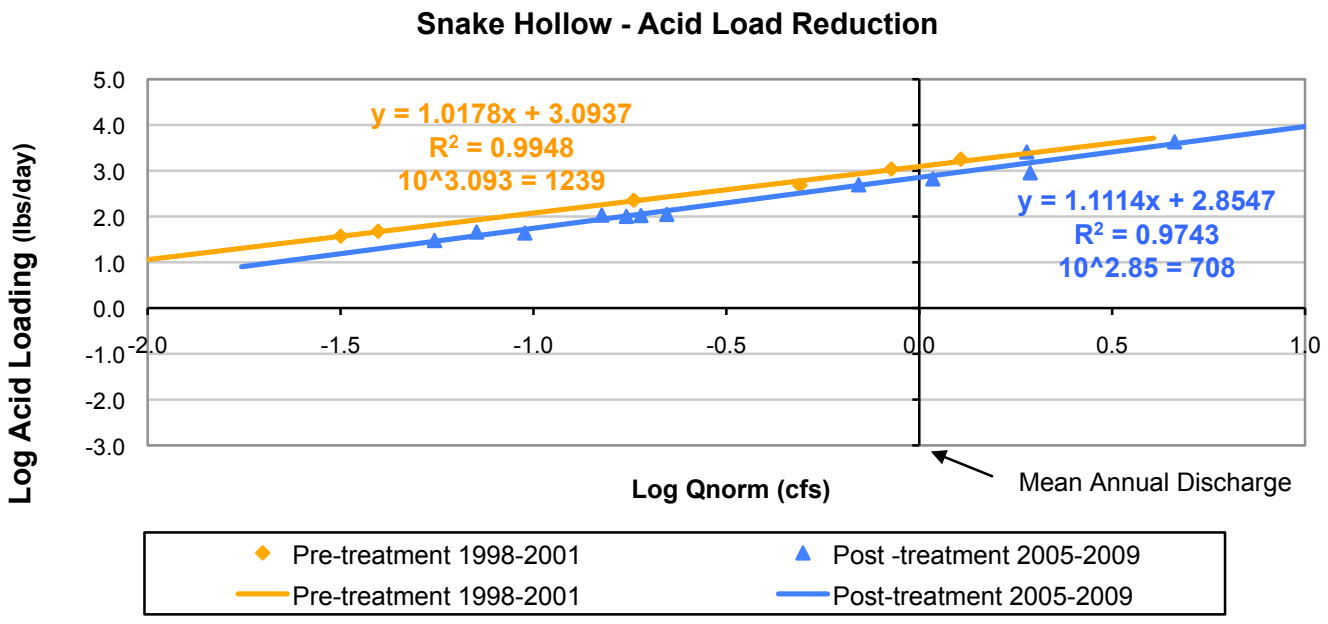
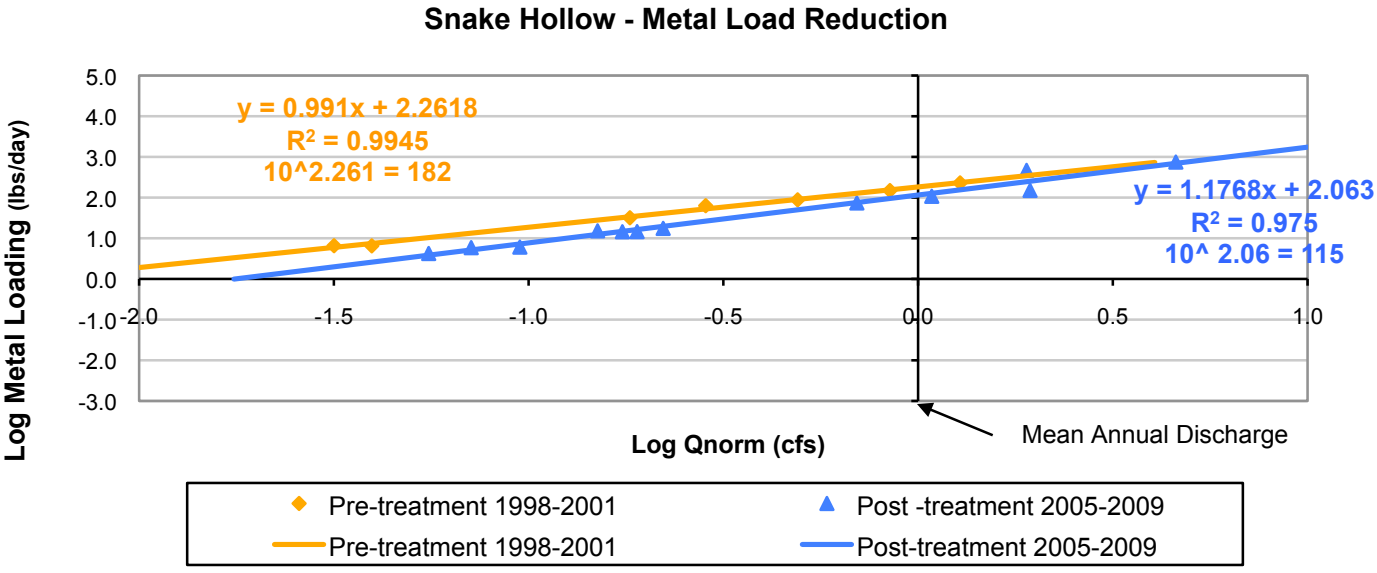


Figure 4. Metal Load Reduction



Similar to other environmental best management practices (BMPs), performance of acid mine drainage reclamation projects are also expected to decline with time. Currently, operation and maintenance plans are being designed for each existing system and for future projects. Figure 5 and 6 show the mean annual acid and metal load reduction (Stoertz, 2004) for each year (or group of years) during post-construction from the project effluent. These graphs show the rate of decline (and/or improvement) with time in the performance of the treatment system. Knowing this rate of decline will aid in the implementation of operation and maintenance plans for each site. Yearly load reductions are plotted and shown in Figure 5 and 6.

Figure 5. Yearly Acid Load Reduction

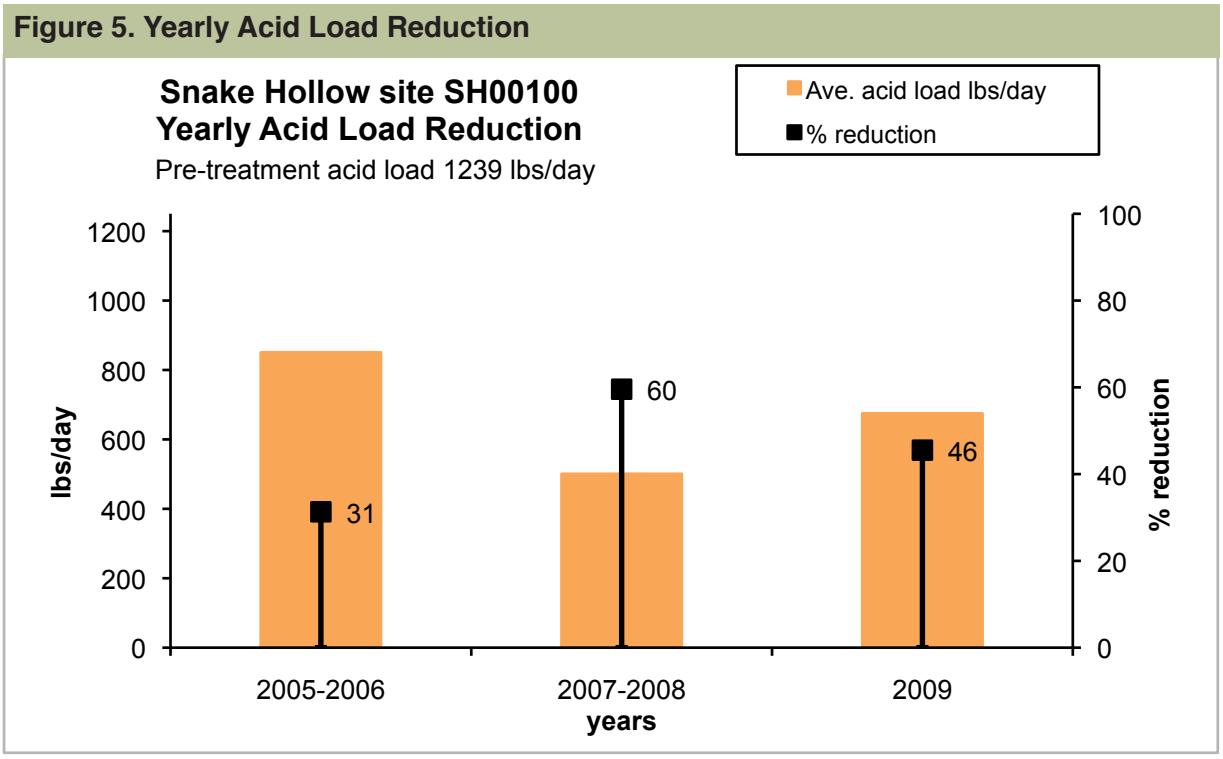
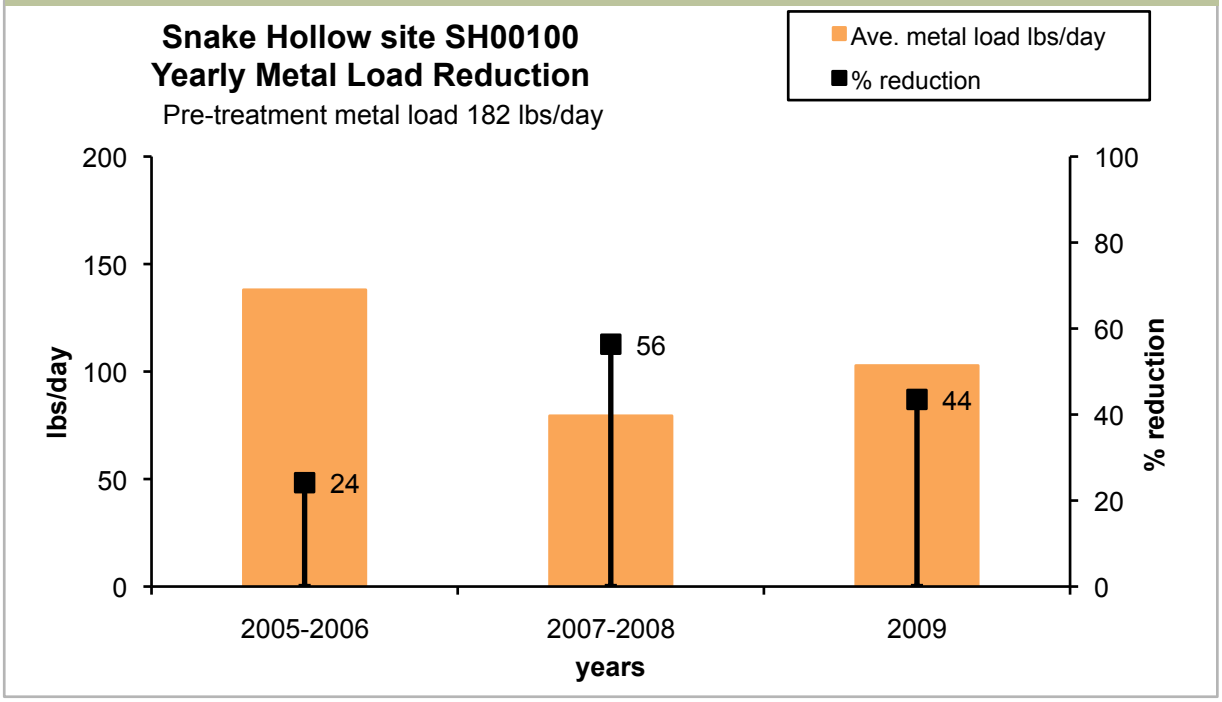


Figure 6. Yearly Metal Load Reduction



2009 NPS Report - Monday Creek Watershed - Lost Run Phase I

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 10/31/2006 ODNR Project Number: HC-Wr-30

Pre-construction

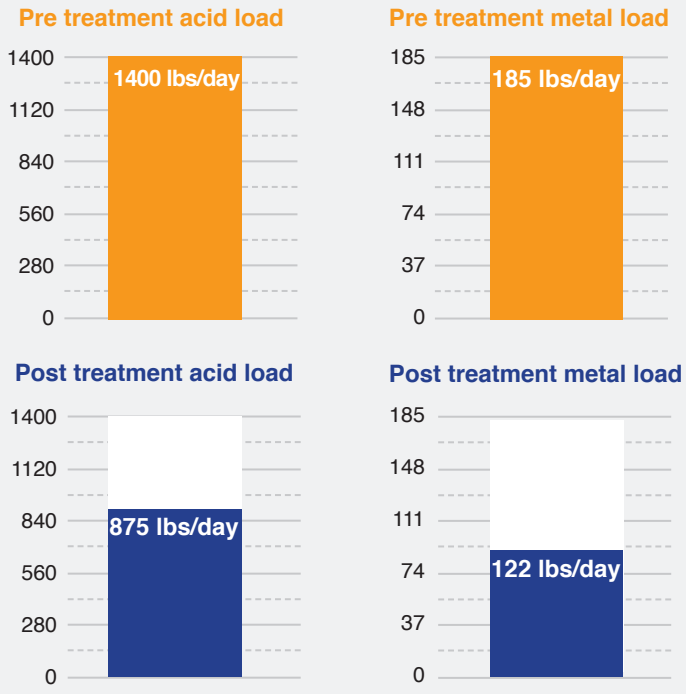
Lost Run Seep (1W2 Seep) Photo by Monday Creek Restoration Project

Post-construction

Lost Run Seep (1W5 Seep) Photo by Monday Creek Restoration Project

Lost Run Phase I is located in Section 36 of Ward Township in Hocking County and lies within the 14 digit HUC unit #05030204060010. The site is located at the mouth of the first tributary to the west in the Lost Run subwatershed. Project area is less than five acres. Lost Run is a tributary to Monday Creek at river mile 16.08. The Lost Run area was providing recharge to underground mine complexes. The majority of AMD discharging in the lower portion of Lost Run occurred beneath the abandoned high walls, or near the perimeter of surface mine reclamation areas at the coal crop line. Seeps also occur in areas where overburden was deposited. The design was completed by Ohio Department of Natural Resources – Division of Mineral Resources Management ($35,000). The treatment consisted of constructing a 13,700 square foot limestone leach bed and installing 3,540 linear feet of limestone channels to treat acid mine drainage from five locations. The goal of the design was to reduce acid and metal concentrations discharging into Monday Creek. Construction was complete 10/31/2006 by Tucson Inc. for a cost of $475,000. Problems with the limestone leach bed were encountered summer of 2007. The system was modified and repaired August 2007. Figure 3 and 4 (shown on page 3 of this report) estimate that 525 lbs/day of acid and 63 lbs/day of metals were prevented from entering Monday Creek as a result of Phase I AMD reclamation project in Lost Run. The funding sources for this project were ODNR-DMRM for the design and for construction was MCRP, ODNR-DMRM and Ohio EPA 319.

Site: LR01020



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

Water Quality Report

Water samples were collected at the project discharge as well as multiple stations pre and post construction. The graphs below show changes in pH (Figure 1) and acidity (Figure 2) along the mainstem of the receiving stream upstream and downstream of the project discharge as a result of the AMD reclamation project.

As a result of the Lost Run Phase I Project, pH and net acidity have improved downstream approximately 6.0 miles. Pre-construction data shows pH in the range of 3.4 – 6.6 at the project discharge and downstream. After installation of the Lost Run Phase I Project, post-construction data shows pH in the range of 4.4 – 6.8 at the discharge and downstream. The net acidity concentration decreased 56% at the project discharge.

Figure 1. Pre and Post pH

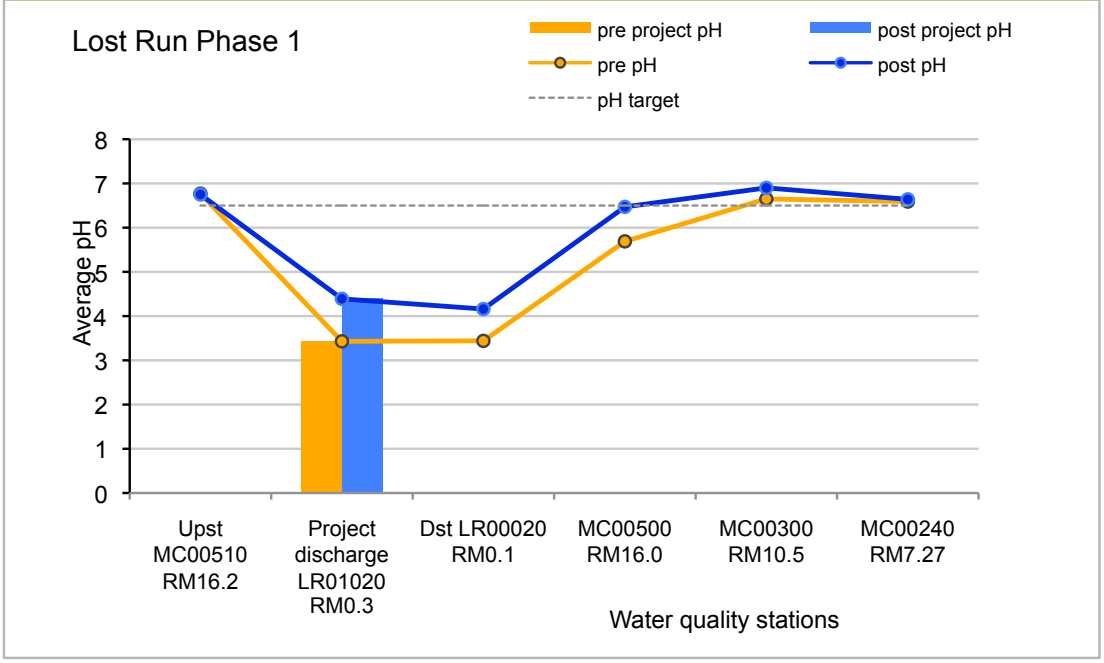
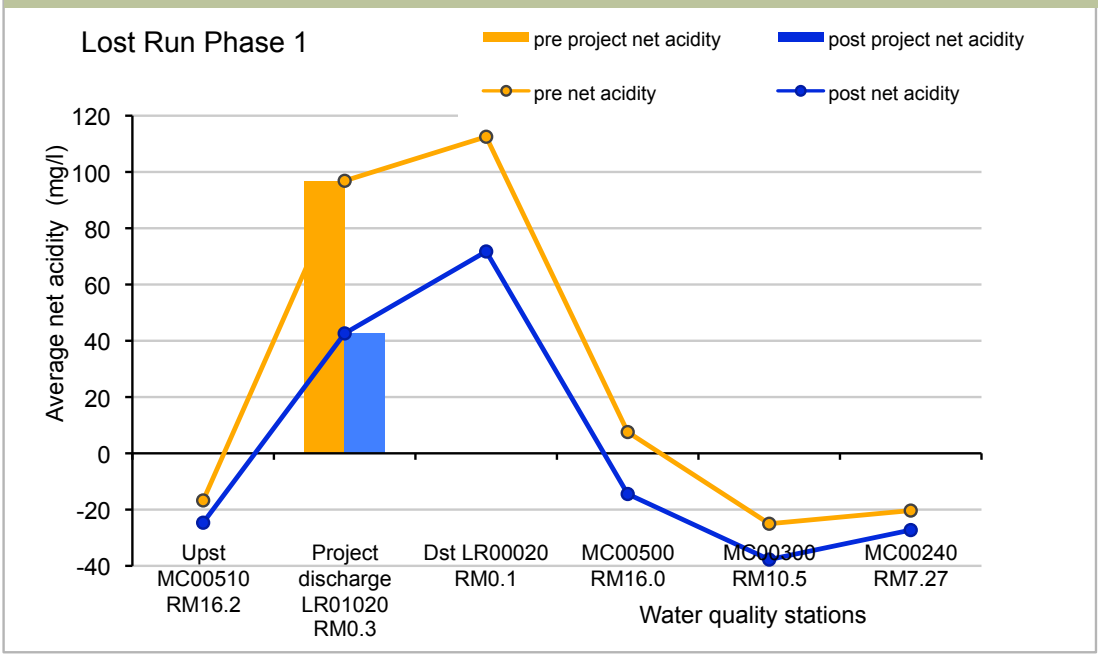


Figure 2. Pre and Post Acidity



Water Quality – load reductions

Using the Mean Annual Load Method (Stoertz, 2004), acid and metal load reduction occurring at this project were plotted and shown in Figure 3 and 4. Acidity, iron, aluminum and discharge were measured pre-, and post-construction at the project discharge from 5/9/2001 to 6/19/2006 for pre-construction and from 3/6/2007 to 12/31/2009 for post-construction. *Stoertz, Mary W. and Douglas H. Green, 2004. Mean Annual Acidity Load: A Performance Measure to Evaluate Acid Mine Drainage Remediation. Ohio Department of Natural Resources Conservation and Restoration Innovations 2004 Applied Research Conference at Ohio University.*

Figure 3. Acid Load Reduction

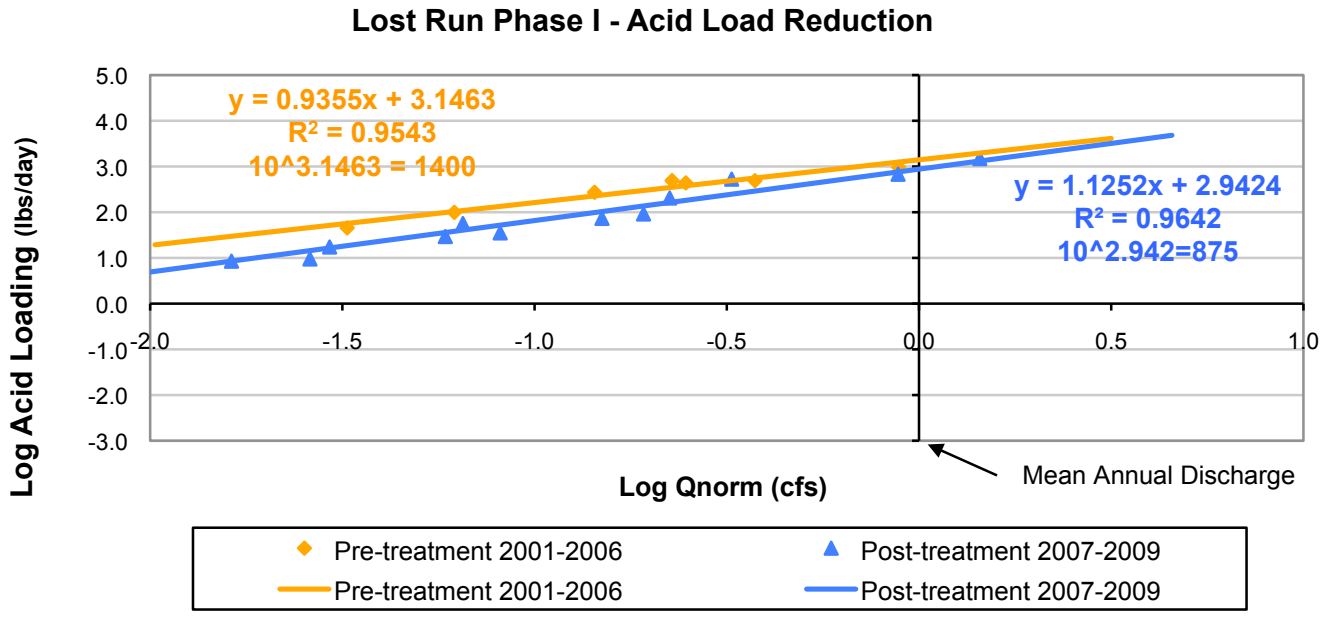
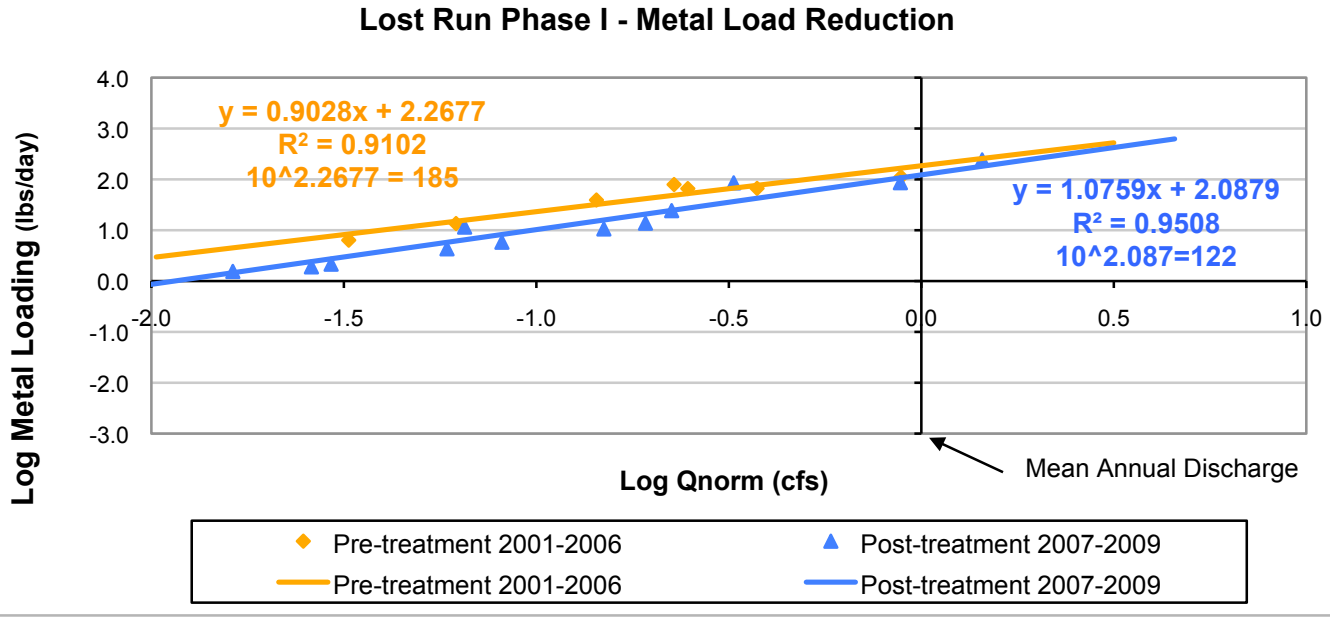


Figure 4. Metal Load Reduction



Similar to other environmental best management practices (BMPs), performance of acid mine drainage reclamation projects are also expected to decline with time. Currently, operation and maintenance plans are being designed for each existing system and for future projects. Figure 5 and 6 show the mean annual acid and metal load reduction (Stoertz, 2004) for each year (or group of years) during post-construction from the project effluent. These graphs show the rate of decline (and/or improvement) with time in the performance of the treatment system. Knowing this rate of decline will aid in the implementation of operation and maintenance plans for each site. Yearly load reductions are plotted and shown in Figure 5 and 6.

Figure 5. Yearly Acid Load Reduction

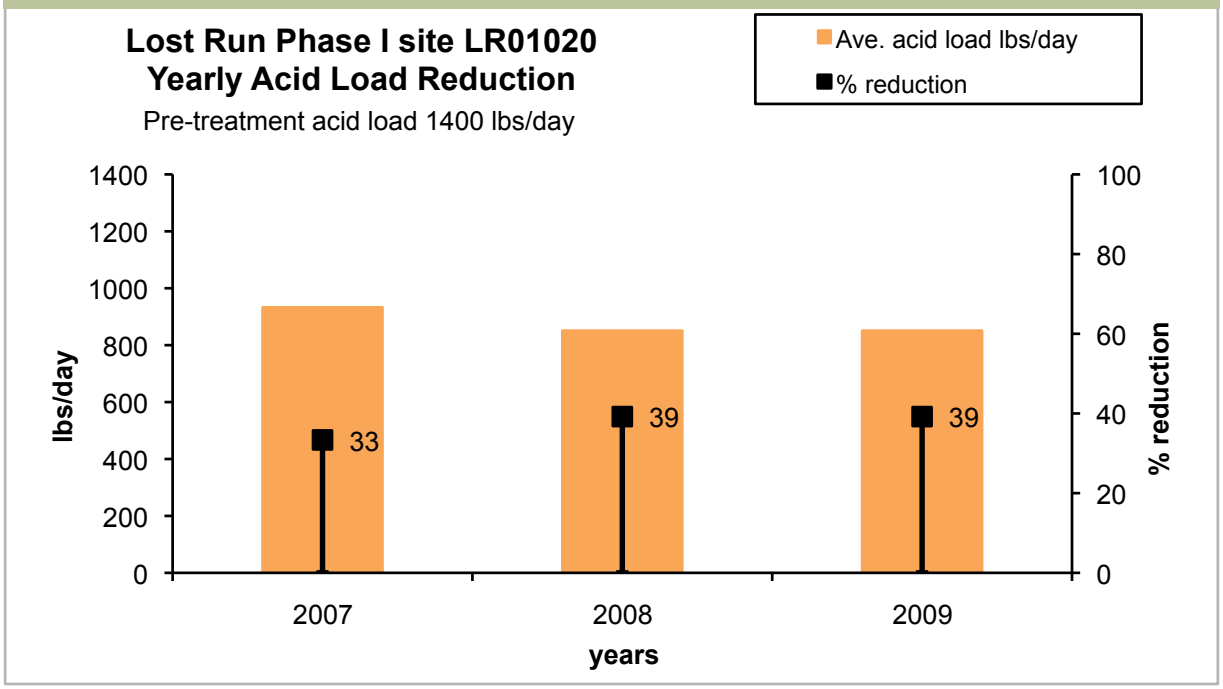
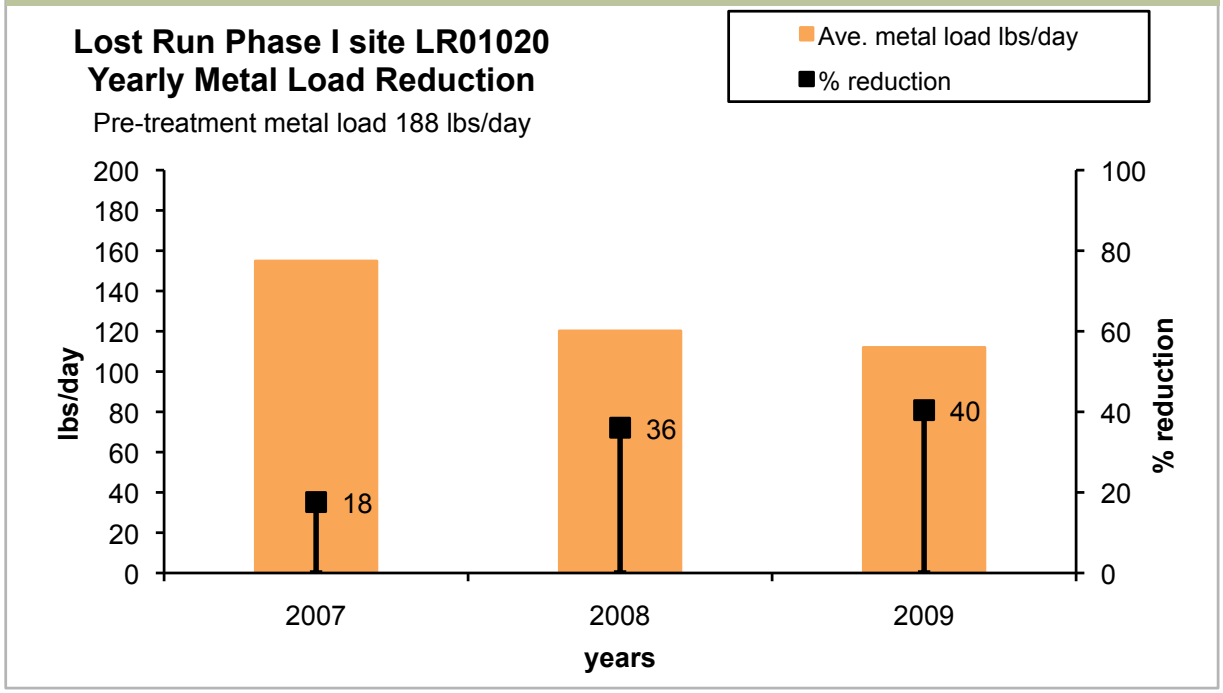


Figure 6. Yearly Metal Load Reduction



2009 NPS Report - Monday Creek Watershed - Lost Run Phase II

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 7/1/2007 ODNR Project Number: HC-Wr-34

Pre-construction

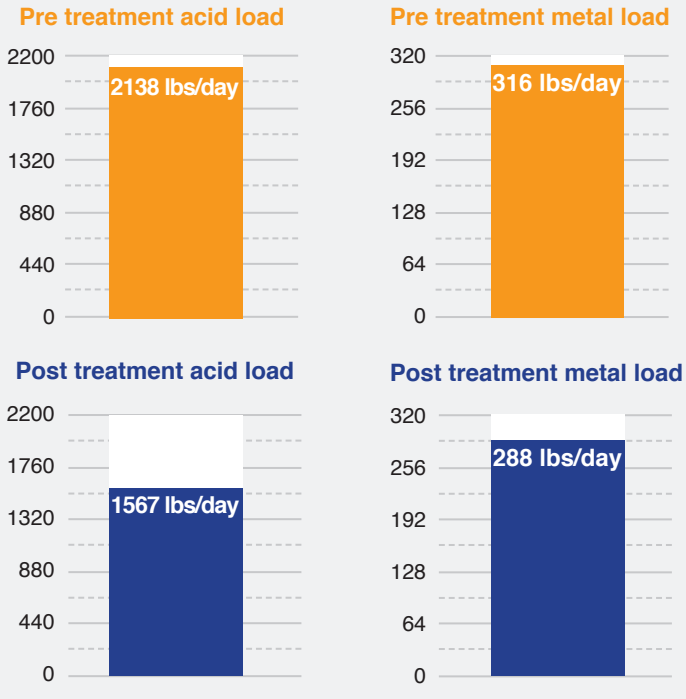
Lost Run Seeps, Photo by Nate Schlater

Post-construction

Lost Run limestone leach bed site (4W)Photo by Monday Creek Restoration Project

Lost Run Phase II is located in Section 30 of Ward Township in Hocking County and lies within the 14 digit HUC unit #05030204060010. Upstream AMD is generated from subsidence features, spoil blocks in side drainages of intermittent streams, fractured high walls, and slumped drift mine entries. Phase II of the Lost Run reclamation project consists of numerous alkaline addition systems spread throughout the headwaters of the Lost Run basin to buffer numerous AMD sources throughout the basin. Post construction monitoring is being collected at site LR00040. However, no pre-construction data was collected at this site. Therefore, reclamation results for this report are evaluated at the mouth of Lost Run (site LR00020). This site also represents water quality from Lost Run Phase I. For this report both Phase I and II of Lost Run are evaluated at the mouth of Lost Run at site LR00020. The design was completed by ODNR – DMRM ($63,979). The treatment consisted of constructing a 7,650 square foot limestone leach bed, installing 1,300 linear feet of limestone channels, 140 linear feet of Limestone J-trenches, 14,250 square ft. of steel slag leach bed and 197 linear feet of a steel slag berm to add alkalinity to buffer acidity generated in Lost Run. The goal of the design was to reduce acid and metal concentrations discharging into Monday Creek. Construction was complete 6/20/2007 by Stimmel Construction for a cost of $489,910. One of the planned steel slag berms could not be constructed due to private landowner denying permission. The funding sources for this project were for the design was ODNR-DMRM and for construction was MCRP, ODNR-DMRM and Ohio EPA 319. Figure 3 and 4 (shown on page 3 of this report) estimate approximately 571 lbs/day of acid and 28 lbs/day of metals were prevented from entering into Monday Creek as a result of Phase I and II of the Lost Run AMD reclamation project.

Site: LR00020



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

2009 NPS Report - Monday Creek Watershed - Lost Run Phase II

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Water Quality Report

Water samples were collected at the project discharge as well as multiple stations pre and post construction. The graphs below show changes in pH (Figure 1) and acidity (Figure 2) along the mainstem of the receiving stream upstream and downstream of the project discharge as a result of the AMD reclamation project.

As a result of the Lost Run Phase I and II Project, pH and net acidity have improved at the mouth of Lost Run. Pre-construction data shows pH at 3.4 at the mouth of Lost Run. After installation of the Lost Run Phase I and II Project, post-construction data shows pH at 4.25 at the mouth of Lost Run. The net acidity concentration decreased 36% at the mouth of Lost Run.

Figure 1. Pre and Post pH

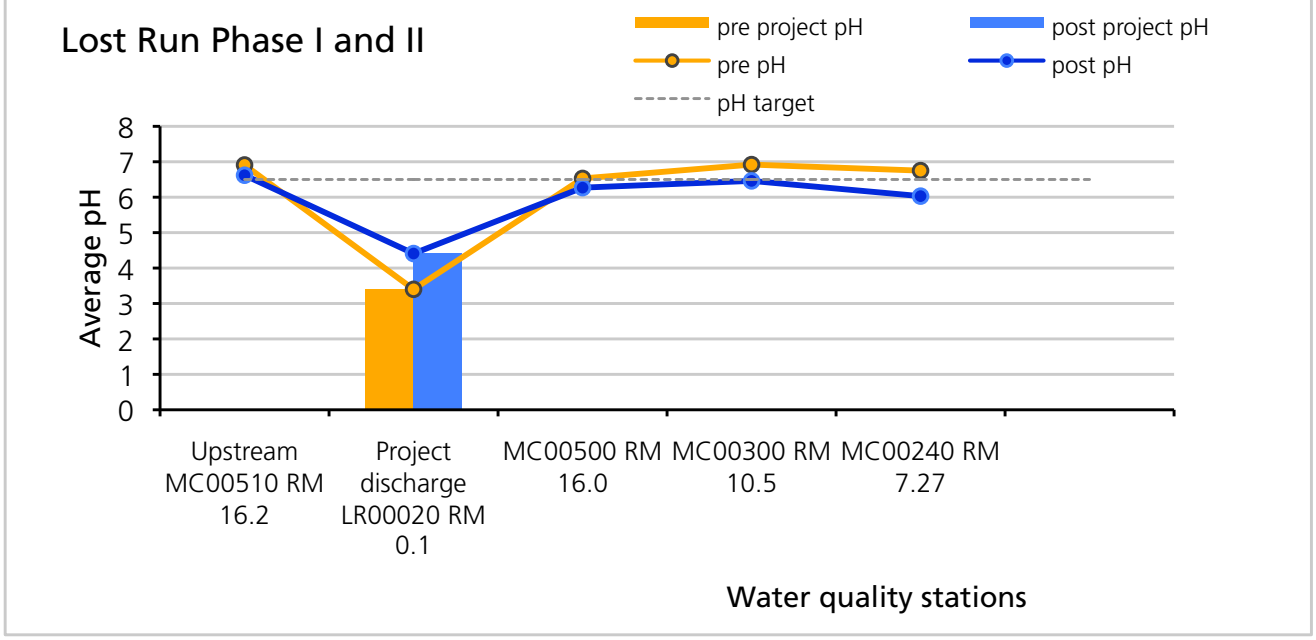
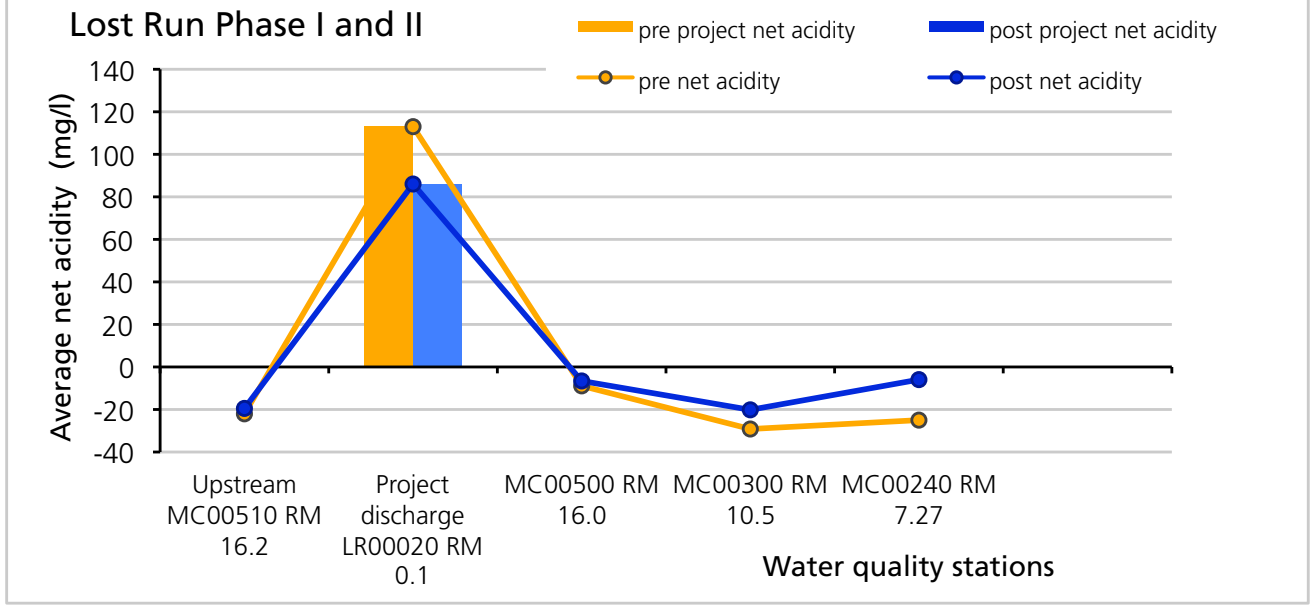


Figure 2. Pre and Post Acidity



2009 NPS Report - Monday Creek Watershed - Lost Run Phase II

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Water Quality – load reductions

Using the Mean Annual Load Method (Stoertz, 2004), acid and metal load reduction occurring at this project were plotted and shown in Figure 3 and 4. Acidity, iron, aluminum and discharge were measured pre-, and post-construction at the project discharge from 3/21/2005 to 6/20/2007 for pre-construction and from 1/1/2008 to 12/31/2009 for post-construction. *Stoertz, Mary W. and Douglas H. Green, 2004. Mean Annual Acidity Load: A Performance Measure to Evaluate Acid Mine Drainage Remediation. Ohio Department of Natural Resources Conservation and Restoration Innovations 2004 Applied Research Conference at Ohio University.*

Figure 3. Acid Load Reduction

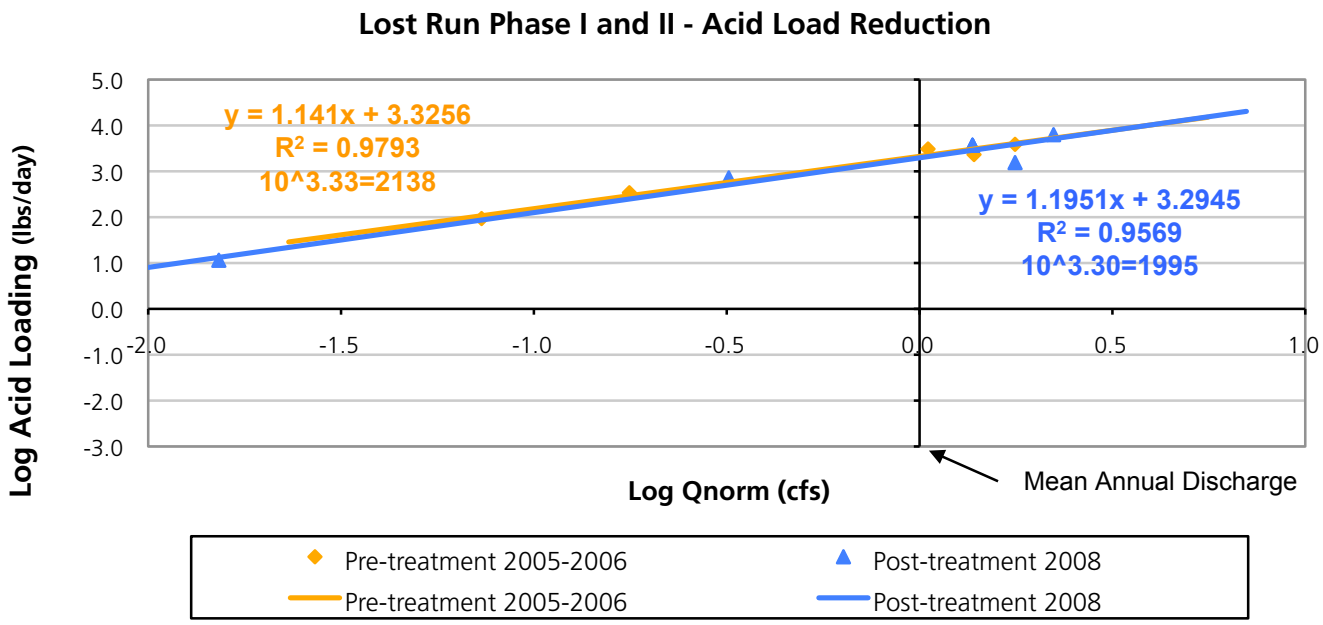
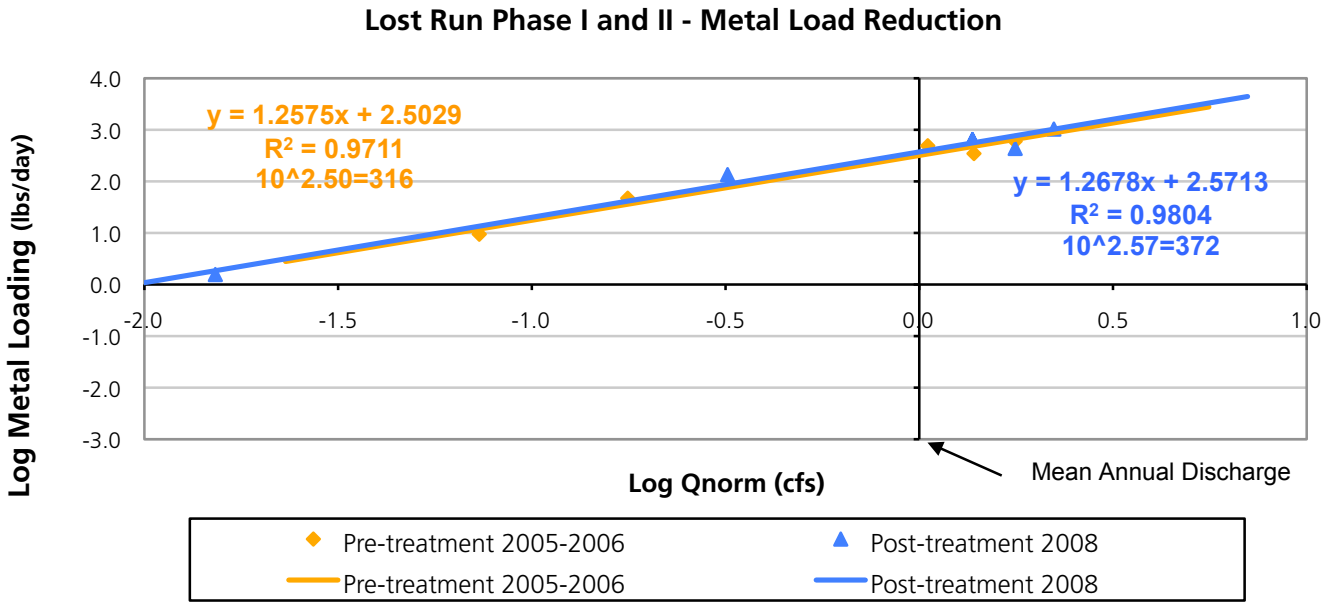


Figure 4. Metal Load Reduction



Similar to other environmental best management practices (BMPs), performance of acid mine drainage reclamation projects are also expected to decline with time. Currently, operation and maintenance plans are being designed for each existing system and for future projects. Figure 5 and 6 show the mean annual acid and metal load reduction (Stoertz, 2004) for each year (or group of years) during post-construction from the project effluent. These graphs show the rate of decline (and/or improvement) with time in the performance of the treatment system. Knowing this rate of decline will aid in the implementation of operation and maintenance plans for each site. Yearly load reductions are plotted and shown in Figure 5 and 6.

Figure 5. Yearly Acid Load Reduction

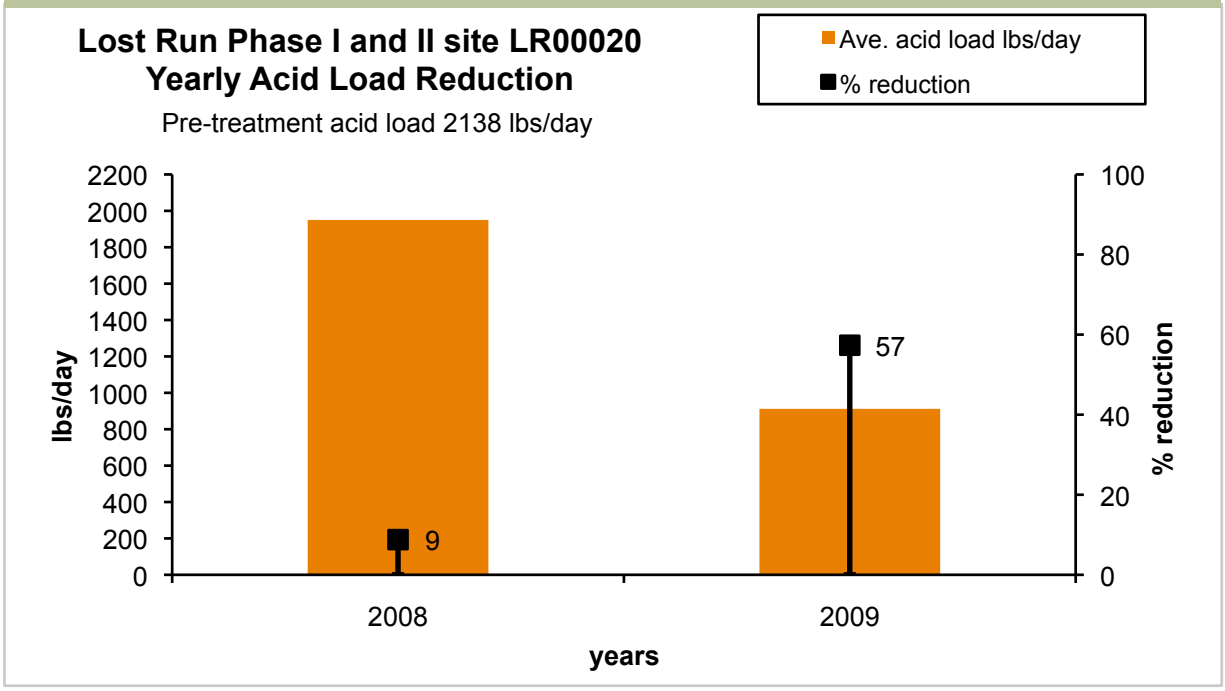
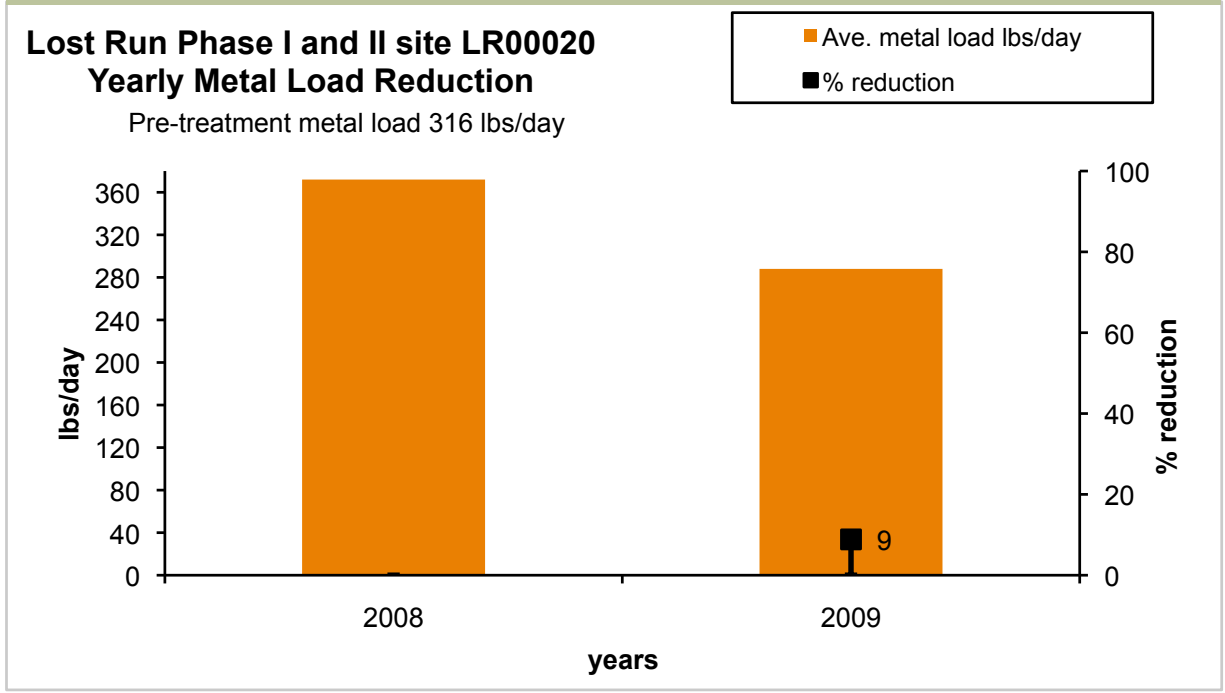


Figure 6. Yearly Metal Load Reduction



2009 NPS Report - Monday Creek Watershed - Shawnee Steel Slag Bed

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Completed 9/23/2008 ODNR Project Number: PR-SL-19

Pre-construction

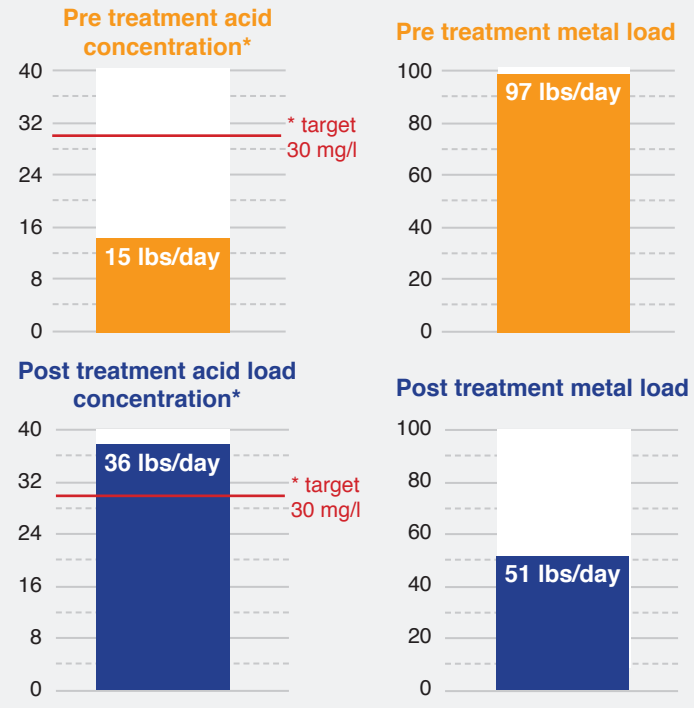
Shawnee Waste Water Plant,Photo by Monday Creek Restoration Project

Post-construction

Shawnee Waste Water Plant Post construction Photo by Monday Creek Restoration Project

Shawnee Steel Slag Bed is located in Section 17 of Salt Lick Township in Perry County and lies within the 14 digit HUC unit #05030204060020. Shawnee Steel Slag Bed reclamation project consists of constructing a steel slag leach bed at the effluent from the Shawnee waste water treatment plant to add alkalinity to Monday Creek. The design was completed by Ohio Department of Natural Resources Division of Mineral Resources Management ($20,000). The treatment consists of one 22,800 square foot steel slag bed, 190 linear feet of open limestone channel, and a sand filter to collect suspended solids and algae before entering the steel slag bed. The goal of the design is to boost net alkalinity on the mainstem to meet an alkalinity target of 30 mg/l and maintain a pH in the 6-9 range for approximately four miles downstream (Figure 1 and 2). Although the goal of this project is to add alkalinity to Monday Creek, reductions in metal loadings were observed (46 lbs/day) (Figure 3). Construction was complete 9/23/2008 by Tucson, Inc, for a cost of $199,791. The funding sources for this project was ODNR-DMRM for the design and Ohio EPA 319, ODNR-DMRM, and MCRP for construction.

Site: MC00900



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

2009 NPS Report - Monday Creek Watershed - Shawnee Steel Slag Bed

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Water Quality Report

Water quality data was collected at the project discharge as well as multiple stations pre-construction. The graphs below show changes in pH (Figure 1) and acidity (Figure 2) along the mainstem of the receiving stream upstream and downstream of the project discharge as a result of the AMD reclamation project.

Data from the Shawnee Steel Slag Bed Reclamation project pre-construction monitoring show pH and net acidity at project discharge and along the mainstem of Monday Creek, shown above. Pre-construction data shows pH in the range of 6.5 to 6.7 and net alkaline conditions in the range of 14 to 19 mg/l at the effluent and downstream of the project on Monday Creek. Post-construction data shows pH in the range of 6.6 to 6.9 and net alkaline conditions continue to rise in the range of -29 to -36 mg/l at the effluent and downstream of the Shawnee SLB project, thus meeting the project goal with pH values between 6 and 9 and alkalinity concentrations of 30 mg/l.

Figure 1. Pre and Post pH

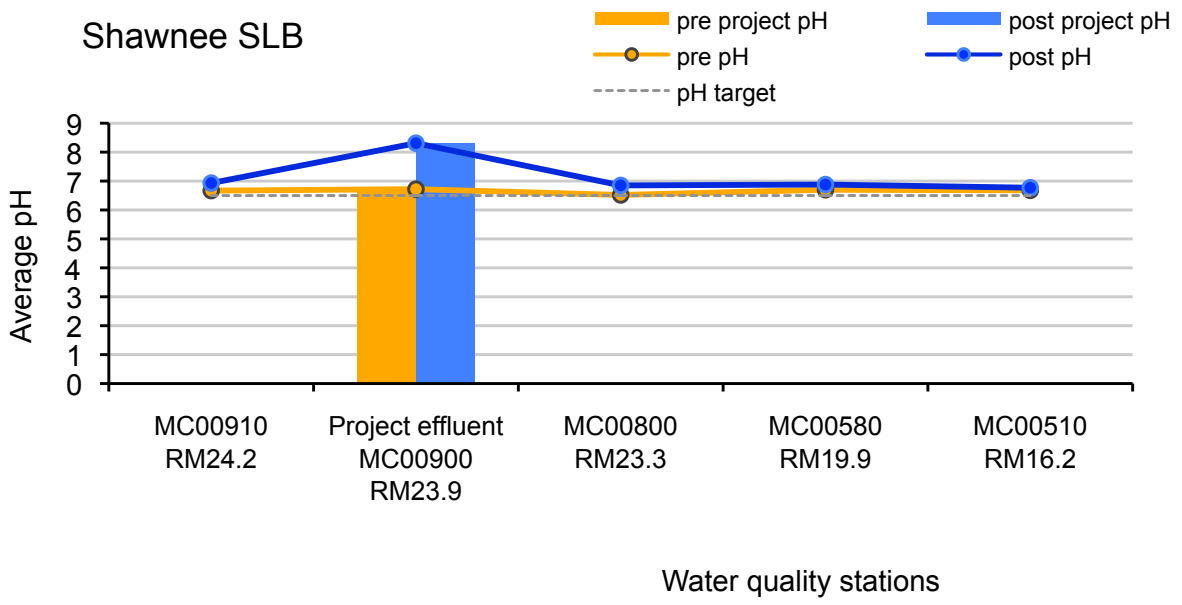
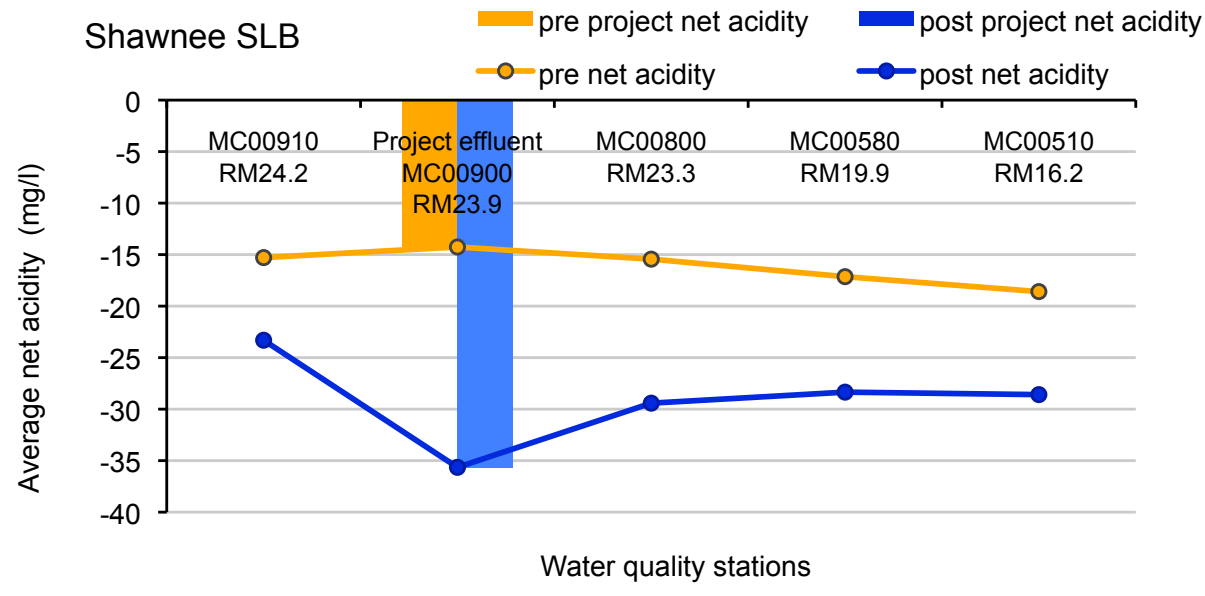


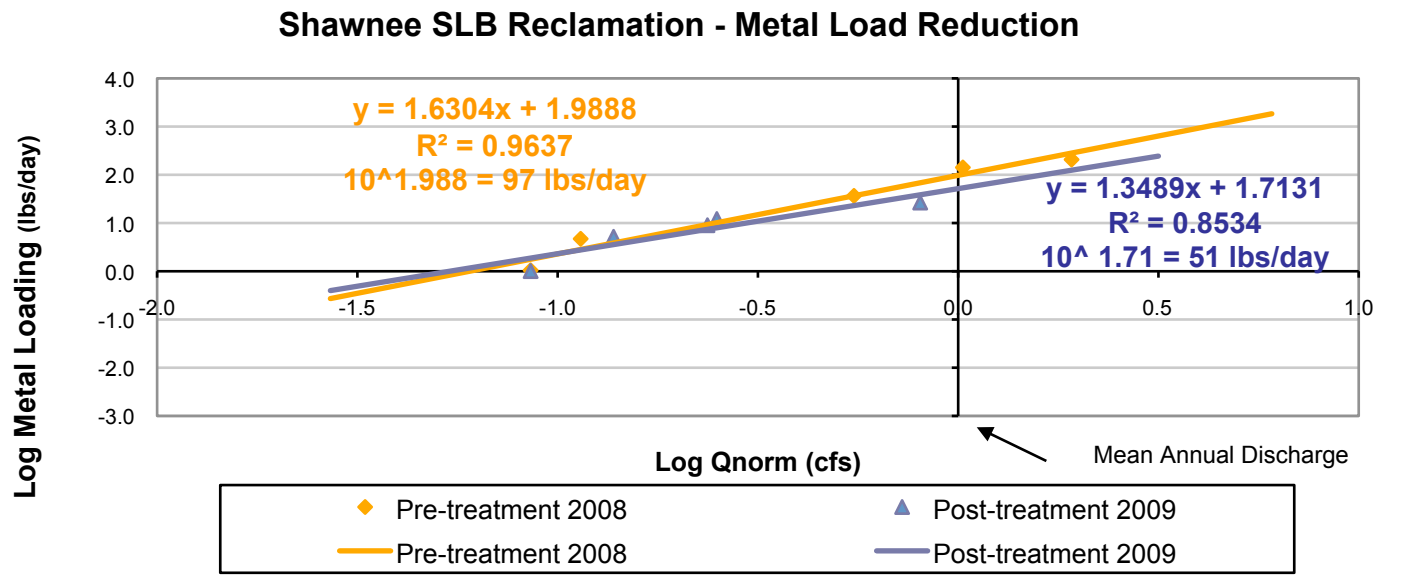
Figure 2. Pre and Post Acidity



Water Quality – load reductions

Using the Mean Annual Load Method (Stoertz, 2004) acid and metal load reduction occurring at this project were plotted and shown in Figure 3 and 4. Acidity, iron, aluminum, and discharge were measured pre-construction at the project effluent from 2/04/2008 to 9/23/2008 for pre-construction and from 3/31/2009 to 12/31/2009 for post-construction.

Figure 3. Metal Load Reduction



2009 NPS Report - Monday Creek Watershed - Lost Run Subsidence and Portal Closures

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Completed 2007 ODNR Project Number: AG-55N9-C-07-0002

In-progress

Lost Run Subsidence (site CDE) in-progress closure
Photo by: Mike Grebeck

In-progress

Lost Run subsidence (site CDE) closed. OLC in progress.
Photo by: Mike Grebeck

Lost Run Subsidence and Portal Closures are located in Section 33 of Coal Township in Perry County and lies within the 14 digit HUC unit #05030204060010. The site footprint is approximately 250 acres and is located in the Lost Run subwatershed a tributary to Monday Creek. The Wayne National Forest partnered with the Monday Creek Restoration Project and the ODNR-DMRM to close ten subsidence and portal features in this subwatershed. The design was completed by USFS engineers for approximately $7,000. The treatment approach was to seal the mine entries to keep water on the surface and for safety purposes. The goal of the design was to keep water out of the underground mine complexes, eliminating the generation of acid mine drainage. Approximately 100 acres of drainage area were restored from captures and 3,280 linear feet of limestone channels were installed. During the design process two additional holes opened up, engineers changed the design to allow for additional work. By closing these ten features, 100- acre drainage area was restored, allowing clean surface water to return to Lost run and decrease 35,000,000 gallons/ yr of water from entering the deep mine and becoming acid mine drainage at deep mines discharges in Lost Run and Sycamore Hollow. The project goal was met by 100 percent. Construction was complete November 1, 2007 by D. J. Group for a cost of $321,900. The major responsibility of the construction company was to perform tasks outlined in the plans and specifications to close all subsidence and portals. The funding sources for this project were for both the design and construction was the USFS.

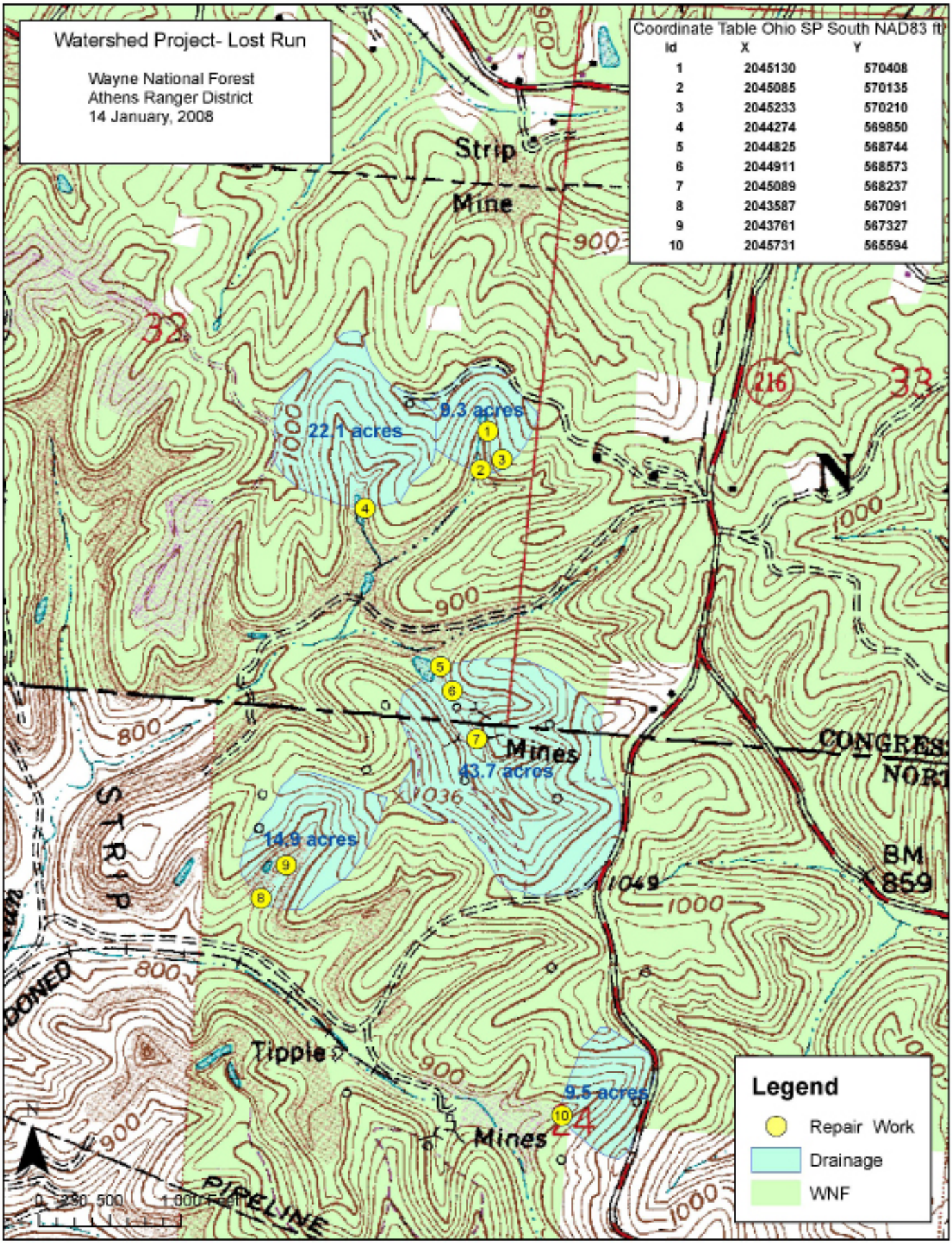
Post-Construction Estimated Effects

Amount of water returned to the stream and diverted from entering the deep mine and generating acid mine drainage

Gallons/yr = 35,000,000

2009 NPS Report - Monday Creek Watershed - Lost Run Subsidence and Portal Closures

Generated by Non-Point Source Monitoring System
www.watersheddata.com



Section III – AMD project reports

Sunday Creek Watershed comprehensive acid mine drainage projects progress report for 2009.

Section III contains individual AMD project reports displaying photos of the project site, a description of the project, water quality data at the site and its impact to the receiving stream, and acid/metal loading reductions as a result of the project.

List of acid mine drainage reclamation projects reported on in the 2009 NPS monitoring report:

1. Rodger's Hollow Stream Capture
2. Pine Run Stream Capture
3. Little Hocking
4. West Branch Headwaters

Archived

5. Congo Run Stream Capture (CR-15)* archived in 2009
6. Corning Gob Floodplain* archived in 2009

* "Status Completed" projects are no longer being monitored

2009 NPS Report - Sunday Creek Watershed - Rodgers Hollow Stream Capture

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 12/14/2007 ODNR Project Number: PR-Mn-16

Pre-construction

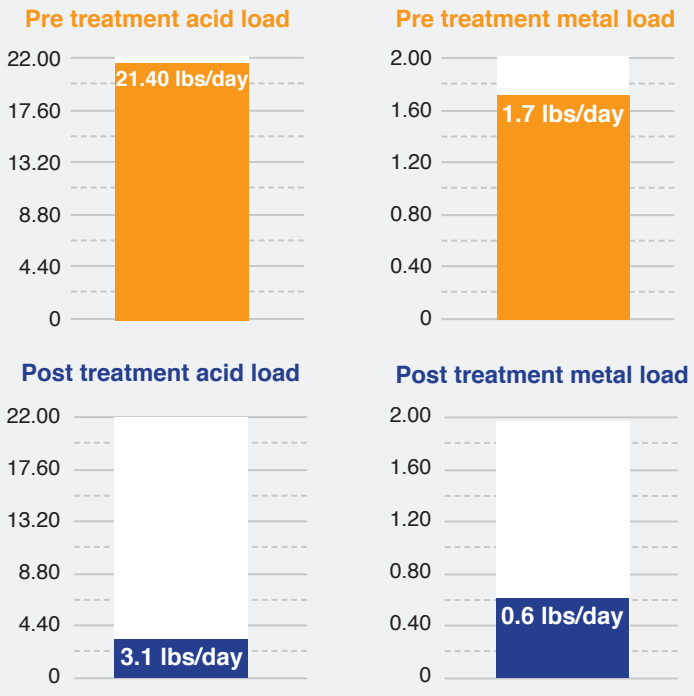
One of Rodger's Hollow primary stream captures during wet conditions, Photo by Sunday Creek Watershed Group

Post-construction

Completed natural channel stream, Photo by Kaabe Shaw

Rodger's Hollow Stream Capture is located in Section 17 of Monroe Township in Perry County and lies within the 14 digit HUC unit #05030204070030. The site is located in Congo Run subwatershed north of Drakes. There are two primary and four secondary stream captures. The design was completed by Fuller, Mossbarger, Scott, May Engineers, Inc. for a cost of $109,725. The treatment approach was to close primary and secondary stream captures and divert the channel, using natural stream design concepts (900 linear feet), away from the existing location which is an unstable abandoned coal pit along a highwall as well as add 879 linear feet of open limestone channels. Currently 1,600 acres (2.5 square miles) of surface water drains into the deep mine complex creating acid mine drainage at down-dip seep discharges in Drakes (WB 49 and 49/36). The goal of the design is to return 100 percent of stream water back into Congo Run thus adding alkalinity to Rodger's Hollow/Congo Run and reducing acid mine discharges in Drakes. Construction was completed December 14, 2007 by Tucson Inc. for $266,826. The funding source for the project design was ODNR-DMRM and construction was OEPA 319. Figures 4 and 5 (shown on page 3 of this report) estimate approximately 18 lbs/day of acid and 1.1 lbs/day of metals were reduced from entering West Branch of Sunday Creek from Drakes seep WB 49 as a result of the subsidence closures in the up-dip adjacent Rodgers Hollow. Reduction of acid and metals from the Drakes wetlands (site 36 and 49/36) has not been documented due to changes in flow route. However, WB 49 is seen as the primary source of AMD in Drakes and has seen a 63% reduction in flow following the subsidence closures. In addition Congo Run the receiving stream from the Rodgers Hollow project as expected has seen, on average, an increase in pH from 6.71 to 6.96, a decrease in net acidity from -39.01 to -47.35 mg/l and an increase in flow from 0.69 to 1.30 cfs.

Site: WB 49



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

Post-Construction Estimated Effects

Expected amount of water to return to the stream and be diverted from entering the deep mine generating acid mine drainage is:

Gallons/yr = 589,290,000

Expected amount of alkalinity loading added to the streams providing buffering capacity to the watershed:

Alkalinity load = 758 lbs/day

2009 NPS Report - Sunday Creek Watershed - Rodgers Hollow Stream Capture

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Water quality report

Water quality data was collected at the suspected AMD discharge as well as multiple stations pre and post construction. The graphs below show changes in pH (Figure 1) and acidity (Figure 2) along the mainstem of West Branch in Drakes. This stream was been monitored because of its possible connected to the Rodgers Hollow deep mine where the subsidence closures were constructed.

Data analysis

Rodgers Hollow subsidence closure project monitoring along the West Branch of Sunday Creek in Drakes show pH and net acidity upstream, at the Drakes Seep WB 49, and along the mainstem of West Branch downstream of the seep discharge. Pre-construction data show pH in the range of 3.8 to 6.95, at the AMD discharge and downstream. Post-construction data show pH in the range of 3.96 to 6.61. Net acidity has decrease at the Drakes Seep by 18% and flow has decreased by 63%.

Figure 1. Pre and Post pH

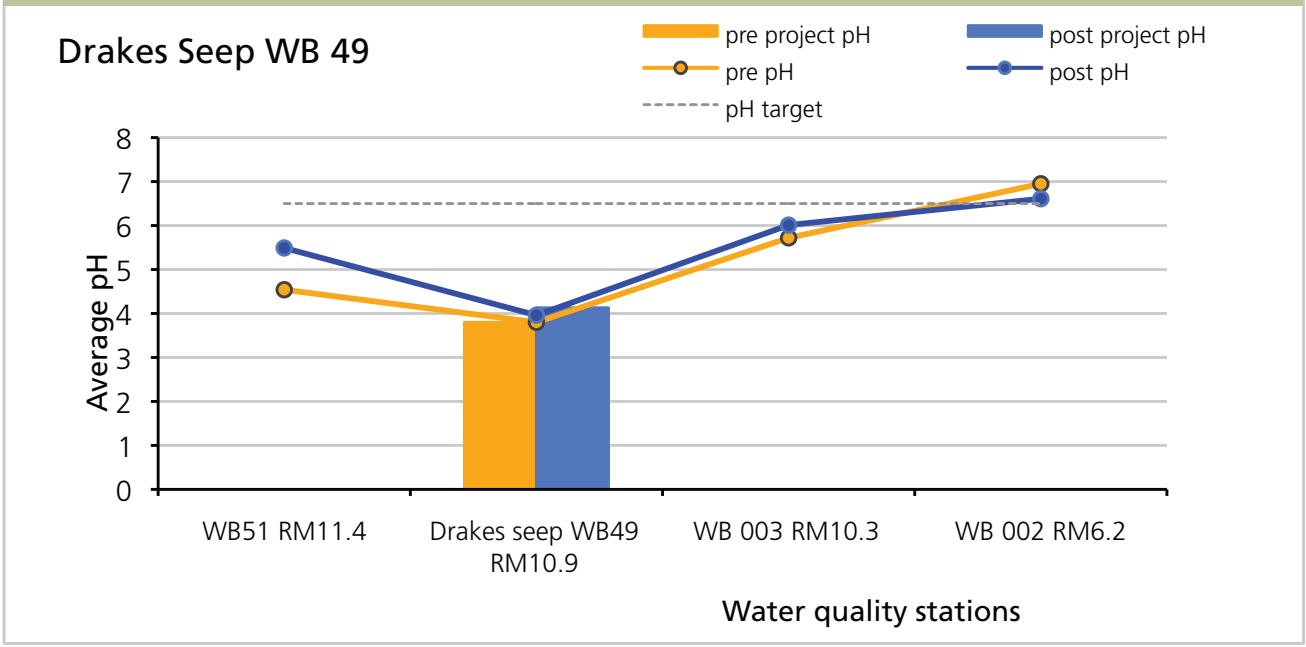
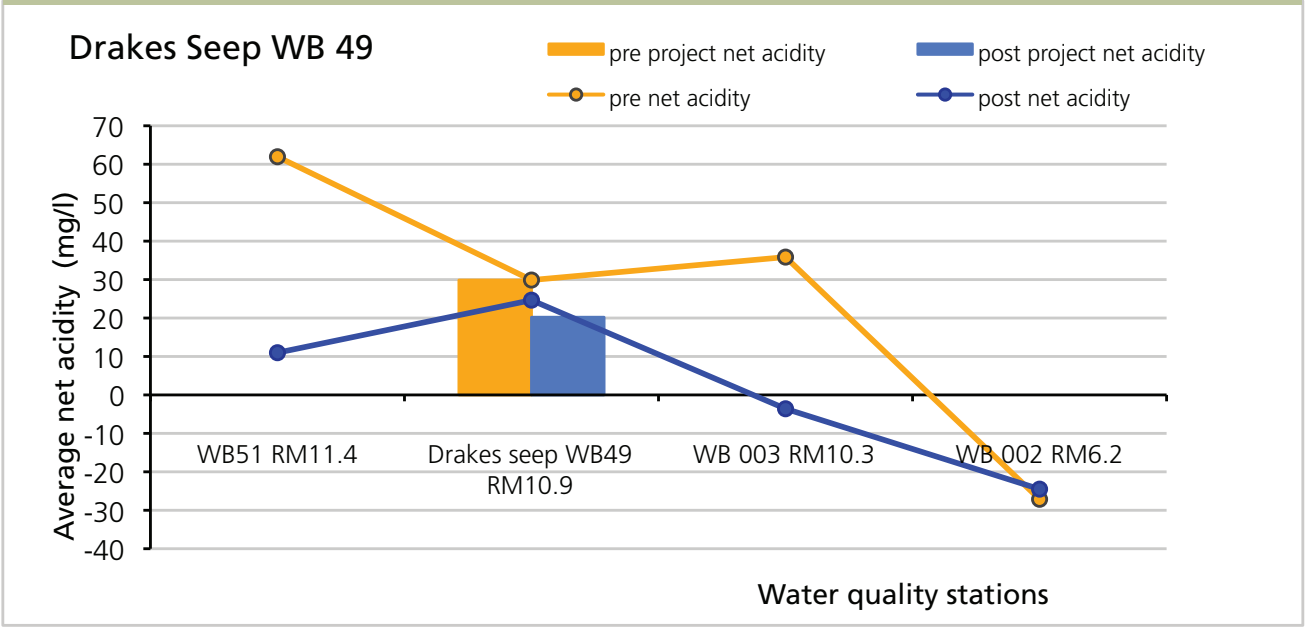


Figure 2. Pre and Post Acidity



Water Quality – load reductions

Using the Mean Annual Load Method (Stoertz, 2004) acid and metal load reduction occurring at this project were plotted and shown in Figure 3 and 4. Acidity, iron, aluminum and discharge were measured pre- construction at the project discharge from 4/24/2001 to 1/29/2009 for pre-construction and 1/15/2008 to 12/31/2009 for post-construction.

As expected a substantial difference in discharge has been recorded at the Drakes Seep site WB49 from pre-subsidence closure to post-closure in Rodger's Hollow. Therefore, when determining the mean annual average discharge for this site for use in the "Mean Annual Acidity Load" calculation, the mean annual discharge was determined separately for each time period (pre-closure 0.16 cfs, post-closure 0.04 cfs).

Figure 3. Acid Load Reduction

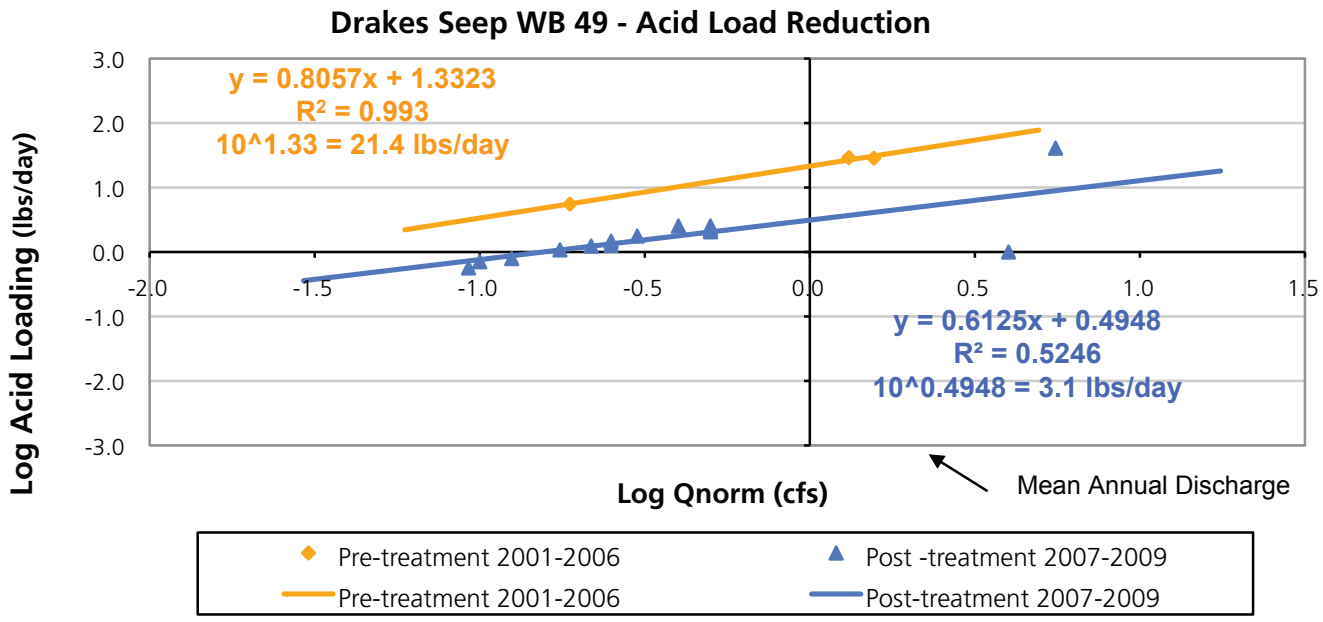
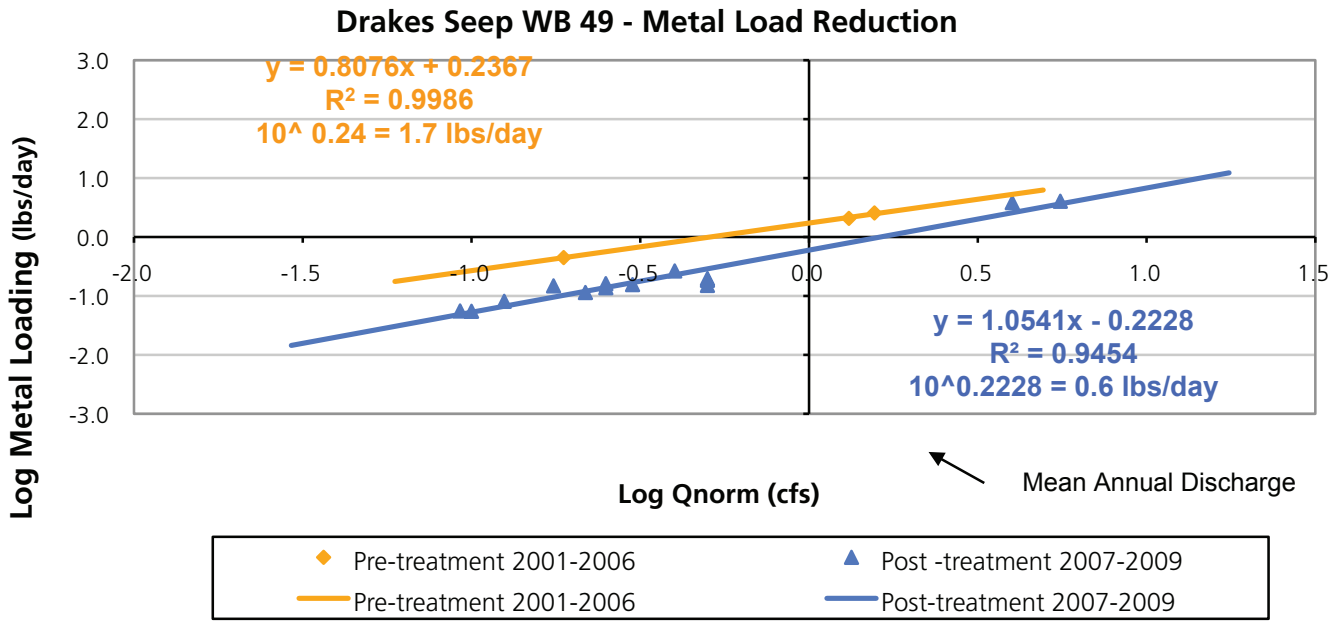
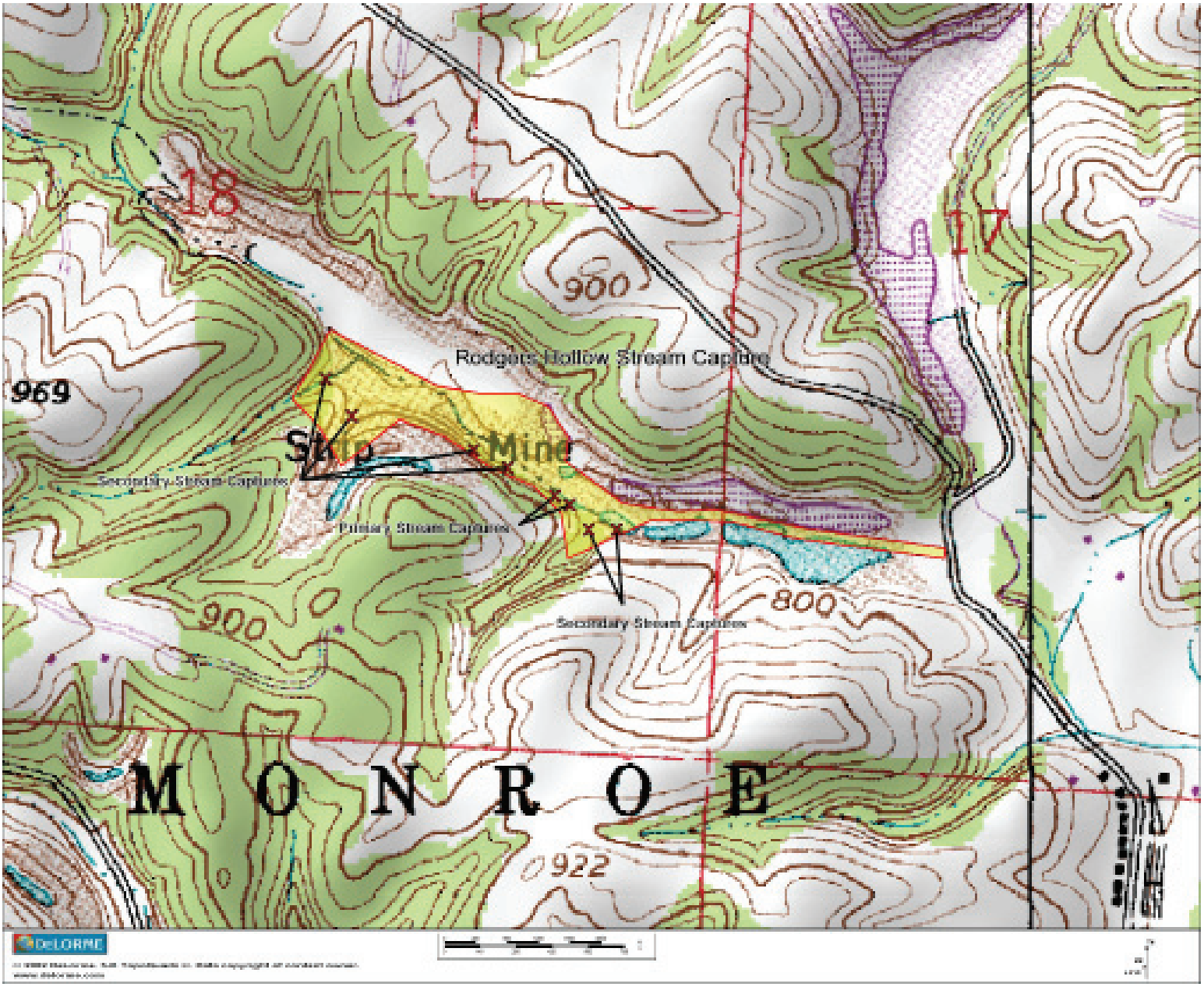


Figure 4. Metal Load Reduction



2009 NPS Report - Sunday Creek Watershed - Rodgers Hollow Stream Capture

Generated by Non-Point Source Monitoring System
www.watersheddata.com



2009 NPS Report - Sunday Creek Watershed - Pine Run Stream Capture

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 4/30/2007 ODNR Project Number: PR-SI-15

Pre-construction

Pine Run Subsidence under wet conditions
Photo by Sunday Creek Watershed Group

Post-construction

Pine Run newly constructed channel
Photo by Sunday Creek Watershed Group

Pine Run Stream Capture is located in Section 14 of Salt Lick Township in Perry County and lies within the 14-digit HUC unit #05030204070030. The site is located in Pine Run subwatershed near Sulphur Springs. There are three subsidence features at the project site. Of the three subsidence features one is a stream capture, while the other two features occur in the valley floor rather than the stream bed, therefore only capturing water during high flow events. Aside from the subsidence caused from the underground mines several seeps also occur including one at the main drift entrance of the mine and an exposed coal that was disturbed when the road was built. The design was completed by ODNR-DMRM for a cost of $36,544. The treatment approach is to create a natural stream channel for fresh water, divert flow into a new channel and to close stream captures and subsidence features to reduce flow into the deep mine. Currently 138 acres of surface water drains into the deep mine complex creating acid mine drainage that discharges, down-dip at mine portals and seeps. The goal of the design is to prevent stream flow into the mine complex Py-76 to reduce flow at down-dip discharges and add alkaline water into Pine Run. Major considerations for this design were to minimize impact to large trees, use a natural stream design and minimize impact on a county road. The construction for this project was completed by Maiden and Jenkins for a cost of $71,981 The major responsibility of the construction company was to close three subsidence features and create natural channel for positive drainage to Pine Run. The funding sources for this project are ODNR-DMRM for design and OEPA 319 and ODNR-DMRM for construction.

Post-Construction Estimated Effects

Expected amount of water to return to the stream and divert from entering the deep mine and generating acid mine drainage is:

Gallons/yr = 50,867,000

Expected amount of alkalinity loading added to the streams thus providing buffering capacity to the watershed is:

Alkalinity load = 46 lbs/day

2009 NPS Report - Sunday Creek Watershed - Pine Run Stream Capture

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Water Quality Report

Water quality data was collected at multiple stations pre and post construction. The graphs below show changes in pH (Figure 1) and acidity (Figure 2) along the mainstem of the receiving stream upstream and downstream of the project discharge as a result of the AMD reclamation project.

As a result of the Pine Run stream capture project, an estimated 50,867,000 gallons/year will be diverted into Pine Run and not into the deep mine Py-76. A slight increase in pH and alkalinity have been measured downstream of the project tributary since last years' report. Pre-construction data shows pH in the range of 4.16 – 6.4 downstream of the project. After closure of the subsidence holes and returning water in Pine Run, post-construction data shows pH in the range of 4.2-6.4 downstream of the project. PR003 is a seep thought to be linked to the py-76 mine complex, pH slightly increased from 4.13 (n:23) to 4.35 (n:17) as well as a slight decrease in flow from 0.30 cfs to 0.23 cfs. Net acidity decreased at the site PR003 see figure 3 and 4, net acidity loading decreased 78 lbs/day, while metals showed a 12 lbs/day decrease.

Figure 1. Pre and Post pH

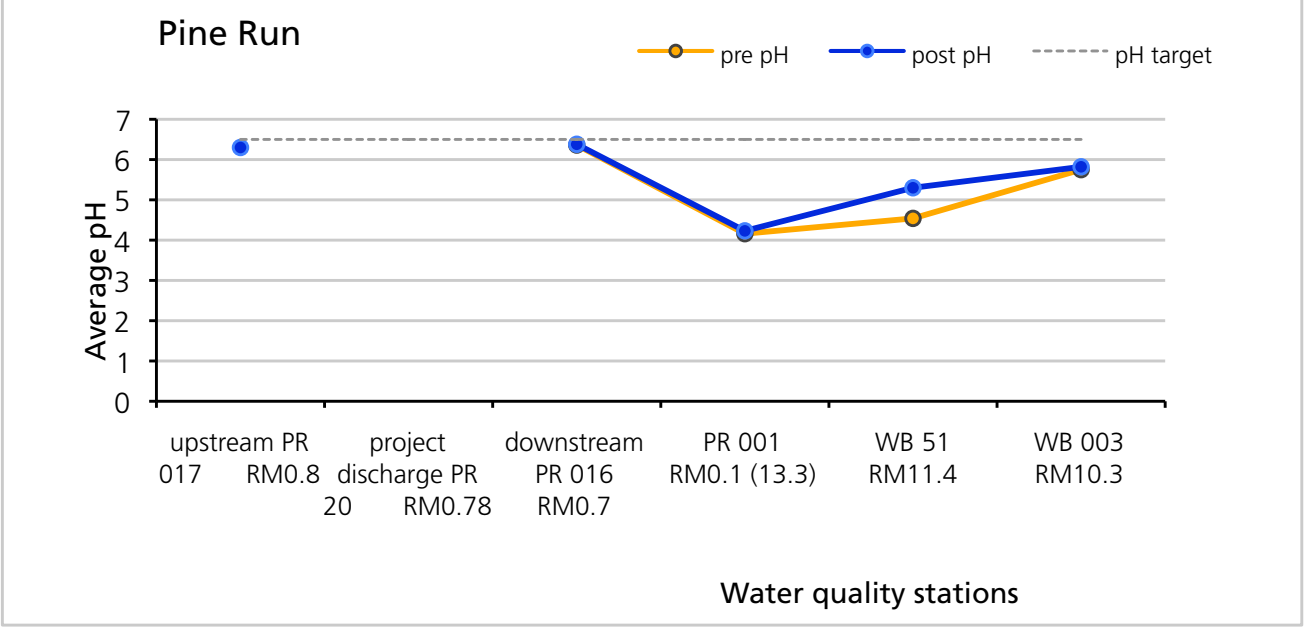
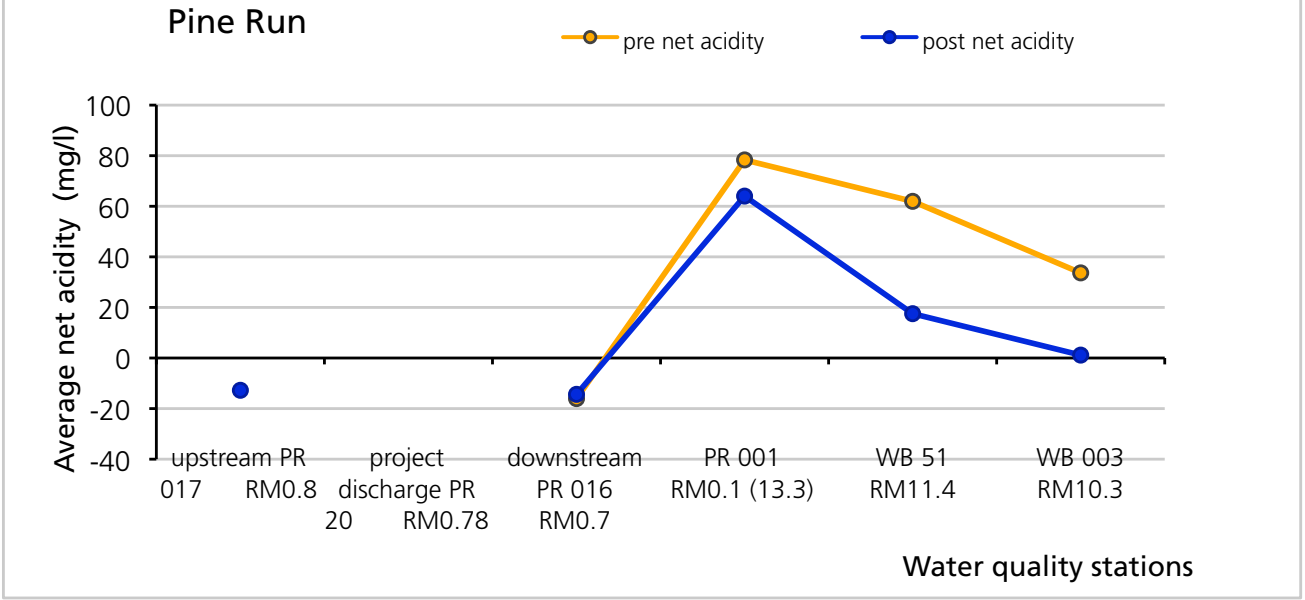


Figure 2. Pre and Post Acidity



2009 NPS Report - Sunday Creek Watershed - Pine Run Stream Capture

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Water Quality – load reductions

Using the Mean Annual Load Method (Stoertz, 2004) acid and metal load reduction occurring at this project were plotted and shown in Figure 3 and 4. Acidity, iron, aluminum and discharge were measured pre- and post-construction at site PR003 thouth to be linked to deep mine complex Py–76 from 1/1/2001 to 4/30/2007 for pre-construction and from 5/1/2007 to 12/31/2009 for post-construction.

Figure 3. Acid Load Reduction

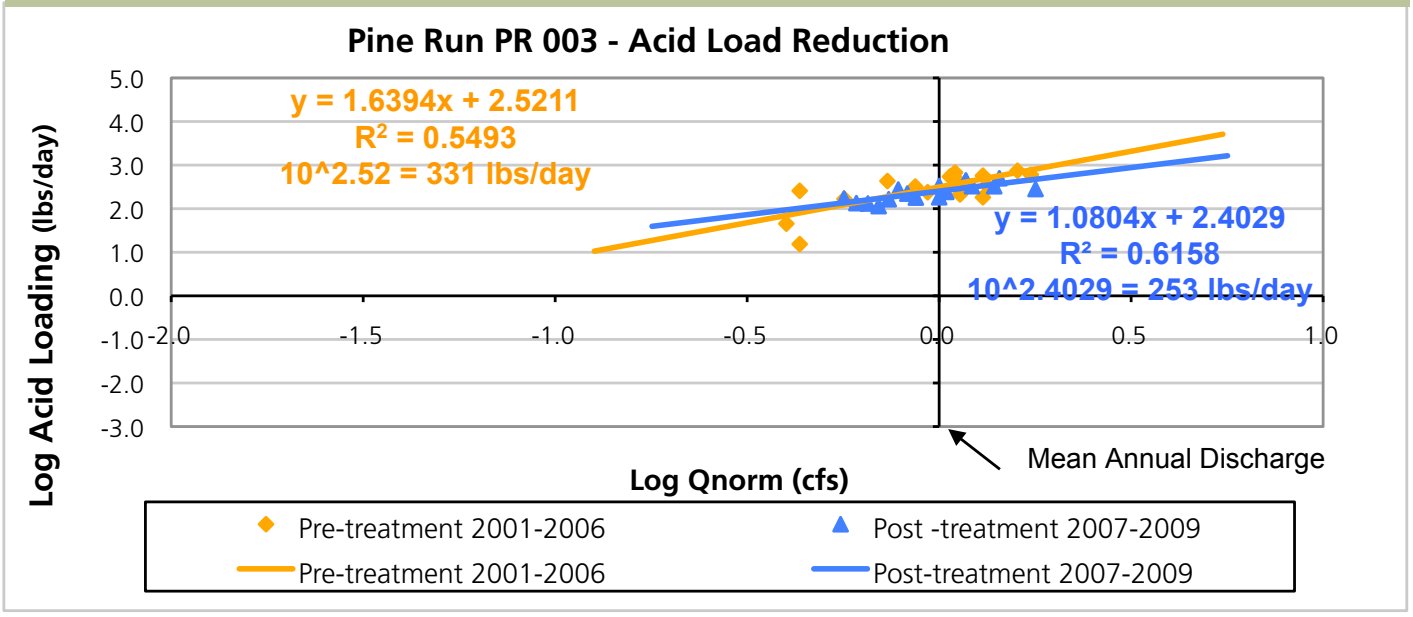
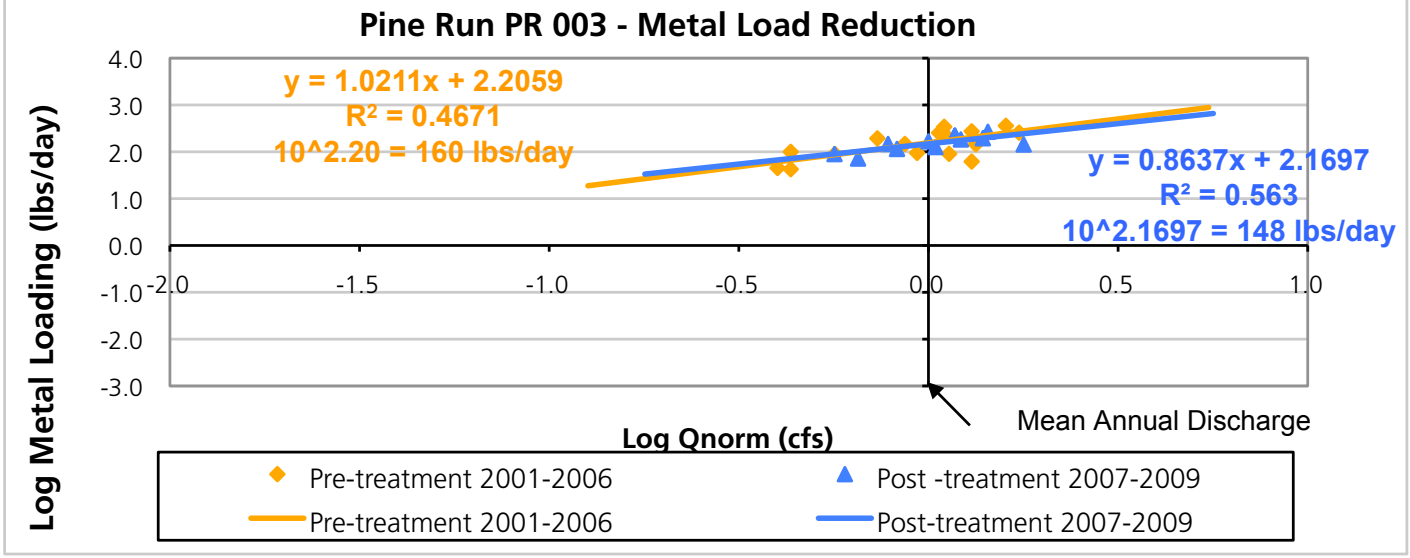
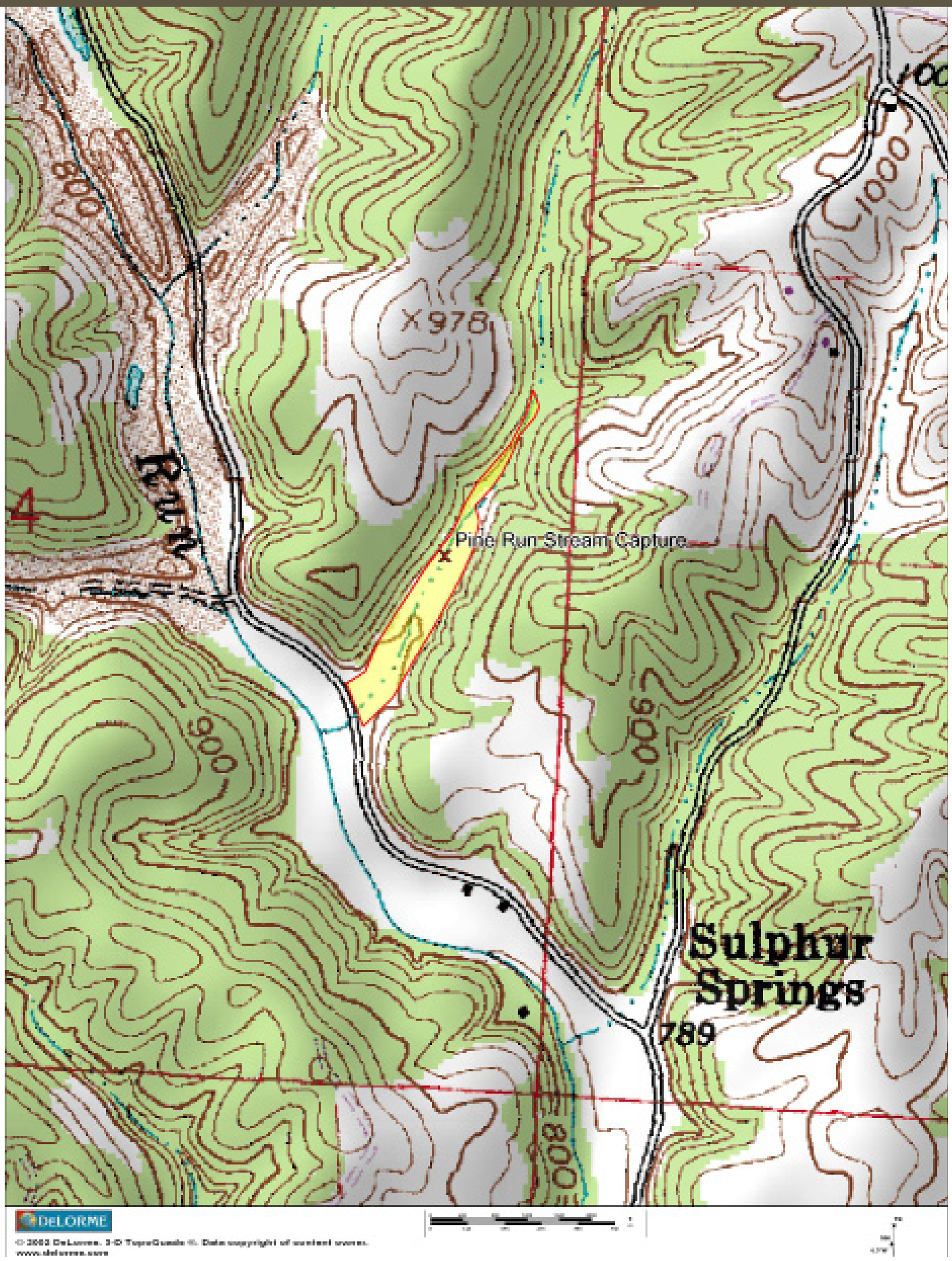


Figure 4. Metal Load Reduction



2009 NPS Report - Sunday Creek Watershed - Pine Run Stream Capture

Generated by Non-Point Source Monitoring System
www.watersheddata.com



2009 NPS Report - Sunday Creek Watershed - Little Hocking Stream Capture CR 11

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 2009 ODNR Project Number: PR-Mn-17

Pre-construction

Primary stream capture, Sunday Creek Watershed Group

Post-construction

Closure of primary stream capture, Dave Agnor

Little Hocking stream capture CR-11 is located in Section 18 of Monroe Township in Perry County and lies within the 14-digit HUC unit #05030204070030. The site is located in the Congo Run sub-watershed near the town of Congo. It discharges into Congo Run on the back side of the strip ponds that make up the mainstem of Congo Run. Congo Run CR 11 consists of a large subsidence that captures the flow from an intermittent stream that drains approximately 0.4 square miles (286 acres). The treatment approach is to seal off the subsidence hole, create new channels to re-connect the headwater stream to the receiving stream. Thus preventing a net alkaline stream from entering the abandoned mine complex via the subsidence feature. The design was completed by ODNR-DMRM for a cost of $194,565. The treatment consisted of 964 linear feet of limestone channel and 286 acres of restored stream capture area. The goal of the design was to eliminate net alkaline water from entering the abandoned mine complex and re-connect the stream to Congo Run, add alkalinity. Construction was complete in December of 2009 by Tucson, Inc. for a cost of $227,791. The funding sources for this project were ODNR/DMRM set-aside funds and OSM direct grant for the design and OSM Clean Streams Initiative and ODNR-DMRM for construction.

Post-Construction Estimated Effects

Expected amount of water to return to the stream and divert from entering the deep mine and generating acid mine drainage is:

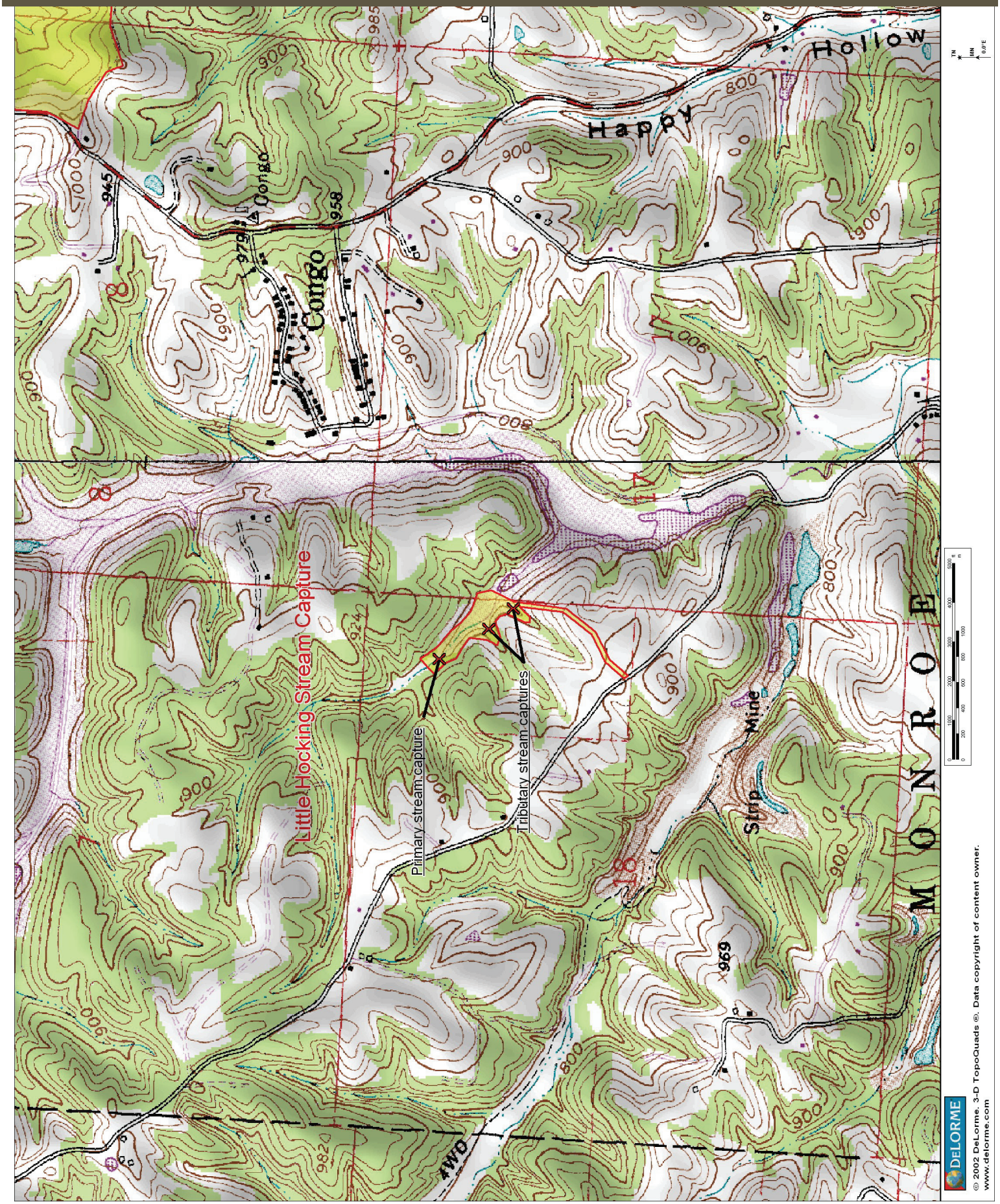
Gallons/yr = 105,400,00

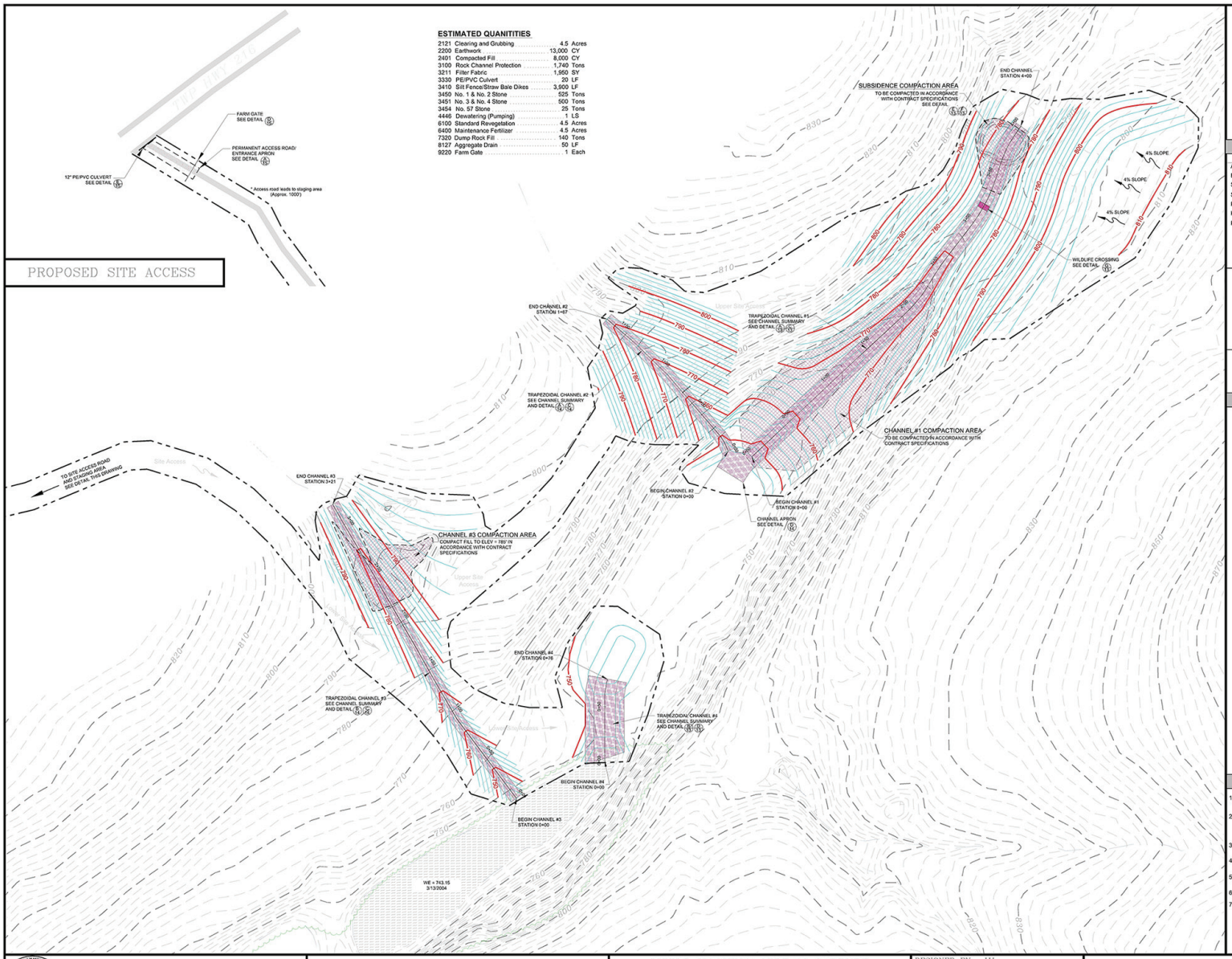
Expected amount of alkalinity loading added to the streams thus providing buffering capacity to the watershed is:

Alkalinity load = 122 lbs/day

2009 NPS Report - Sunday Creek Watershed - Little Hocking Stream Capture CR 11

Generated by Non-Point Source Monitoring System
www.watersheddata.com





UTILITY INFORMATION

COMPANY NAME	UTILITY	PHONE	MEMBER
AEP Ohio Power	Electric		OUPS
Burr Oak Water	Water		OUPS
Southern Perry Water	Water		OUPS
SBC	Phone		OUPS
Portersville Water	Water	740-342-1290	NO
Ken Oil	Oil/Gas	330-263-7890	OGPUPS
Producers Gas Transmission	Oil/Gas	740-452-9326	OGPUPS

UNDERGROUND UTILITIES
TWO WORKING DAYS BEFORE YOU DIG
1-800-362-2764
OHIO UTILITIES PROTECTION SERVICE
NON-MEMBERS MUST BE CALLED-DIRECTLY

WARNING CALL BEFORE YOU DIG
OIL & GAS PRODUCERS UNDERGROUND PROTECTION SERVICE
CALL 1-800-925-0988

BAR SCALE 0' 40' 80' 120'

LEGEND

- EXISTING 10' CONTOUR
- EXISTING 2' CONTOUR
- PROPOSED 10' CONTOUR
- PROPOSED 2' CONTOUR
- CONSTRUCTION LIMITS
- TREE LINE
- STREAM

NOTES

1) Aerial mapping contours provided by P & L Systems, Inc., 171 Charring Cross Drive, Westerville, Ohio 43081. Phone (614) 891-4970. Aerial Photography Exposed 3/13/04.
2) Utility lines and appurtenances are shown as located in the field and/or as reported by the respective owners. Neither the number, type, size, or location can be guaranteed, and it is therefore, the responsibility of the Contractor to verify all utility locations.
3) Existing access roads within the construction limits shall be maintained in a condition that is equal to or better than before construction.
4) Sediment control will be placed on regraded slope areas concurrent with construction and prior to revegetation.
5) All disturbed areas will be protected from erosion and will be reclaimed in a contemporaneous fashion.
6) Additional silt barriers will be required in all areas where the Chief deems necessary.
7) Straw bale dikes will be placed side by side, where needed, if deemed necessary by the Chief.

DIVISION OF MINERAL RESOURCES MANAGEMENT ENGINEERING AND DESIGN SERVICES	STATE OF OHIO DEPARTMENT OF NATURAL RESOURCES	LITTLE HOCKING STREAM CAPTURE PERRY COUNTY, OHIO PROJECT NO. PR-Mn-17	DESIGNED BY: JJJ PROJECT OFFICER: WRJ DRAWN BY: BTA DATE: NOVEMBER 2008	PROPOSED SITE PLAN	4 / 15

2009 NPS Report - Sunday Creek Watershed - West Branch Sunday Creek Headwaters Phase I

Generated by Non-Point Source Monitoring System
www.watersheddata.com

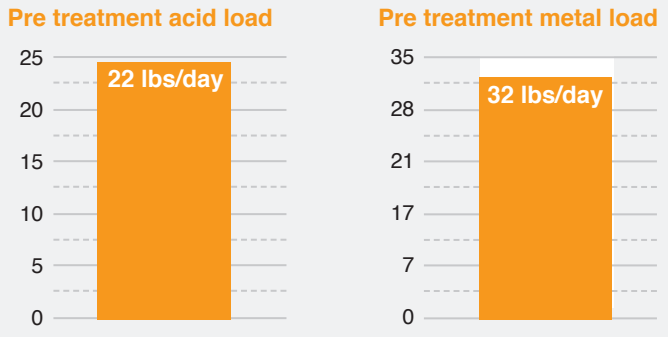
Project Status: Funded ODNR Project Number: Pr-SI-16

Pre-construction

Caption: 1.3 acre gob pile along West Branch Headwaters
Photographer: Dave Agnor, OSM

West Branch Headwaters Phase I is located in Section 24 of Salt Lick Township in Perry County and lies within the 14-digit HUC unit #05030204070030. The West Branch Headwaters (WBHW 03) meets with tributary Pine Run to form the West Branch of Sunday Creek at site WB004. The West Branch Headwaters (WBHW) project area consists of several subsidence features, gob and spoil piles (approx. 8 acres), one large deep mine discharge, and several smaller AMD seeps. The treatment approach for this project area has been split into two phases. Phase I will include approximately 2,200 linear feet of limestone channel for new drainage at the four subsidence features, additional earthwork will reclaim one acre of gob, seven acres of spoil, two acres of pit impoundments, and 1,200 linear feet of highwall. The design was completed in-house by ODNR-DMRM. The goal of the design for phase I will reduce the amount of AMD being produced while the final phase will add alkalinity and reduce acidity being discharged at the five AMD discharge locations. Construction is scheduled for 2010 by McMillan Inc. for a cost of $270,161.20. The funding sources for this project are ODNR/DMRM for the design and OSM Clean Streams and OEPA 319 grant for construction.

Site: WB004



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

Water Quality Report

Water quality data was collected at the project discharge as well as multiple stations pre construction. The graphs below show changes in pH (Figure 1) and acidity (Figure 2) along the mainstem of the receiving stream upstream and downstream of the project discharge.

Data analysis

West Branch Headwaters Phase I pre-construction monitoring was conducted for pH and net acidity upstream of the project area and along the mainstem of the West Branch Headwaters downstream of the project. Pre-construction data show pH in the range of 5.02 to 5.76, at the mouth and further downstream along the mainstem of West Branch of Sunday Creek. Post-construction data will be evaluated in the 2010 annual report.

Figure 1. Pre and Post pH

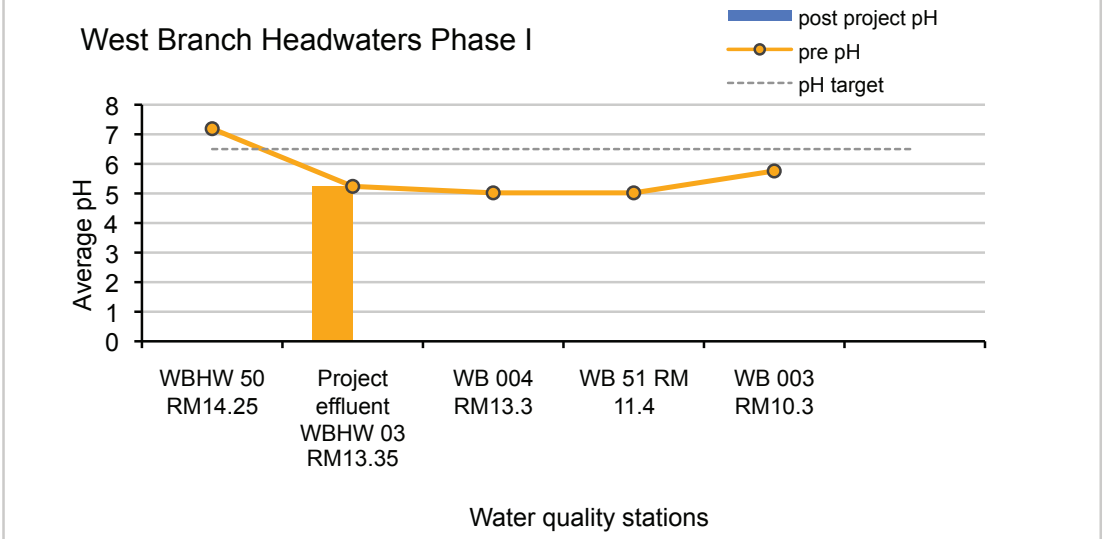
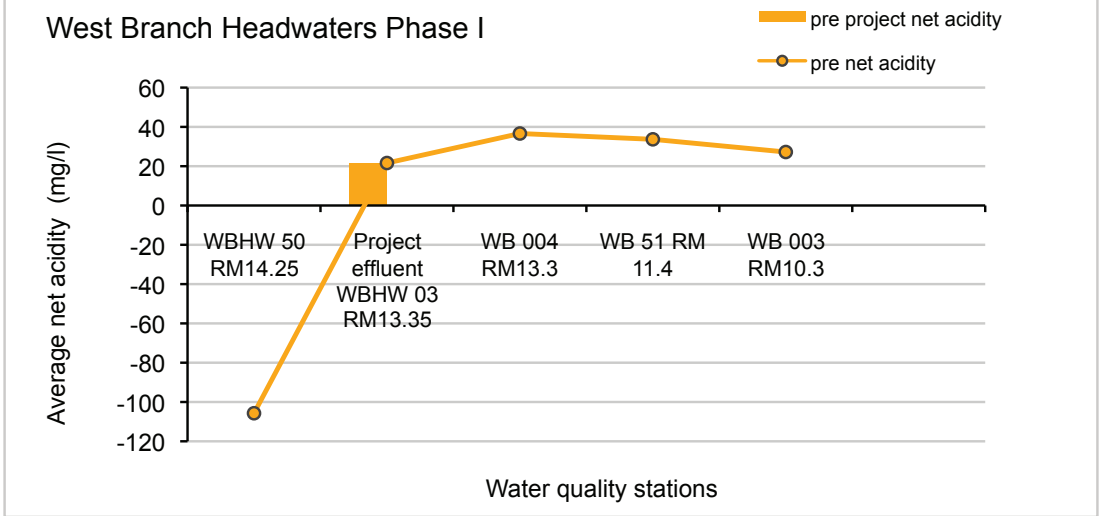


Figure 2. Pre and Post Acidity



2009 NPS Report - Sunday Creek Watershed - Congo Stream Capture *Archive*

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete 2004, Archive 2009 ODNR Project Number: PR-Mn-13

Pre-construction

Stream capture at highwall, Photo by Bill Jonard

Post-construction

New channel created above old stream capture, Photo by Bill Jonard

Congo Stream Capture (CR-15) is located in Section 17 of Monroe Township in Perry County and lies within the 14-digit HUC unit #05030204070030. The site is located in Congo Run subwatershed near the town of Congo. The deep mine opening and stream capture is located east of the Congo Strip Lakes and southwest of the town of Congo. The design was completed by ODNR-DMRM. The treatment approach was to seal the mine entry at the abandoned highwall and fill in the pit to allow the stream discharge, of the 72-acre drainage area, to reach Congo Run. The goal of the design was to close the stream capture hole and return 100 percent of the stream flow to Congo Run, thus allowing clean surface water to return to Congo Run and preventing 24 million gallons/yr of water from entering the deep mine and becoming acid mine drainage at surrounding deep mines discharges. The project goal was met by 100 percent. Construction was complete July 9, 2004, by Perry Reclaiming for a cost of $35,522.60. The major responsibility of the construction company was to perform tasks outlined in the plans and specifications to eliminate the stream capture and create a channel to carry flows to Congo Run. The funding sources for this project were ODNR-DMRM for the design and OSM-ACSI for construction.

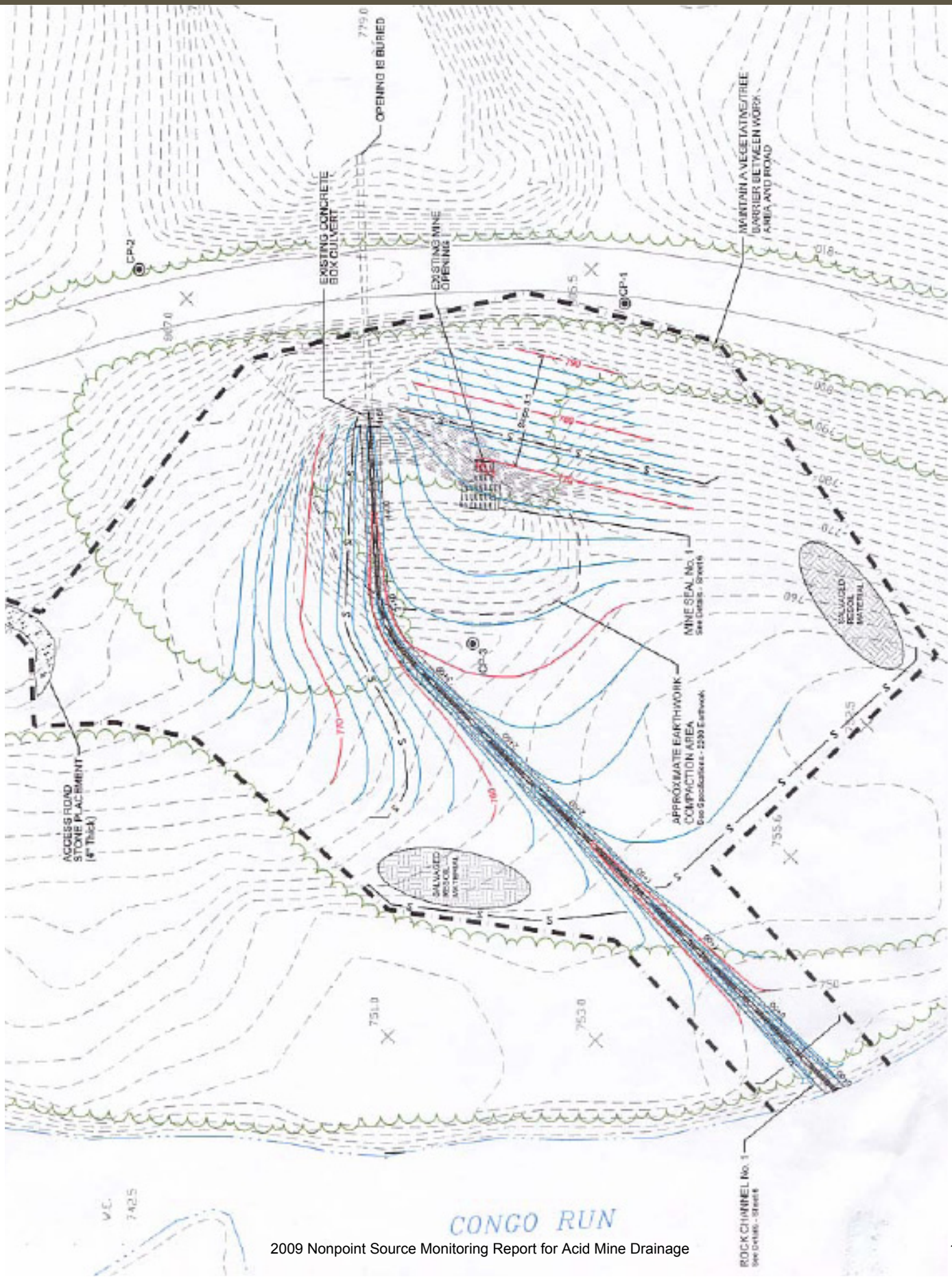
Post-Construction Estimated Effects

Estimated amount of water diverted from generateing acid mine drainage.

Gallons/yr = 24,000,000

Estimated amount of alkalinity loading added to the streams, thus providing buffering capacity to the watershed.

Alkalinity load = 60 lbs/day


OPENING IS BURIED
EXISTING CONCRETE BOX CULVERT
EXISTING MINE OPENING
MAINTAIN A VEGETATIVE/TREE BARRIER BETWEEN WORK AREA AND ROAD
CP-2
CP-1
CP-3
MINE SEAL No. 1
APPROXIMATE EARTHWORK COMPACTION AREA
ACCESS ROAD STONE PLACEMENT (4" Thick)
SALVAGED TOPSOIL MATERIAL
ROCK CHANNEL No. 1
CONGO RUN

2009 NPS Report - Sunday Creek Watershed - Corning Gob Floodplain Archive

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete 2007, Archive 2009 ODNR Project Number: PR-Mn-12

Pre-construction

Coal Refuse along stream bank, Photo by Bill Jonard

Post-construction

Vegetation established on reclaimed gob pile. Photo by Kaabe Shaw

Corning Gob Pile is located in Section 4 of Pleasant Township in Perry County and lies within the 14 digit HUC unit #05030304070010. The project site is 5 acres and is located in the Headwaters of Sunday Creek north of Rendville. Due to the lack of vegetative cover, the 5 acre gob pile is eroding along the slopes and creating AMD discharge into the Headwaters of Sunday Creek. The upper and lower gob piles are the result of underground mining that occurred east of the area. One AMD seep occurs within the eastern portion of the site at an abandoned entry, but rarely discharges water into Sunday Creek. Project discharge was measured at the pond discharge from coal refuse area (CG02). The design was be completed by ODNR-DMRM for a cost of $1,710. The treatment approach for this site is to remove all coal refuse located in the floodplain and along the stream bank of Sunday Creek. The major consideration for this project was not to impact the stream configuration, re-establish a floodplain, move refuse to higher elevation and cover with soil to reduce contact with air and water. The goal of the design is to reduce metal loadings from headwaters of Sunday Creek. Funding for this project was ODNR-DMRM in house design in conjunction with Federal AML Program site and Ohio EPA 319 for construction. The construction was completed by McMillan on 11/19/2007 for a cost of $130,069.

Water Quality Report

Water quality data was collected at the project discharge as well as multiple stations downstream pre- and post- construction. The graphs below show pH (Figure 1) and acidity (Figure 2) along the mainstem of the receiving stream upstream to downstream of the project discharge as a result of the gob pile reclamation project.

As a result of the Corning Gob Floodplain project, pH and net acidity have improved at the project discharge and immediately downstream for two miles. Further downstream between sites SC 079 and SC080, the Corning AMD discharge enters into Sunday Creek and the effect can be seen at site SC 080. However, at the Corning Gob Floodplain project discharge and immediately downstream during pre-construction show pH in the range of 2.9 – 7.27. After construction pH increases and is in the range of 5.66 to 7.38. Net acidity concentration decrease 100% and are now net alkalinity at the project discharge (Site CG 02).

Figure 1. Pre and Post pH

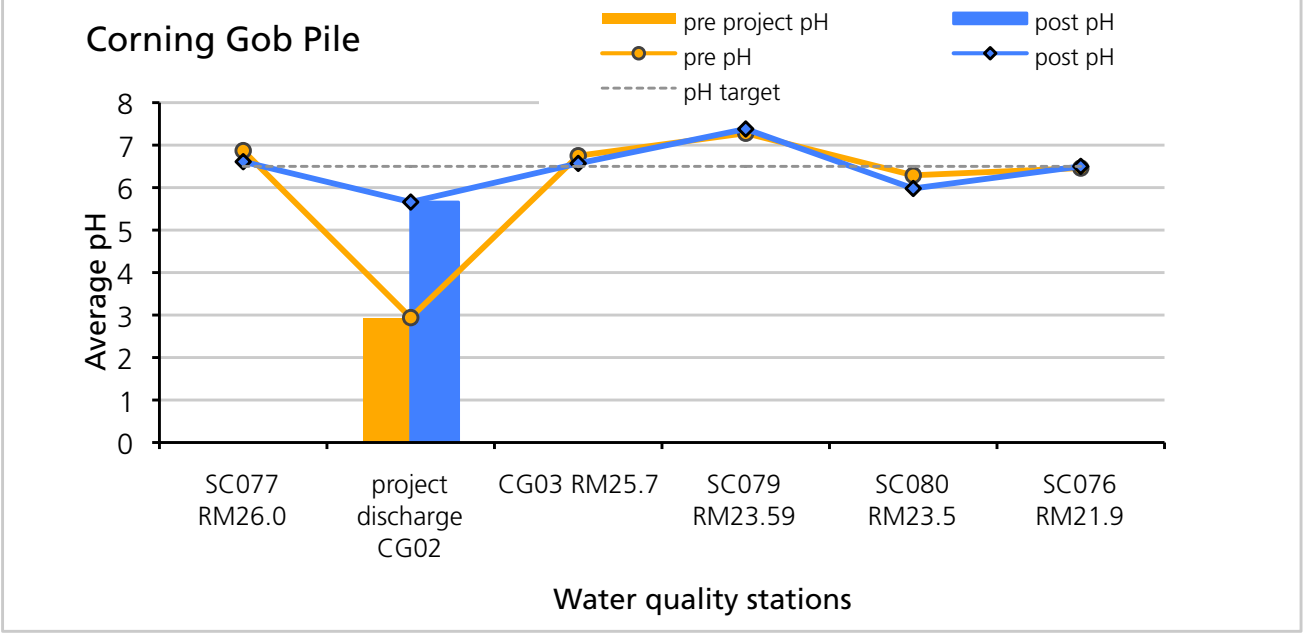
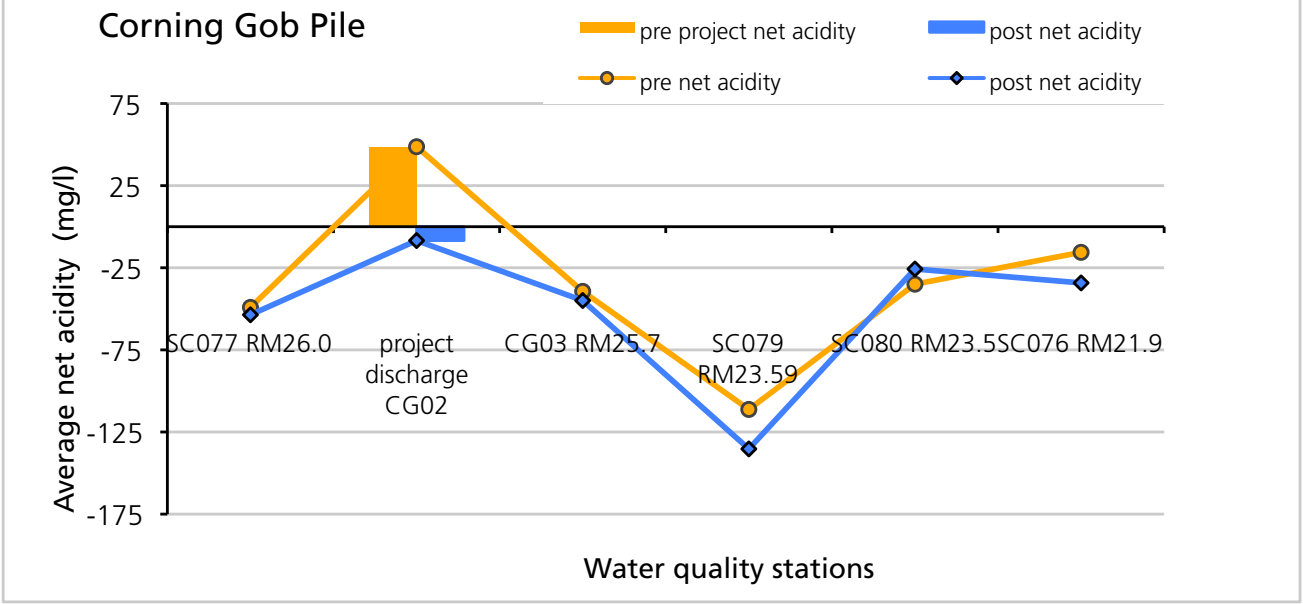
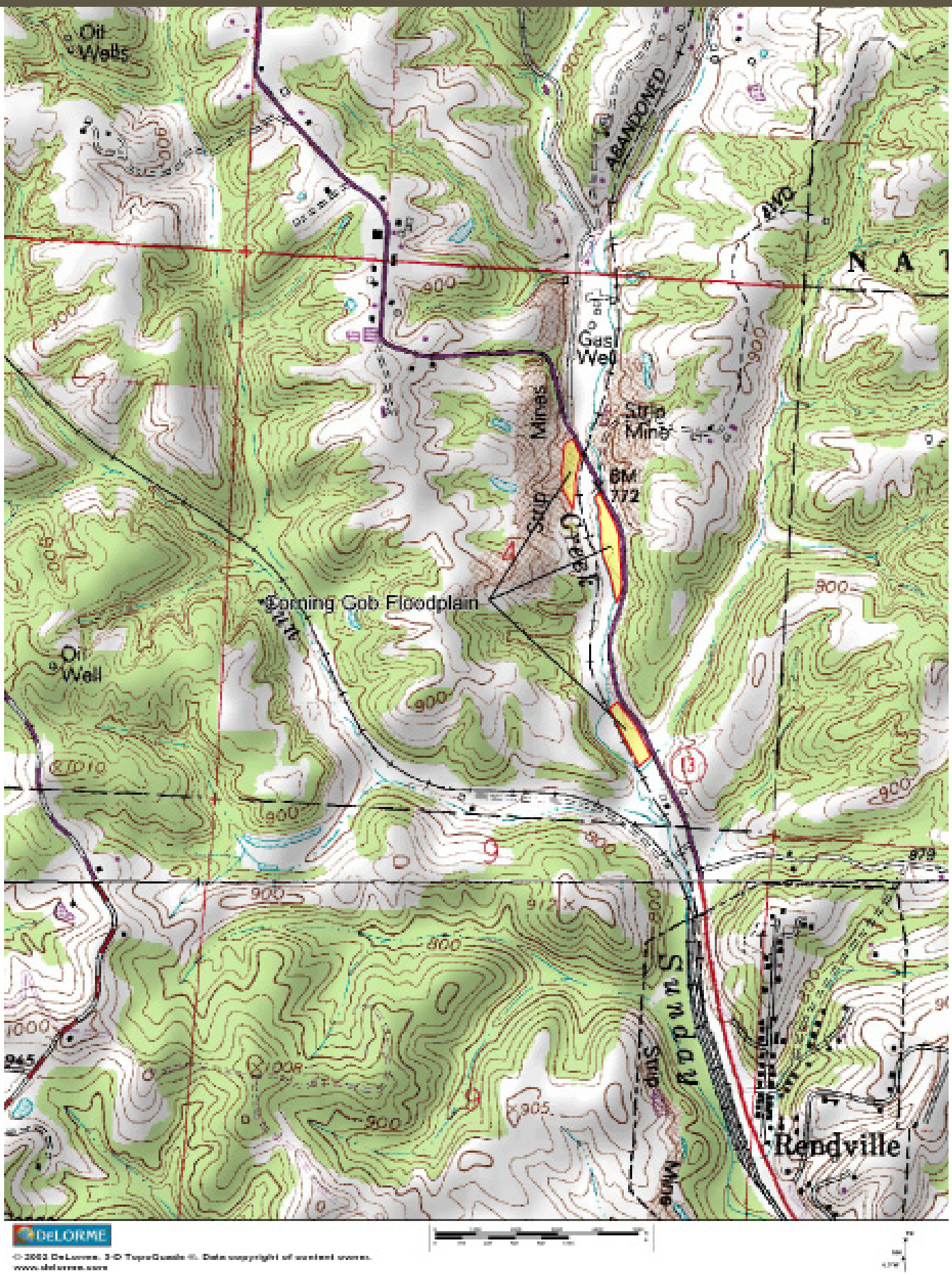


Figure 2. Pre and Post Acidity



2009 NPS Report - Sunday Creek Watershed - Corning Gob Floodplain Archive

Generated by Non-Point Source Monitoring System
www.watersheddata.com



Section III – AMD project reports

Huff Run Watershed comprehensive acid mine drainage projects progress report for 2009.

Section III for the Huff Run Watershed contains, in addition to the individual AMD project, one comprehensive report listing completed and funded AMD projects; displaying photos of the project site, a description of the project, water quality data change at the mouth of Huff Run (station HRR08/HR 32) and the impact of all the reclamation projects from the period 1976-1997 for pre-construction to 1997-2009 for post construction. Acidity and pH graphs have been generated for all completed projects. Acid and metal load reductions were calculated with limited discharge data for: Linden, Lindentree, Lyons, and Belden. Farr, Acid Pit #1, Harsha, and Fern Hill HR-42 are lacking either pre or post discharge data to generate the acid and metal load reductions.

List of acid mine drainage reclamation projects reported on in the 2009 NPS monitoring report:

1. Farr project
2. Linden Bioremediation project
3. Acid Pit #1 (Phase I) project
4. Lindentree project
5. Harsha North project
6. Lyons project
7. Fern-Hill HR-42 project
8. Belden project
9. Thomas project
10. Mineral Zoar Road AMD project

Archived

11. Huff Run AML project*

Future Funded Projects: Hr-42 pond A, Belden Gob Pile

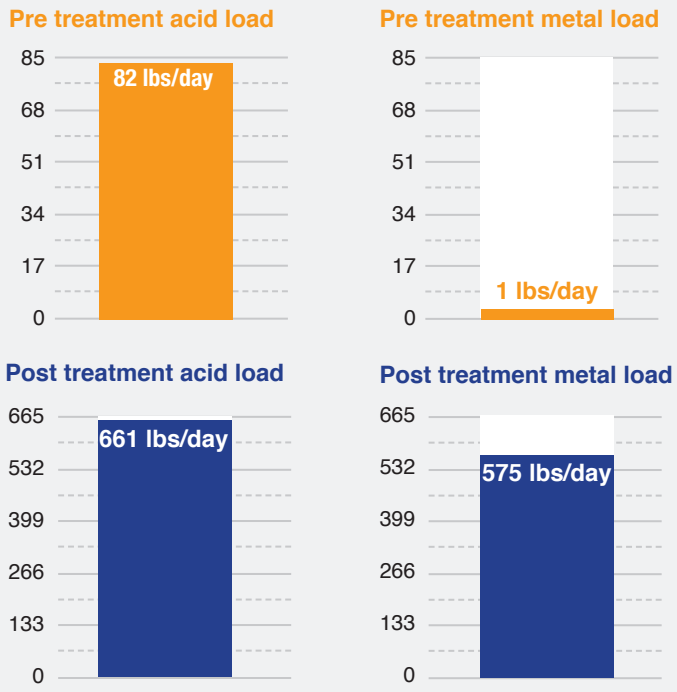
* "Status Completed" projects are no longer being monitored

2009 NPS Report - Huff Run Watershed - Overview

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: All completed projects since 1999

Huff Run is located in Sandy Township in Tuscarawas County and Rose Township in Carroll County. The watershed has a 14 square mile drainage area and flows ten miles long before discharging into Conotton Creek. The completed projects in Huff Run are evaluated collectively at the mouth of Huff Run (Station HRR08/HR 32). Since 1999 seven projects have been completed and are shown on the following pages. The designs and construction were completed by a variety of companies. The funding sources for these projects for both design and construction were ODNR-DMRM, Ohio EPA 319, and OSM Clean Streams. Figure 3 and 4, estimate that approximately 81 lbs/day of acid and 86 lbs/day of metals were reduced from entering Huff Run as a result of these AMD reclamation projects.



Mouth of Huff Run used for this analysis

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

List of construction projects completed since 1999:

1. Huff Run AML 1999 “status complete”
2. Farr 2003
3. Linden Bioremediation 2003
4. Acid Pit #1 2004
5. Lindentree 2005
6. Lyons 2005
7. Harsha North 2006
8. Fern Hill 2008
9. Belden 2008
10. Mineral Zoar 2009
11. Thomas 2009

List of funded projects to be complete within the next year:

1. HR-42 pond A
2. Belden Gob Pile

2009 NPS Report - Huff Run Watershed - Overview

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Water Quality Report

Water quality data was collected along the mainstem at long-term monitoring stations during pre- and post- construction conditions. The graphs below show changes in pH (Figure 1) and acidity (Figure 2) along the mainstem of Huff Run. Changes between the pre- and post- conditions are attributed to the completed AMD reclamation projects.

As a result of these projects completed in Huff Run Watershed, the pH and net acidity has improved downstream of the reclamation sites for 5 miles to the mouth. Pre-construction data shows average pH in the range of 4.5 – 7.0 along the mainstem. However after the completion of eleven major AMD reclamation projects, post-construction data shows average pH in the range of 6.3 – 7.1. The net acidity concentrations decreased resulting in net alkaline conditions the entire length of Huff Run, 10 miles.

Figure 1. Pre and Post pH

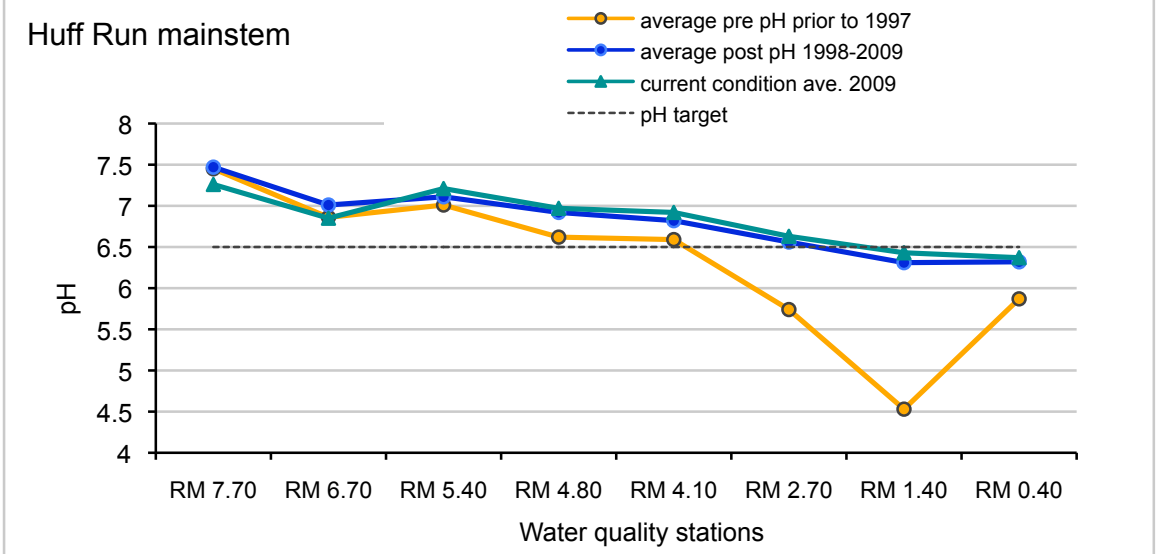
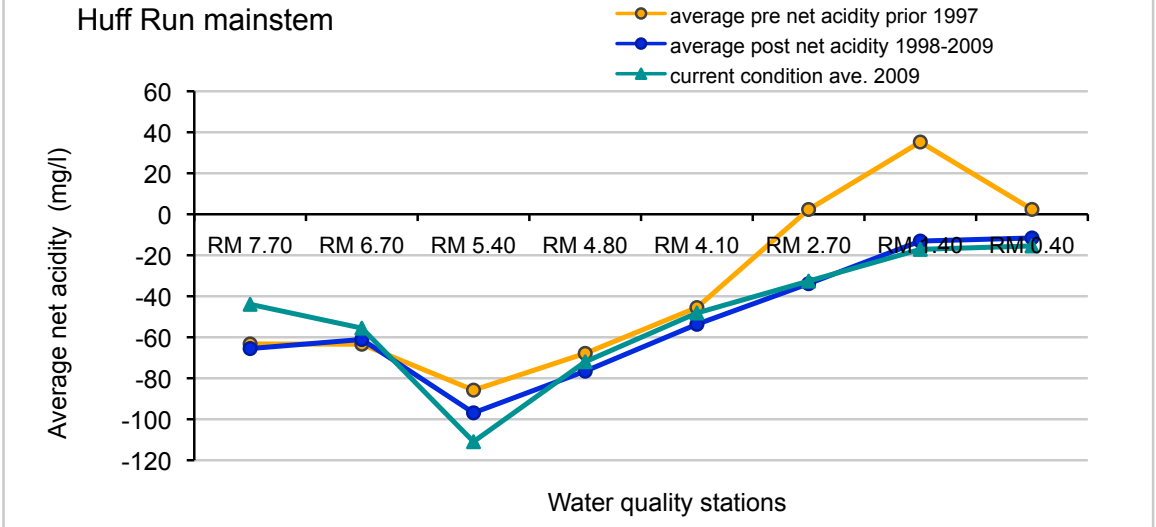


Figure 2. Pre and Post Acidity



Using the Mean Annual Load Method (Stoertz, 2004) acid and metal load reduction occurring at this project (site HRR08) were plotted and shown in Figure 3 and 4. Acidity, iron, aluminum and discharge were measured pre- and post-construction at the project discharge from 1985 to 1997 for pre-construction and from 1998 – 2009 for post-construction.

Figure 3. Acid Load Reduction

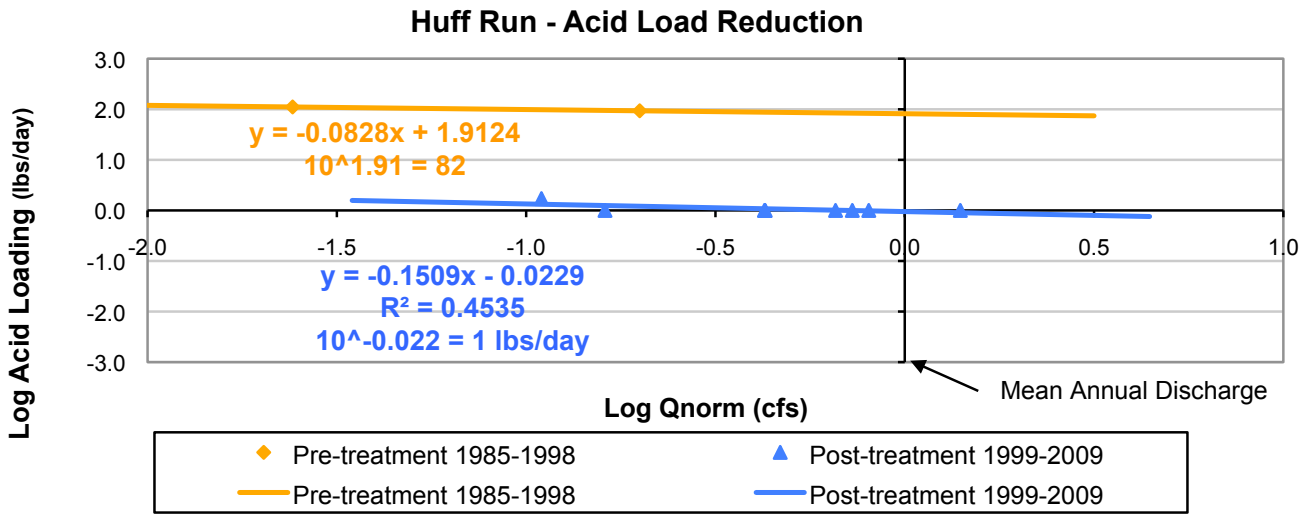
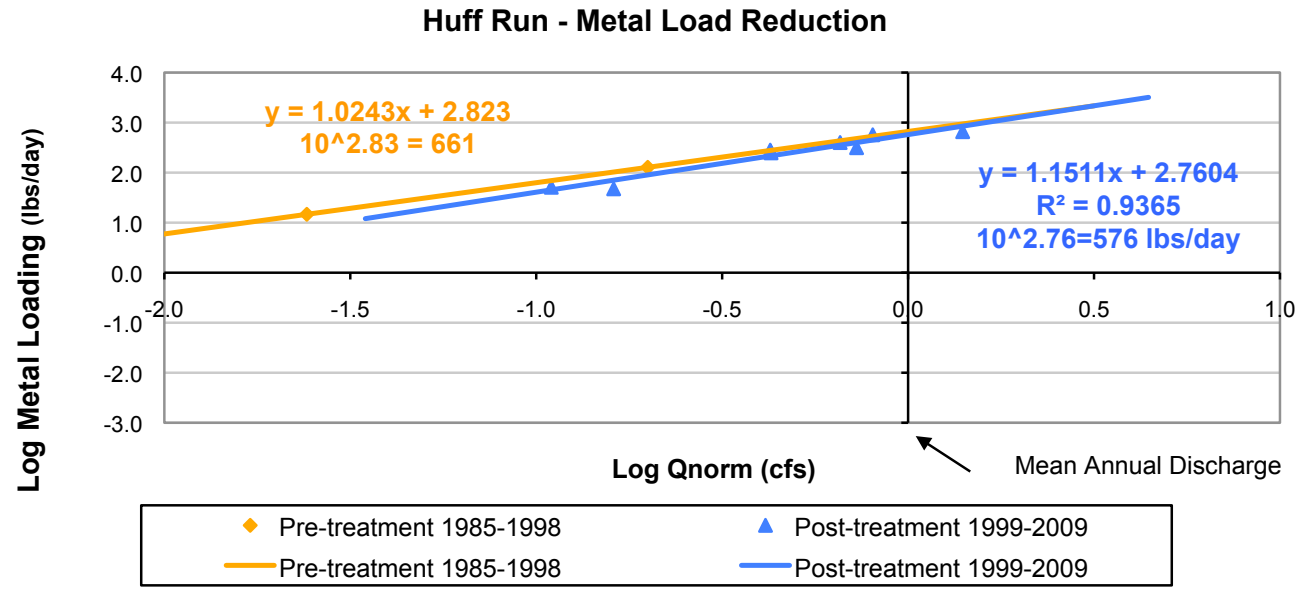


Figure 4. Dissolved Metal Load Reduction



2009 NPS Report - Huff Run Watershed - Farr Project

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete 2003 Project Number: TS-SN-06 and TS-SN-20

Site: Pre FAR01/02, Post FAR09

Pre-construction

Farr AMD discharge pre-construction
Photo by Huff Run Watershed

Post-construction

View from finishing cells looking upstream
Photo by Douglas Leed

The Farr Project is located in Sandy Township in Tuscarawas County. The site is located at the open limestone channel before entering Huff Run. The Farr Project discharges into Huff Run at river mile 1.0. This area was affected by unreclaimed gob piles and an impoundment fed by deep mine discharge. The design was completed by Gannett Flemming for $30,976. The treatment approach was to passively treat deep mine discharge with a anoxic limestone system. The treatment consisted of installing 500 linear feet of limestone channels, a 10,000 cubic foot anoxic limestone drain, a 0.5 acre wetland and complete 1.2 acres of surface reclamation. The goal of the design was to reduce high metals from deep mine discharges to the mainstem of Huff Run. Construction was complete May 2003 by Tucson Inc. for a cost of $150,000. Problems with the construction were unexpected high flows versus design flow of system, inadequate retention in system, continue high metal output, limited space for reconstruction or improvements. The funding sources for this project were, ODNR-DMRM for the design and for construction was OSM Clean Streams, ODNR/DMRM and Ohio EPA.

Water Quality Report

Water quality data was collected at the project discharge as well as multiple stations pre and post construction. The graphs below show changes in pH (Figure 1) and acidity (Figure 2) along the mainstem of the receiving stream upstream and downstream of the project discharge as a result of the AMD reclamation project.

As a result of the Farr Project, pH and net acidity have improved downstream approximately 1.0 mile. Pre-construction data shows pH range of 5.25-5.97 at the project discharge and downstream. After installation of the Farr Project, post-construction data shows pH range of 6.3-6.45 at the discharge and downstream. The net acidity concentration decreased 100% at the project discharge and downstream on Huff Run.

Figure 1. Pre and Post pH

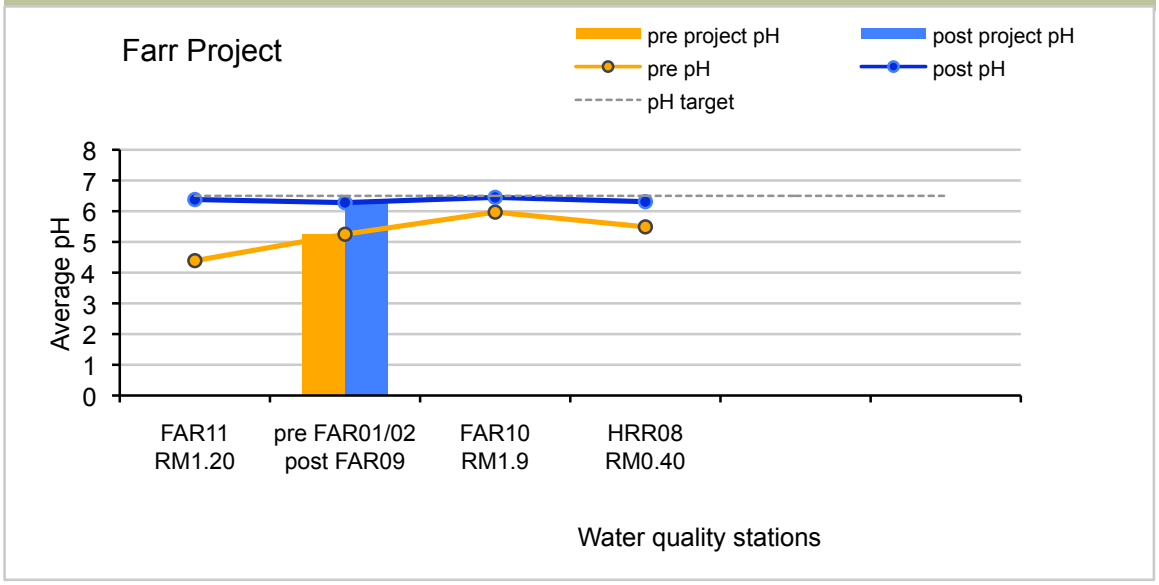
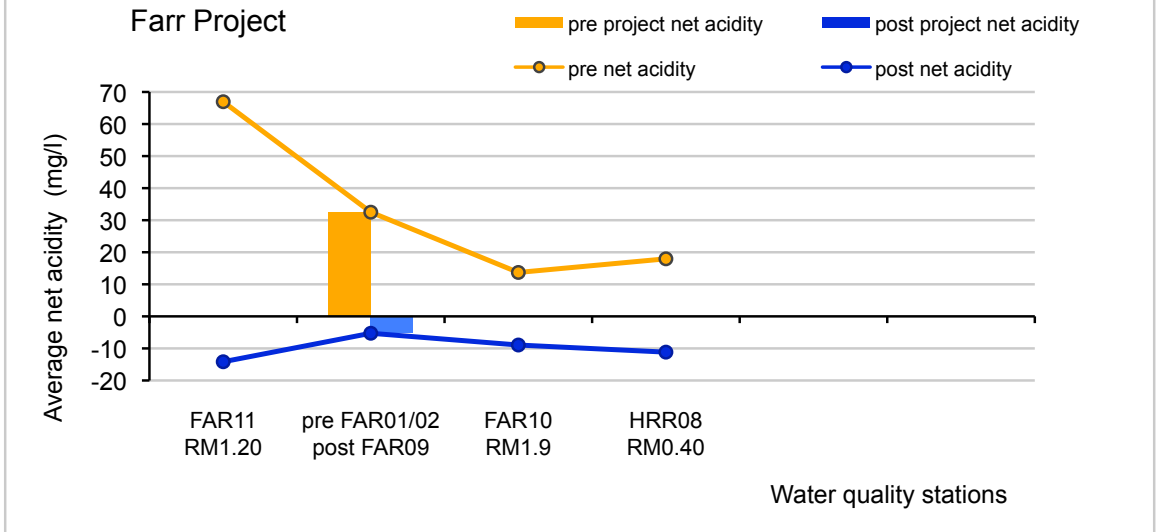


Figure 2. Pre and Post Acidity



2009 NPS Report - Huff Run Watershed - Linden Bioremediation Project

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete 2003 Project Number: CR-RS-04

Pre-construction

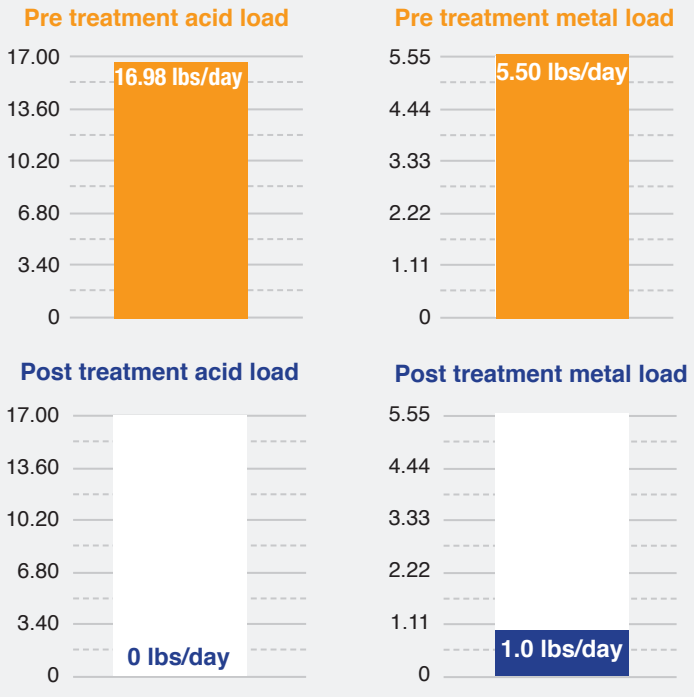
Farr AMD discharge pre-construction, Photo by Huff Run Watershed

Post-construction

Huff Run Awareness Day 2003, Photo by Huff Run Watershed

Linden Bioremediation Project is located in Rose Township in Carroll County. The Linden project discharges into Huff Run near river mile 4.6. The Linden project consists of treating a deep mine discharge by directing the water sequentially through a flow control system with a wetland to reduce metal concentrations and provides microbial nutrients. This water then flows through an inoculated Pyrolusite limestone treatment bed, discharge structures, and diversion ditches, before being discharged to the receiving stream. The design was completed by Office of Surface Mining (OSM) engineers at no cost. The treatment consisted of installing a 0.5 acre Pyrolusite limestone bioremediation treatment bed and a 0.3 acre passive wetland. The goal of the design was to generate alkalinity in the upper reaches of Huff Run, with the potential for reduction in metals requiring low maintenance. Construction was complete June 16, 2003 by Tucson Inc. for a cost of $321,619. Problems encountered included complications with the bedrock for liner installation, unknown pre-existing gas well in location of treatment bed, and high expense of the inocculant. The funding sources for this project were Ohio EPA, OSM, and ODNR/DMRM. Figure 3 & 4 (shown page 3 of this report) estimate approximately 16.98 lbs/day of acid and 4.5 lbs/day of metals were reduced from entering into Huff Run.

SITE: PRE LIN01, POST LIN08



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

Water Quality Report

Water quality data was collected at the project discharge as well as multiple stations pre and post construction. The graphs below show changes in pH (Figure 1) and acidity (Figure 2) along the mainstem of the receiving stream upstream and downstream of the project discharge as a result of the AMD reclamation project.

Data Analysis

As a result of the Linden Project, pH and net acidity have improved downstream approximately 0.5 miles. Pre-construction data shows pH in the range of 5.34 – 6.26 at the project discharge and downstream. After installation of the Linden Bioremediation Project, post-construction data shows pH in the range of 6.87 -7.16 at the discharge and downstream. The net acidity concentration decreased 100% at the project discharge.

Figure 1. Pre and Post pH

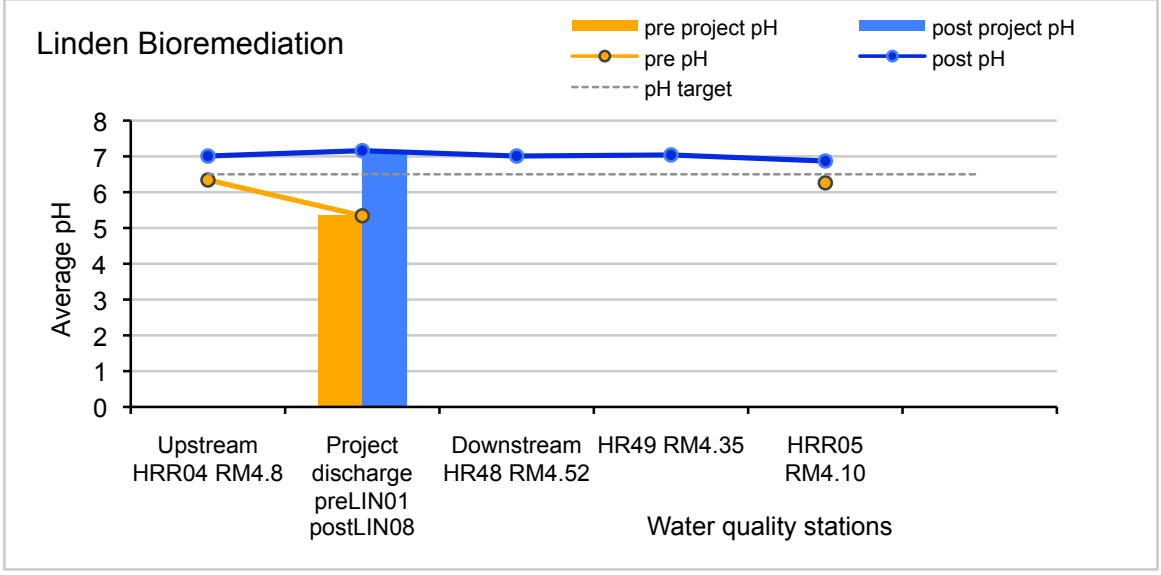
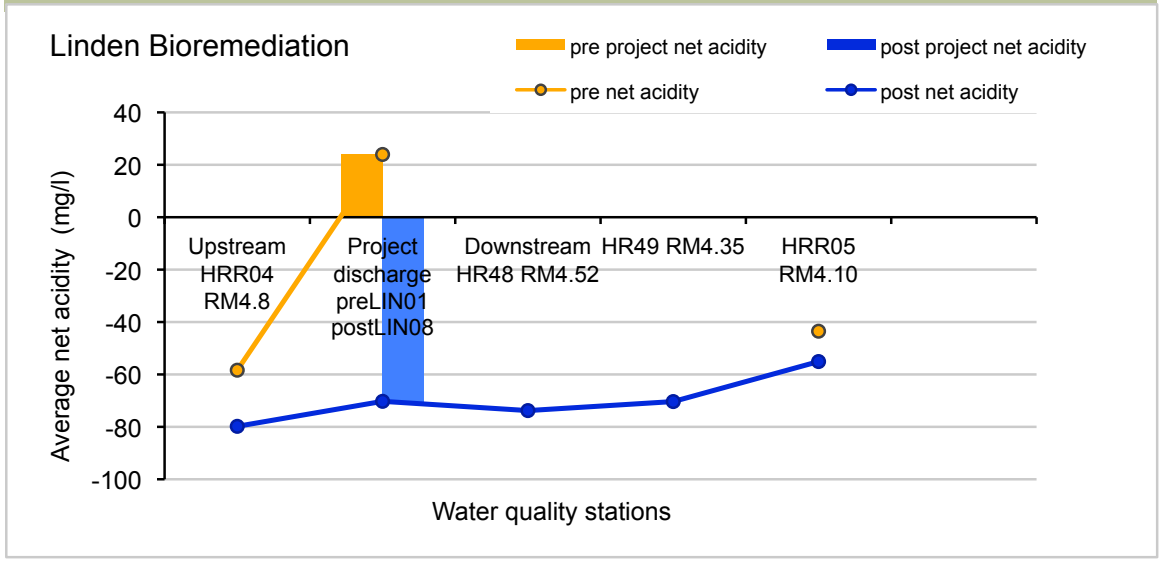


Figure 2. Pre and Post Acidity



Water quality – acid and metal load reduction

Using the Mean Annual Load Method (Stoertz, 2004) acid and metal load reduction occurring at this project were plotted and shown in Figure 3 and 4. Acidity, iron, aluminum and discharge were measured pre- and post-construction at the project discharge from 6/17/1998 to 6/21/1999 for pre-construction and from 8/4/2005 – 12/31/2009 for post-construction. Post-construction data with discharge measurements was very limited for this site (n=5), all sampling events occurred during base to low flow. No sampling events were measured greater than the mean annual discharge.

Figure 3. Acid Load Reduction

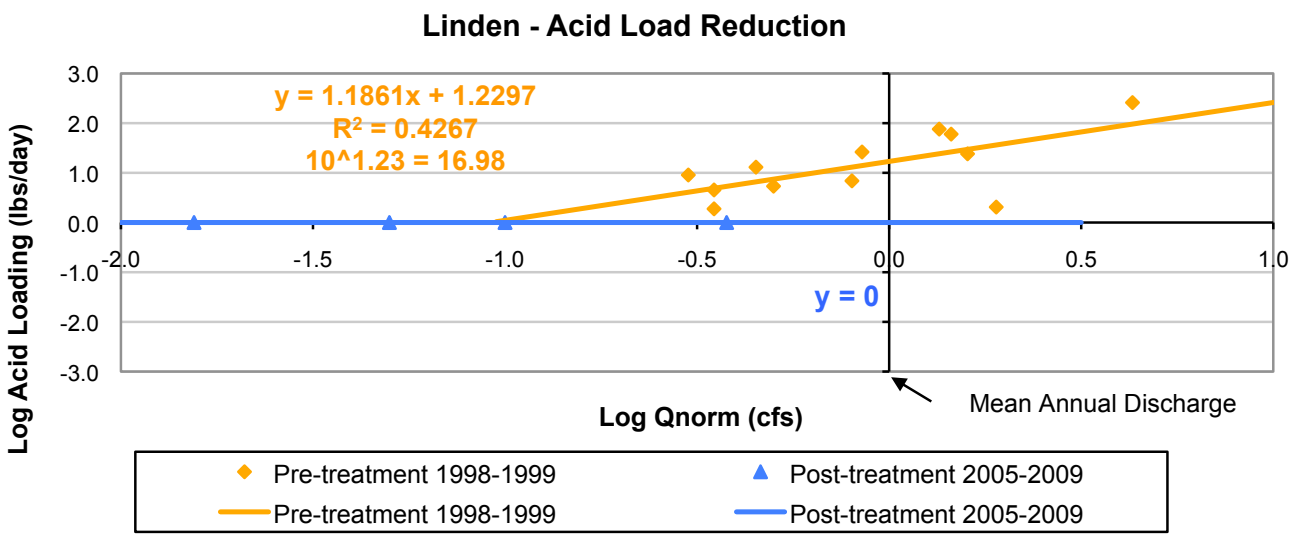
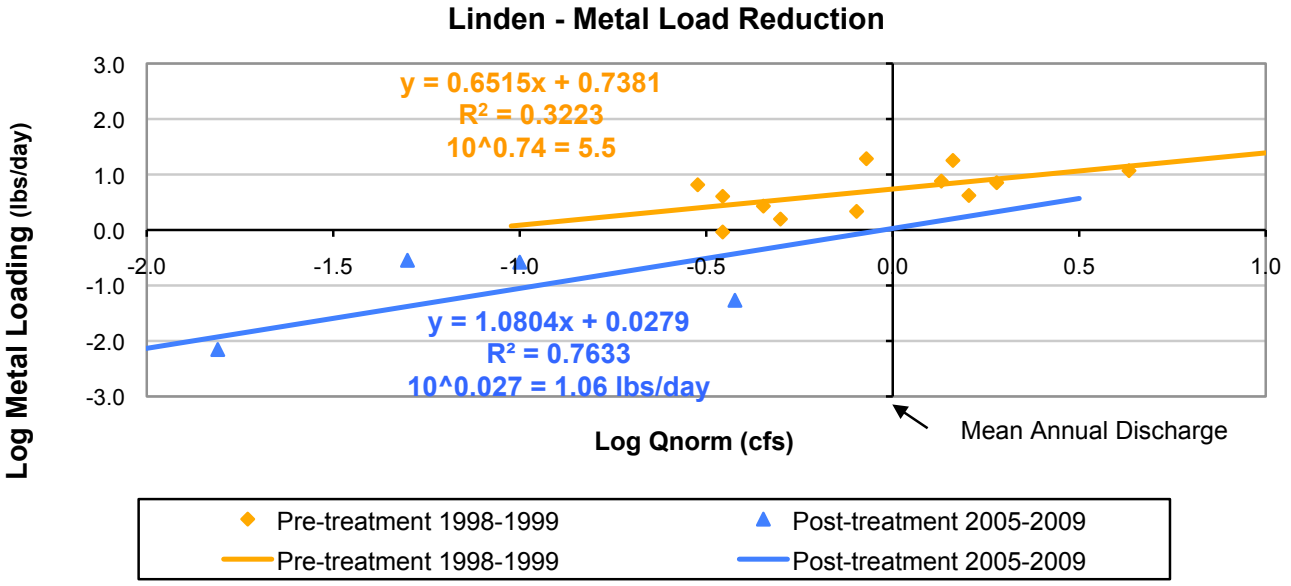


Figure 4. Dissolved Metal Load Reduction



2009 NPS Report - Huff Run Watershed - HRWRP Acid Pit #1 Project

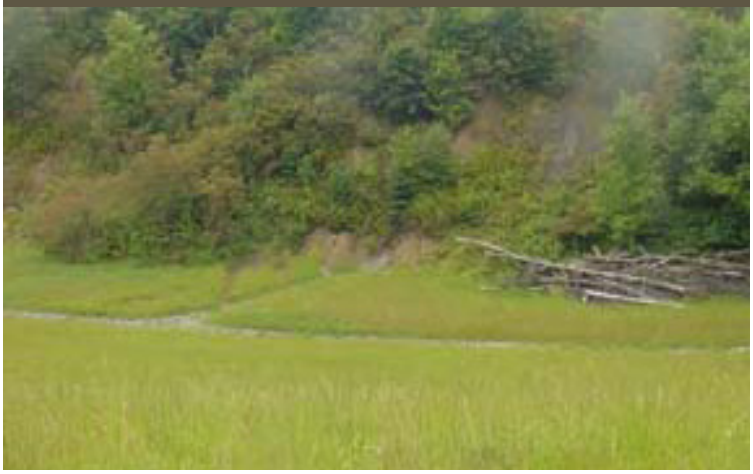
Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete 2004 Project Number: TS-SN-28

SITE ID: ACPO1

Pre-construction

Post-construction



Acid pit completed project Photo by Jim Gue

Acid Pit #1is located in Rose and Sandy Township in Tuscarawas County. The site is located at the effluent from Acid Pit #1. The Acid Pit #1 discharges into Huff Run at river mile 3.78. The design was completed by Ohio Department of Natural Resources – Division of Mineral Resources Management for a cost of $14,000. The treatment approach was to eliminate the acid-filled impoundments, reclaim the mine spoil, eliminate the recharge through the spoil and provide positive drainage. The treatment consisted of installing 2000 linear feet of limestone channels and reclaim 15 acres of gob spoil. The goal of the design was to eliminate the and recharge of extremely acidic water through spoil material and draining into the mainstem Huff Run. Construction was complete March 2004 by Tucson Inc. for a cost of $150,000. The problem encountered during construction was the lack of solid base (underclay), to effectively place underdrains for subsurface collection of mine drainage flows. The funding sources for this project were for the design was ODNR-DMRM and for construction was OSM Clean Streams, ODNR/DMRM.

2009 NPS Report - Huff Run Watershed - HRWRP Acid Pit #1 Project

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Water Quality Report

Water quality data was collected at the project discharge as well as multiple stations pre and post construction. The graphs below show changes in pH (Figure 1) and acidity (Figure 2) along the mainstem of the receiving stream upstream and downstream of the project discharge as a result of the AMD reclamation project.

Data Analysis

As a result of the Acid pit #1 Project, pH and net acidity have improved downstream approximately 2.4 miles. Pre-construction data shows pH in the range of 3.38–5.8 at the project discharge and downstream. After installation of the Acid Pit #1 Project, post-construction data shows pH in the range of 3.5-6.6 at the discharge and downstream. The net acidity concentration decreased 33% at the project discharge. This project needs at least two (high and low flow) discharge measurements at site ACP01 to show acid and metal load reductions.

Figure 1. Pre and Post pH

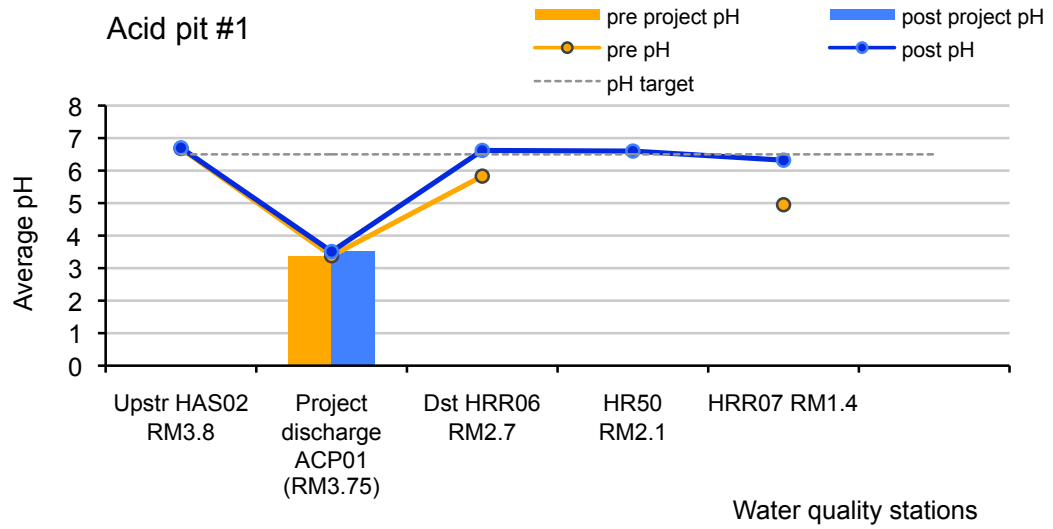
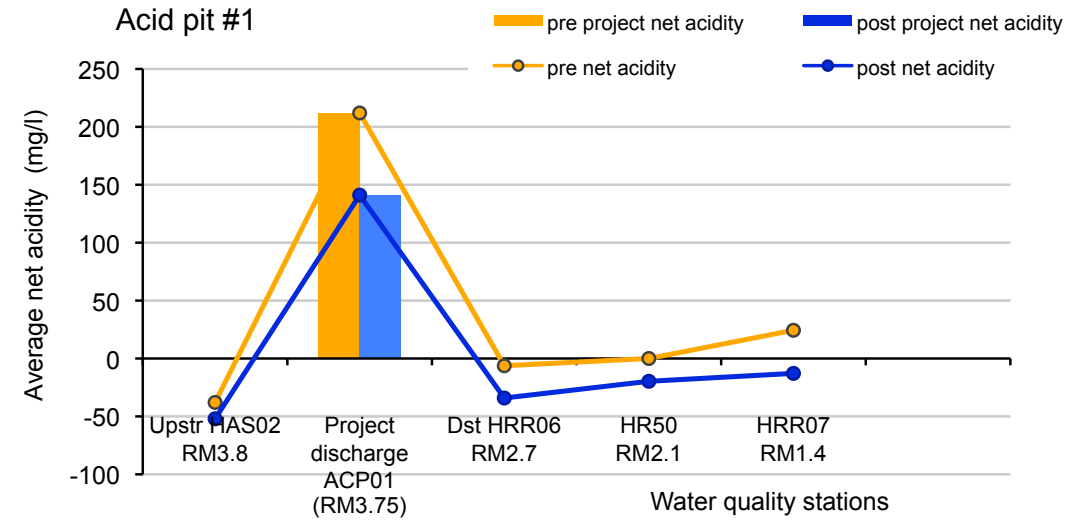


Figure 2. Pre and Post Acidity



2009 NPS Report - Huff Run Watershed - Lindentree Project

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete 2005 Project Number: CR-RS-07

Pre-construction

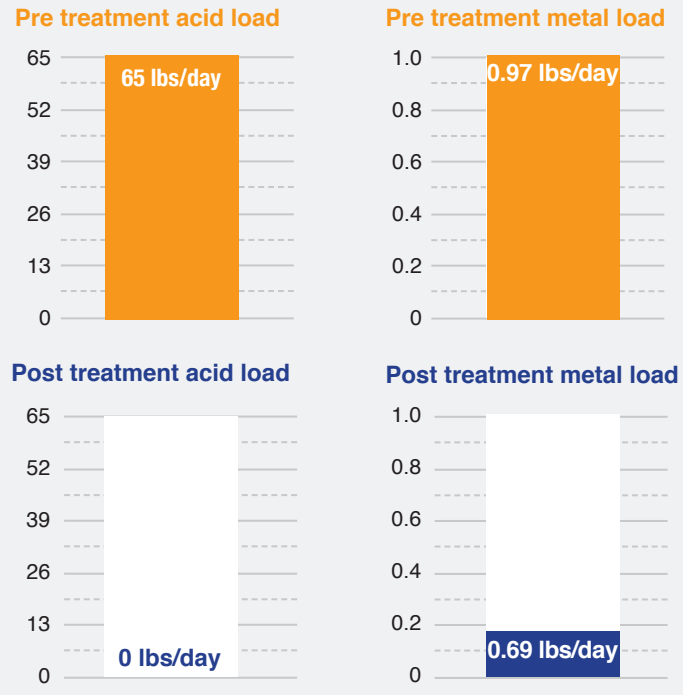
One of four acidic ponds on project site, Photo by Jim Gue

Post-construction

Lindentree reclamation area, Photo by Maureen Wise

The Lindentree Project is located in Rose Township in Carroll County. The Lindentree project discharges into Huff Run near river mile 5.0 and consists of many acidic ponds, high walls, and exposed gob piles. Baker Consulting completed the design for a cost of $60,240. The treatment approach consisted of filling the acid pits, raising alkalinity with the use of steel slag, and 100 linear feet of limestone channels. The goal of the design was to reduce acid infiltration from old impoundments, introduce alkaline recharge with steel slag and open limestone channels to upstream reaches of Huff Run. Construction was complete February 17, 2005 by Monarelli for a cost of $210,000. The funding sources for this project were Ohio EPA and ODNR/DMRM. Figure 3 & 4 (shown on page 3 of this report) estimate approximately 65 lbs/day of acid and 0.28 lbs/day of metals were reduced from entering into Huff Run(minimum metal load at this site pre-construction).

SITE: PRE HRT06, POST LNT01



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

2009 NPS Report - Huff Run Watershed - Lindentree Project

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Water Quality Report

Water quality data was collected at the project discharge as well as multiple stations pre and post construction. The graphs below show changes in pH (Figure 1) and acidity (Figure 2) along the mainstem of the receiving stream upstream and downstream of the project discharge as a result of the AMD reclamation project.

Data analysis

As a result of the Linden Project, pH and net acidity have improved downstream approximately 0.5 miles. Pre-construction data shows pH in the range of 4.1 – 6.34 at the project discharge and downstream. After installation of the Linden Bioremediation Project, post-construction data shows pH in the range of 6.81-7.21 at the discharge and downstream. The net acidity concentration decreased 100% at the project discharge.

Figure 1. Pre and Post pH

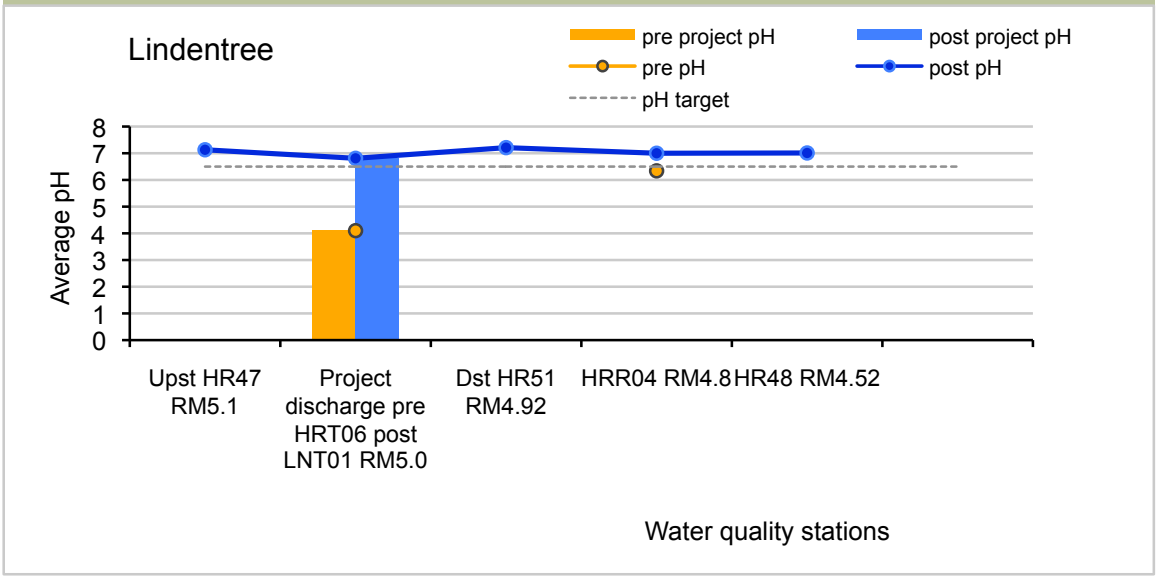
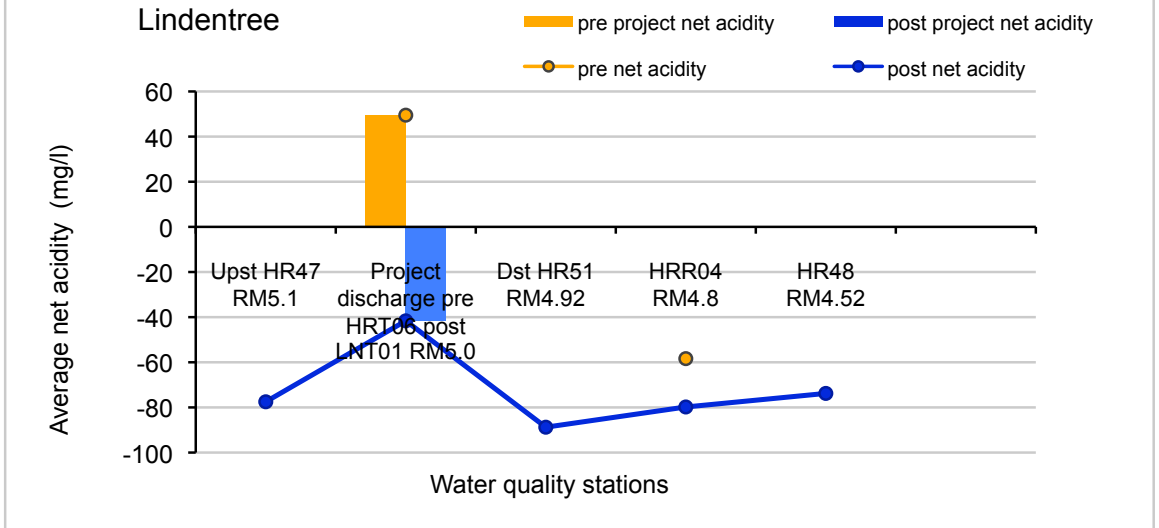


Figure 2. Pre and Post Acidity



Water Quality – acid and metal load reduction

Using the Mean Annual Load Method (Stoertz, 2004) acid and metal load reduction occurring at this project were plotted and shown in Figure 3 and 4. Acidity, iron, aluminum and discharge were measured pre- and post-construction at the project discharge from 2/11/1997 to 3/1/1999 for pre-construction and from 8/4/2005 – 12/31/2009 for post-construction. Pre and post-construction data with discharge measurements were very limited for this site (pre n=2 and post n=7), post construction sampling events all were sampled during low to base flow.

Figure 3. Acid Load Reduction

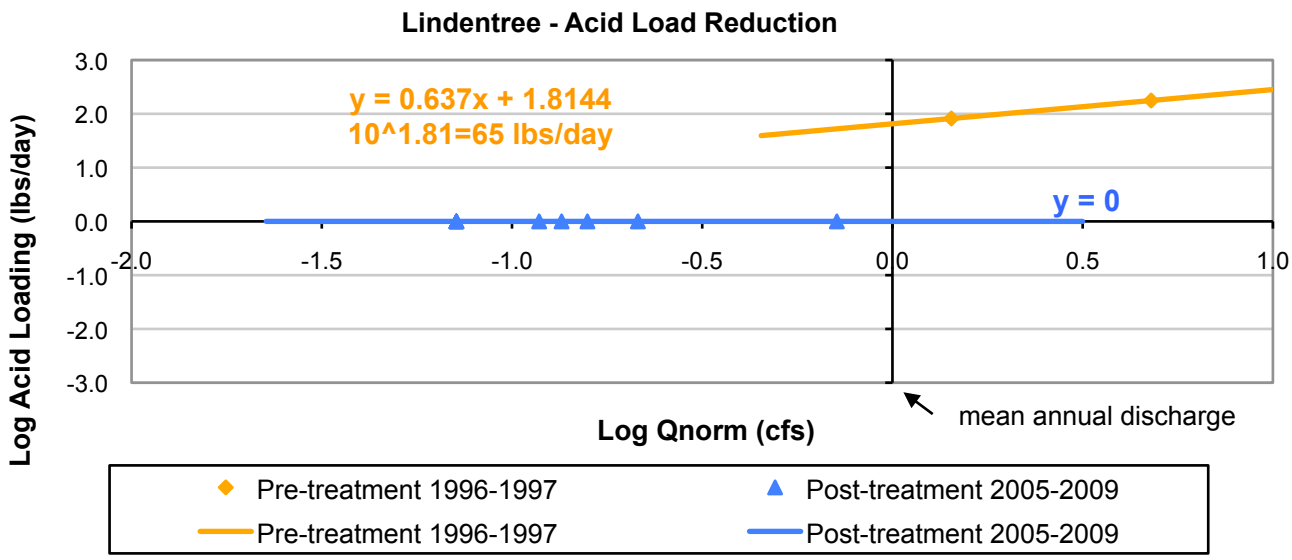
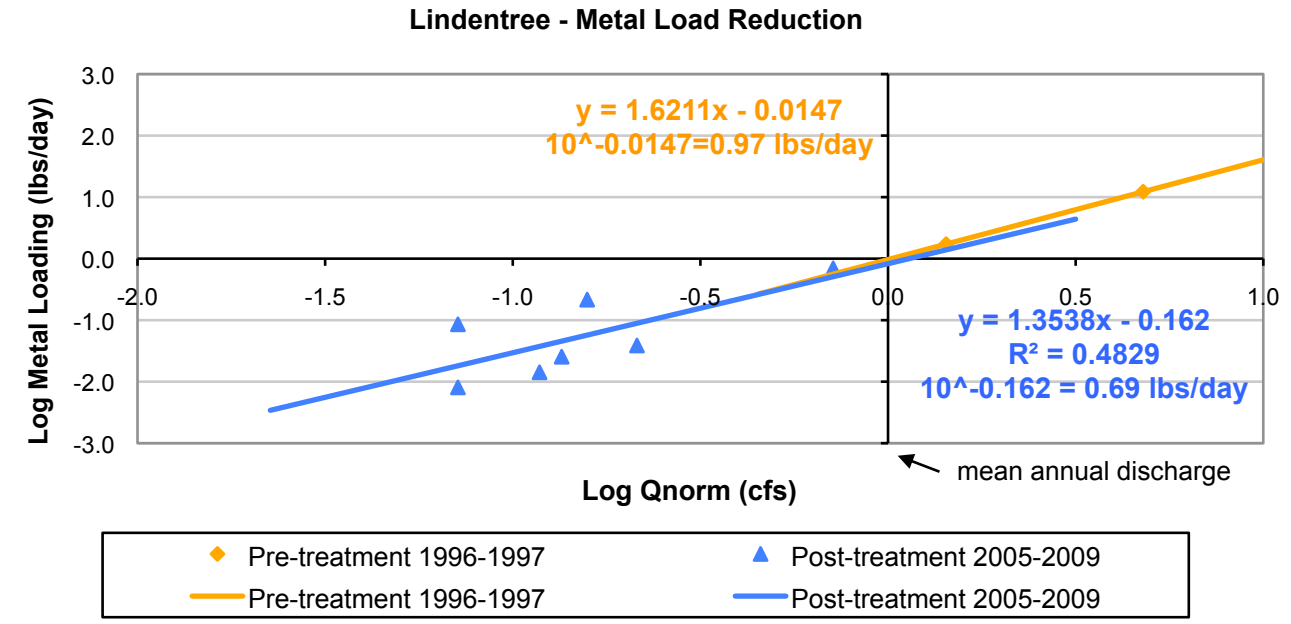


Figure 4. Dissolved Metal Load Reduction



2009 NPS Report - Huff Run Watershed - Harsha North Project

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete 2006 Project Number: CR-RS-06

SITE ID: HAN03

Pre-construction

Post-construction

Harsha North spoil and gob pile, Photo by Jim Gue

Harsha North is located in Rose Township in Carroll County. The sample site is located at the effluent from the Harsha North project. Harsha North discharges into Huff Run at river mile 4.19. The site was primarily toxic coal refuse piles and highwalls along with areas affected by deep mine drainage and unreclaimed contour surface mines. The treatment approach was to eliminate discrete acid mine drainage sources via open limestone channels and surface reclamation of acid-forming and refuse material. Major considerations were to collect diffuse acid seeps and discharges and direct them through constructed open limestone channels. The design was completed by ATC Associates for $106,909. The treatment consisted of 22.2 acres of surface reclamation, 4,725 linear feet of limestone J-trenches, and reclaiming a 6-acre gob pile. The goal of the design was to reduce diffuse seeps to a concentrated location via open limestone channels for future passive treatment if necessary, neutralize deep mine discharges with alkaline limestone channels, and add alkalinity to streamflow. Construction was complete September 2006 by Tucson Inc. for a cost of $686,186. Problems encountered were concerns with intended borrow/resoil material. The funding sources for this project were ODNR/DMRM, for the design, and ODNR-DMRM, 319 OEPA grant, and OSM Clean Streams grant for construction.

2009 NPS Report - Huff Run Watershed - Harsha North Project

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Water Quality Report

Water quality data was collected at the project discharge as well as multiple stations pre and post construction. The graphs below show changes in pH (Figure 1) and acidity (Figure 2) along the mainstem of the receiving stream upstream and downstream of the project discharge as a result of the AMD reclamation project.

Data Analysis

As a result of the Harsha North Project, pH and net acidity have improved at the project discharge and downstream. Pre-construction data shows pH at the project discharge at an average 3.78. After installation of the Harsha North Project, post-construction data shows an average pH of 6.04. The net acidity concentration decreased 93% at the project discharge. This project needs post construction discharge measurements at site HAN03 to show acid and metal load reductions.

Figure 1. Pre and Post pH

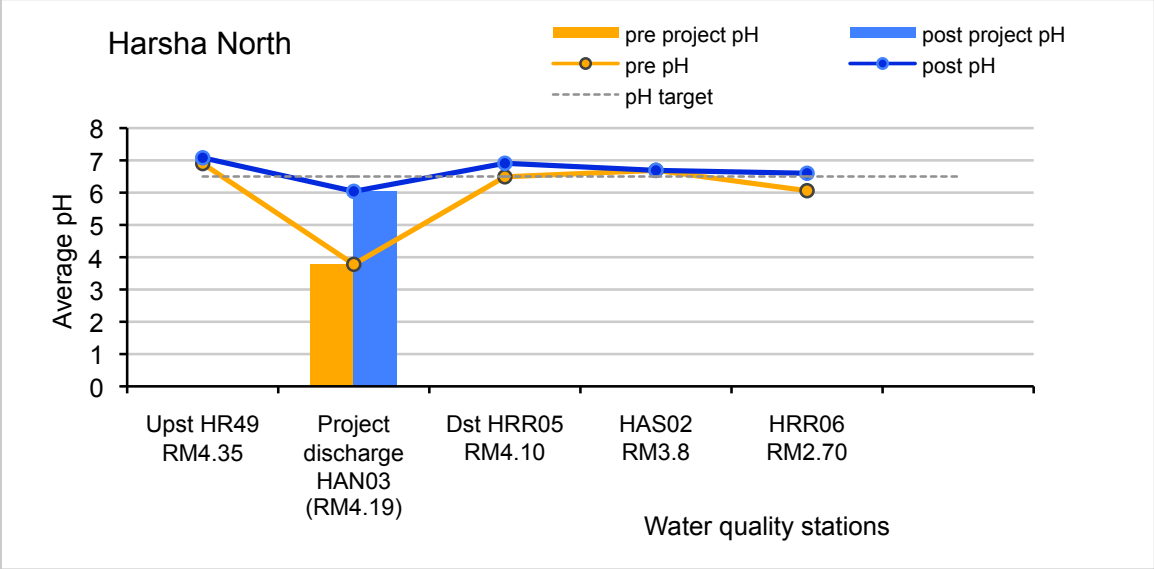
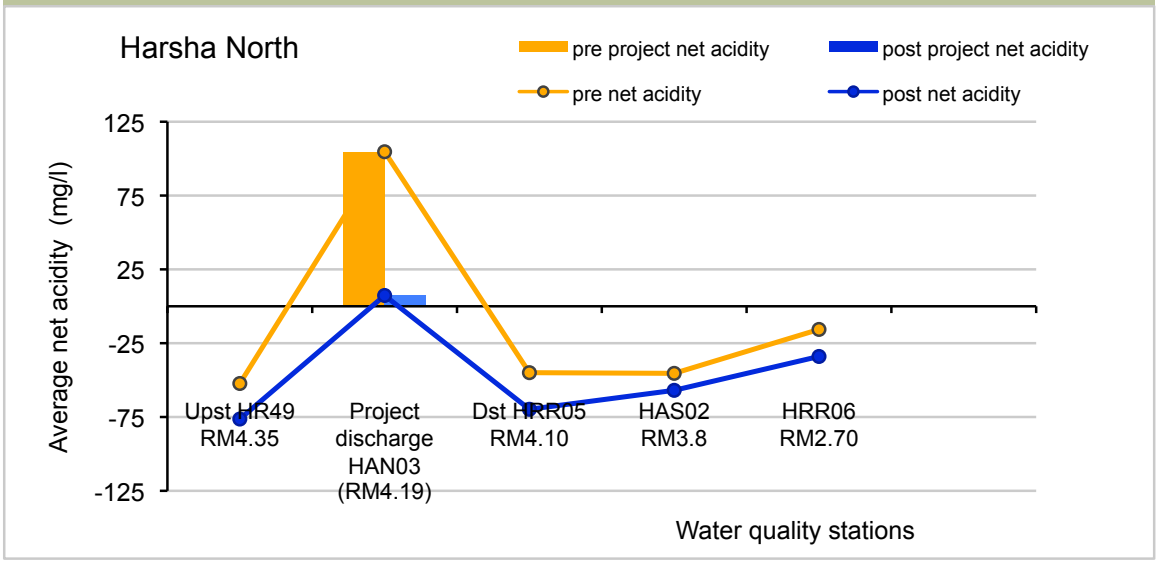


Figure 2. Pre and Post Acidity



2009 NPS Report - Huff Run Watershed - Lyons Project

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete 2005 Project Number: TS-SN-3

Pre-construction

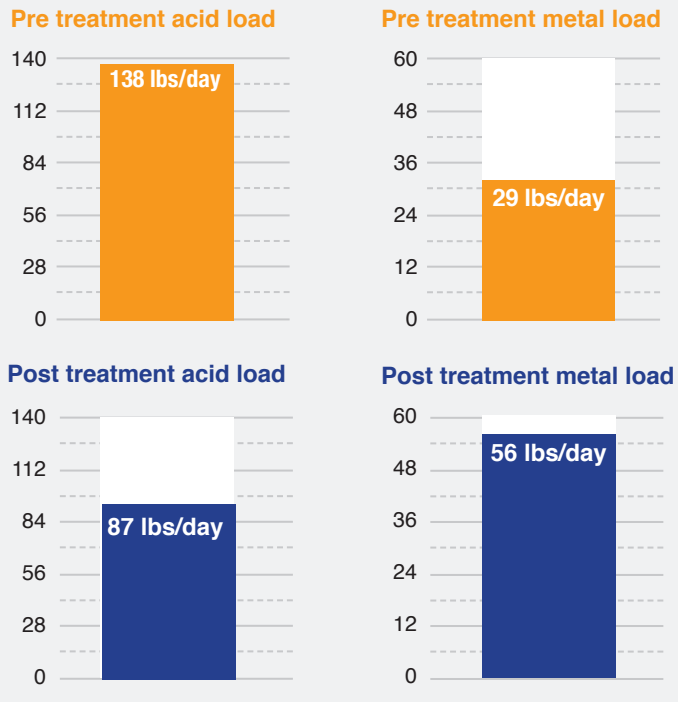
Overview of gob on the project site, Photo by Brent Miller

Post-construction

After construction major outlet, Photo by Jim Gue

Lyons is located in Sandy Township in Tuscarawas County. The project site is 35 acres. Lyons discharges into Huff Run at river mile 1.90. The Lyons site was one of the highest contributors of AMD within the lower reaches of the watershed. The AMD problems were caused by unvegetated coal refuse, highwalls, acid pits and exposed spoil. The design was completed by ATC Associates for $53,335. The treatment approach was to reclaim eroding mine spoils, eliminate acid impoundments, install alkaline recharge with steel slag berms and open limestone channels. The treatment consisted of installing 3,000 linear feet of limestone channels and 1,500 linear feet of steel slag channel and reclaim a 15 acre of gob pile and 5 acres of surface reclamation. The goal of the design was to eliminate eroding acid spoils and impoundments, generate alkalinity to deep mine pools, decrease AMD discharges and neutralize acidic discharges prior to draining into the mainstem. Construction was complete December 2005 Malcuit for a cost of $794,030. Problems with the construction were placement of underdrain tiles to effectively collect subsurface flows to constructed OLC/steel slag channels. The funding sources for this project were Ohio EPA and ODNR/MRM. Figure 3 & 4 (shown on page 3 of this report) estimate approximately 51 lbs/day of acid were reduced from entering into Huff Run. No reduction in metals were measured, yet an 27 lbs/day increase has been documented.

SITE: LYN01



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

Water Quality Report

Water quality data was collected at the project discharge as well as multiple stations pre and post construction. The graphs below show changes in pH (Figure 1) and acidity (Figure 2) along the mainstem of the receiving stream upstream and downstream of the project discharge as a result of the AMD reclamation project.

As a result of the Lyons Project, pH and net acidity have improved downstream approximately 1.5 miles. Pre-construction data shows pH in the range of 3.3 – 5.63 at the project discharge and downstream. After installation of the Lyons Project, post-construction data shows pH in the range of 6.07-6.36 at the discharge and downstream. The net acidity concentration decreased 29% at the project discharge.

Figure 1. Pre and Post pH

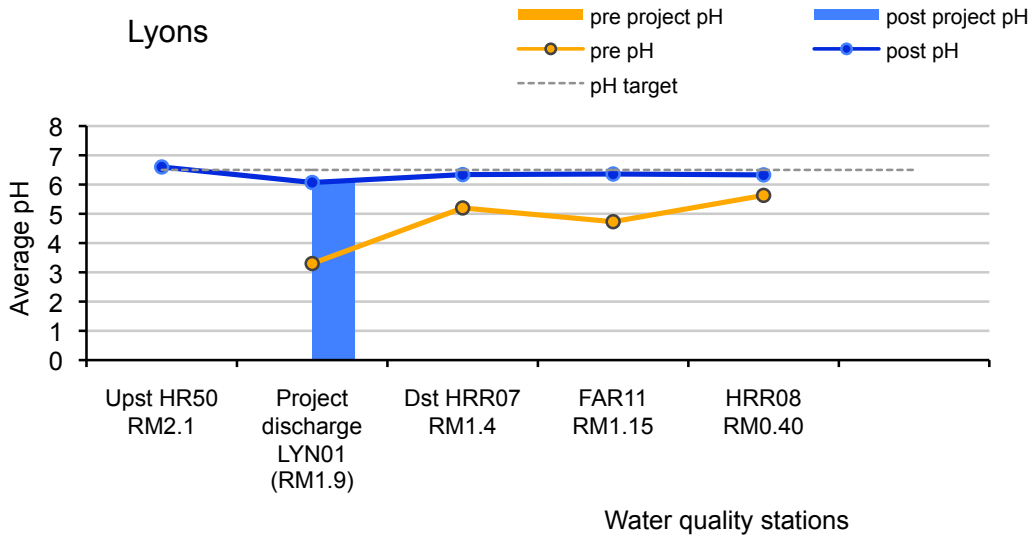
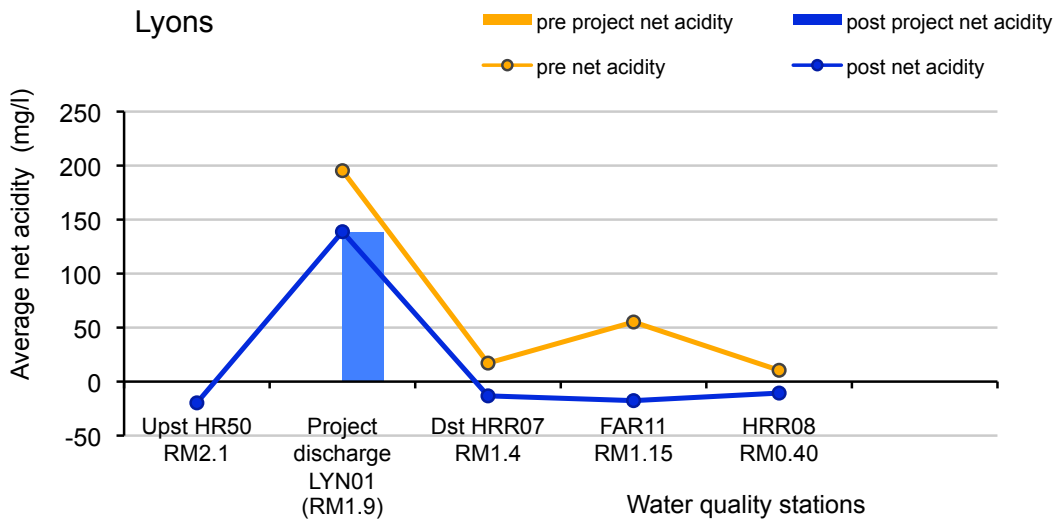


Figure 2. Pre and Post Acidity



Using the Mean Annual Load Method (Stoertz, 2004) acid and metal load reduction occurring at this project were plotted and shown in Figure 3 and 4. Acidity, iron, aluminum and discharge were measured pre- and post-construction at the project discharge from 8/25/76 to 6/21/1999 for pre-construction and from 1/4/2006 to 12/31/2009 for post-construction.

Figure 3. Acid Load Reduction

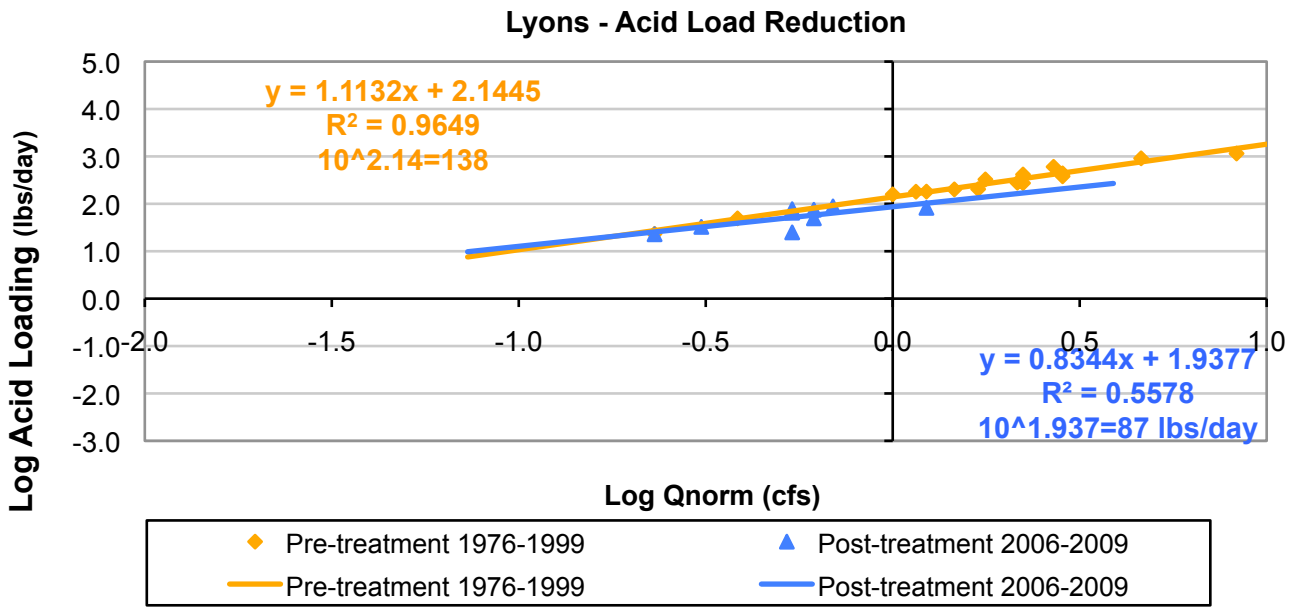
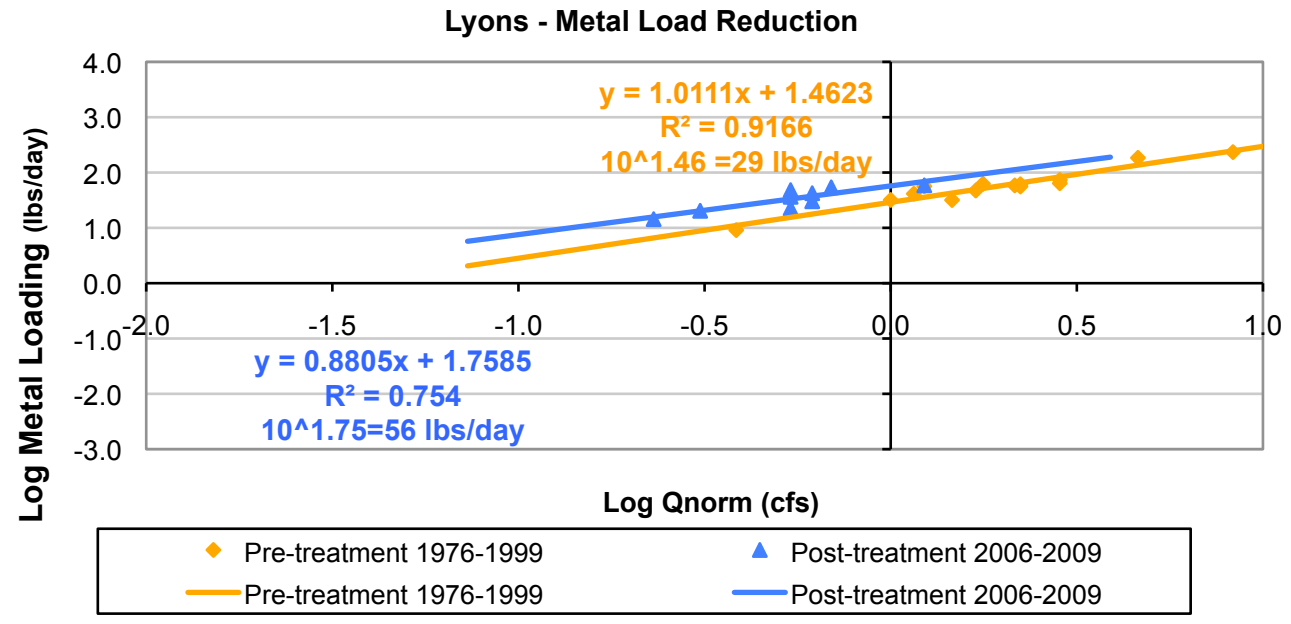


Figure 4. Dissolved Metal Load Reduction



2009 NPS Report - Huff Run Watershed - Fern Hill HR-42

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete 2008 Project Number: CR-RS-15

Pre-construction

AMD plume, Photo by Maureen Wise

Post-construction

Caption: Fern Hill AMD project entrance, Photographer: Linda March

Fern Hill is located in Section 27 of Rose Township in Carroll County and lies within the 14-digit HUC unit #05040001080050. Fern Hill site FRN01, discharges into Huff Run at river mile 4.9. Fern Hill HR-42 consists of a few acid pits and a large AMD plume that sits directly beside Huff Run and discharges AMD directly into Huff Run. The treatment approach was to reclaim three acidic ponds that were situated up-dip from the AMD plume on the site through basic surface reclamation and open limestone channels. The design was completed in-house by ODNR-DMRM. The treatment consisted of 6.0 acres of surface reclamation and 500 linear feet of limestone channels. The goal of the design was to reduce flow of the underground mine seep and reduce acidity and metal loadings to Huff Run. Construction was complete October 2008 by Malcuit for a cost of $106,573.75. The funding sources for this project were ODNR/DMRM for the design and OSM Clean Streams and ODNR-DMRM for construction.

2009 NPS Report - Huff Run Watershed - Fern Hill HR-42

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Water Quality Report

Water quality data was collected at the project discharge as well as multiple stations pre and post construction. The graphs below show changes in pH (Figure 1) and acidity (Figure 2) along the mainstem of the receiving stream upstream and downstream of the project discharge as a result of the AMD reclamation project.

Data Analysis

Fern Hill HR-42 Project pre-construction monitoring show pH and net acidity upstream, at the project discharge and along the mainstem of Huff Run downstream of the project. Pre-construction data show pH in the range of 4.7 to 6.9, at the project discharge and downstream. Post-construction data show pH in the range of 5.6 to 7.0. Acidity concentrations decreased by 46% at the project discharge site FRN01. This project needs post construction discharge measurements at site FRN01 to show acid and metal load reductions.

Figure 1. Pre and Post pH

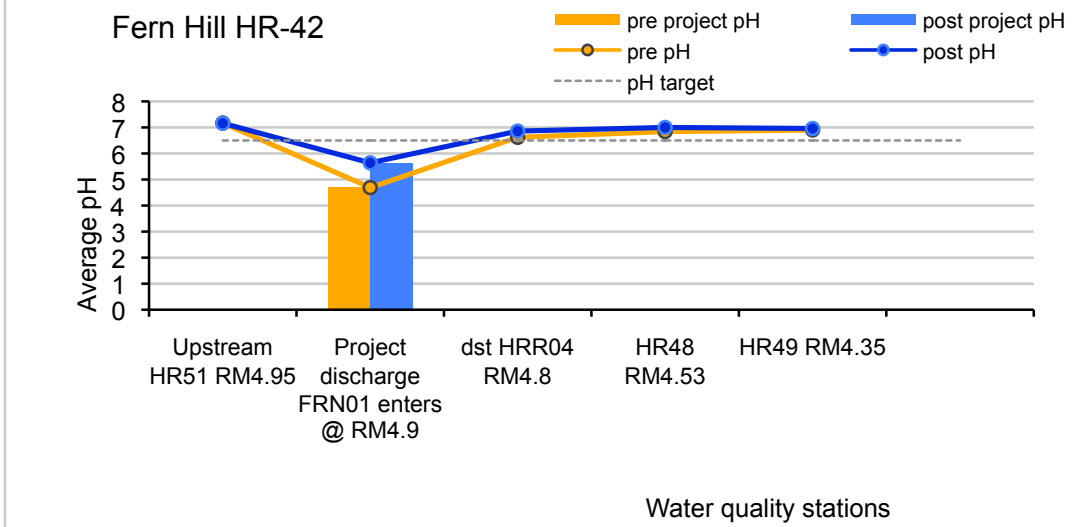
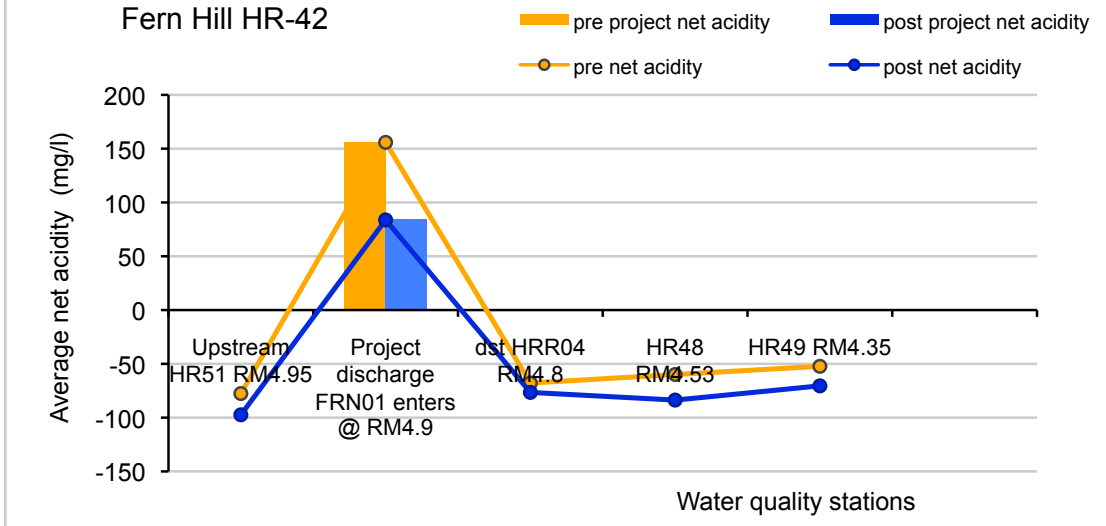


Figure 2. Pre and Post Acidity



2009 NPS Report - Huff Run Watershed - Belden

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete 2008 Project Number: CR-RS-10

Pre-construction

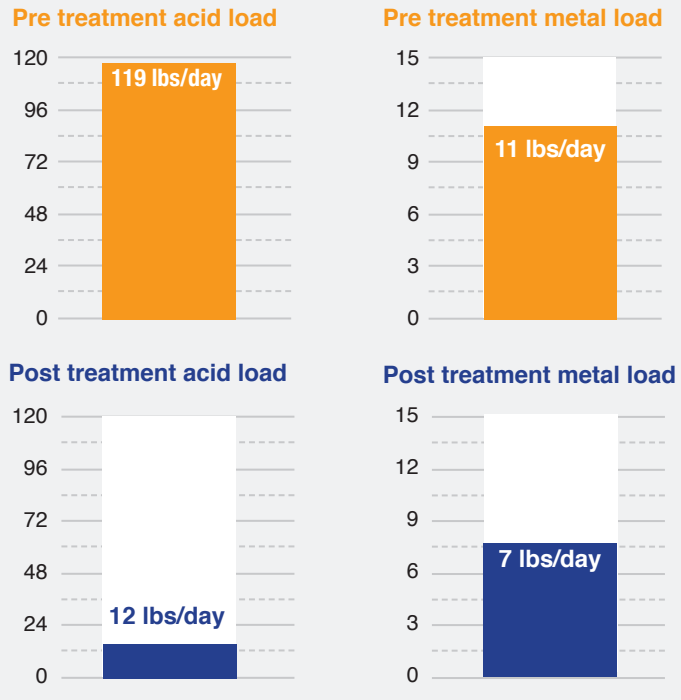
Gob pile with impounded acidic water, Photo by Huff Run Watershed

Post-construction

Caption: Steel Slag Bed #3, Photographer: Maureen Wise

Belden is located in Section 33 of Rose Township in Carroll County and lies within the 14-digit HUC unit #05040001080050. Belden site BLD01, discharges into Huff Run at river mile 4.5. The Belden site consists of large gob piles, exposed toxic clay, and strip pits north of the former Kopp Clay Plant. These sources contributed to the degradation of a 20-acre area in the Huff Run watershed. The treatment approach was to conduct surface reclamation, install steel slag beds to boost alkalinity, and install a sediment pond to allow metals to precipitate. The design was completed by ATC Associates for $123,000. The treatment consisted of 4.0 acres of surface reclamation, 10 acres of gob pile reclamation, install 9,600 square foot steel slag leach bed and a 7 acre settling pond. The goal of the design was to boost alkalinity and reduce iron metals and acidity from entering Huff Run. Construction was complete December 2008 by Tuscon for a cost of $688,330.25. The funding sources for this project were ODNR/DMRM for the design and USEPA Targeted Watershed Grant and ODNR-DMRM for construction. Figure 3 and 4 (shown on page 3 of this report) estimates approximately 107 lbs/day of acid were reduced from entering into Huff run and 4 lbs/day of metals.

SITE: BLD01



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

2009 NPS Report - Huff Run Watershed - Belden

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Water Quality Report

Water quality data was collected at the project discharge as well as multiple stations pre and post construction. The graphs below show changes in pH (Figure 1) and acidity (Figure 2) along the mainstem of the receiving stream up-stream and downstream of the project discharge as a result of the AMD reclamation project, as a result of the AMD reclamation project.

Data Analysis

Belden Project pre-construction monitoring show pH and net acidity upstream, at the project discharge and along the mainstem of Huff Run downstream of the project. Pre-construction data show pH in the range of 3.4 to 6.7, at the project discharge and downstream. Post-construction data show pH in the range of 5.8 to 7.0. Acidity concentrations decreased by 77% at the project discharge site BLD01.

Figure 1. Pre and Post pH

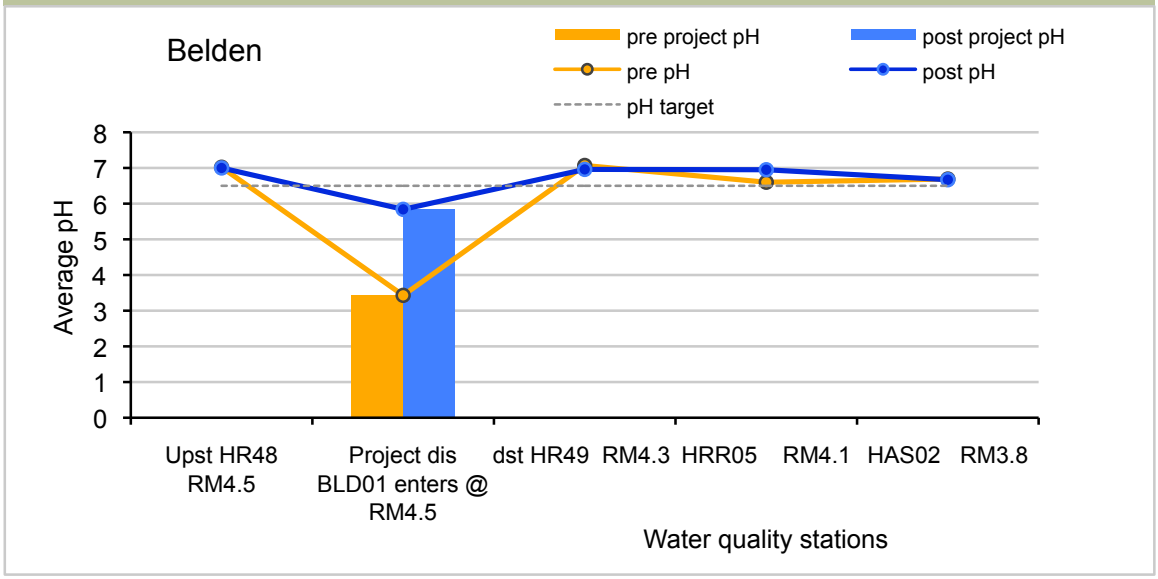
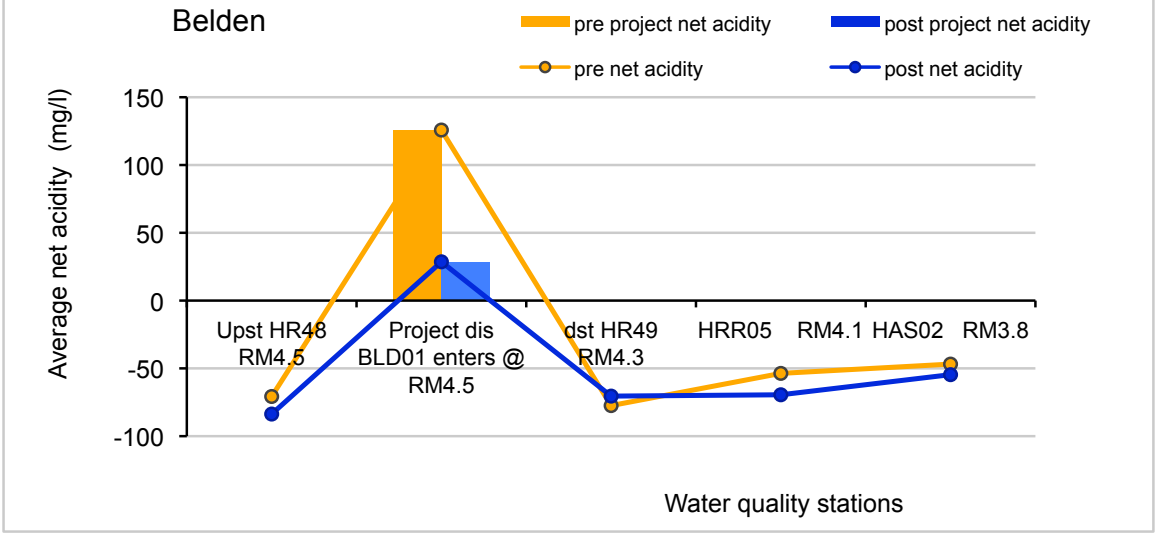


Figure 2. Pre and Post Acidity



Using the Mean Annual Load Method (Stoertz, 2004) acid and metal load reduction occurring at this project were plotted and shown in Figure 3 and 4. Acidity, iron, aluminum and discharge were measured pre- and post-construction at the project discharge from 8/1/1985 to 10/7/2008 for pre-construction and from 1/12/2009 to 12/31/2009 for post-construction. Post construction sampling events all were sampled during low to baseflow.

Figure 3. Acid Load Reduction

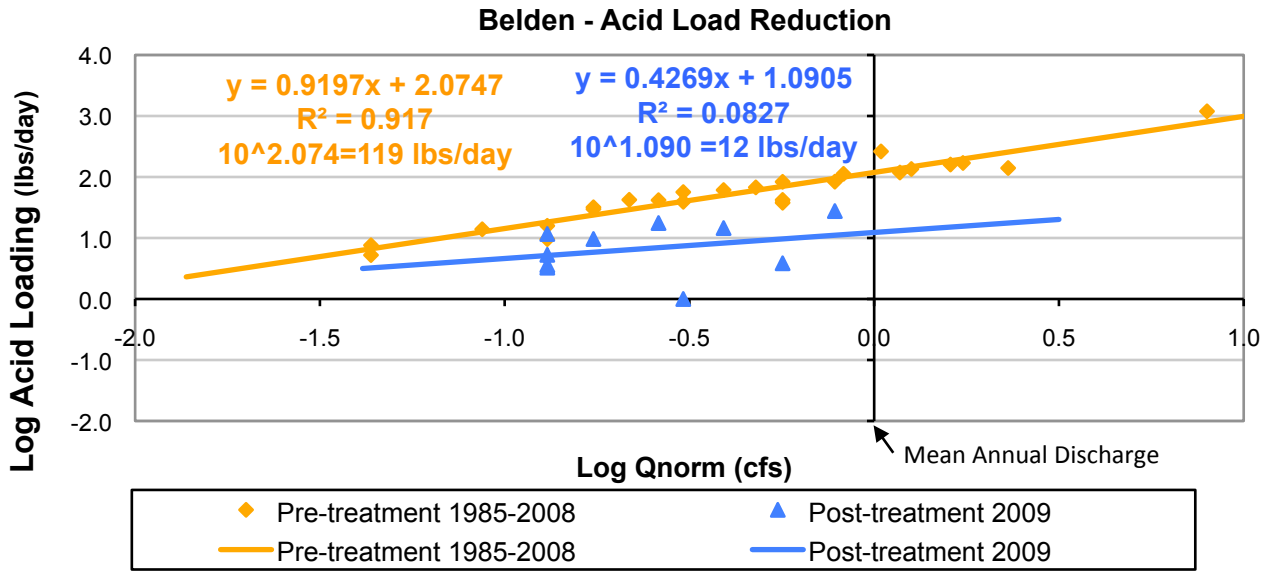
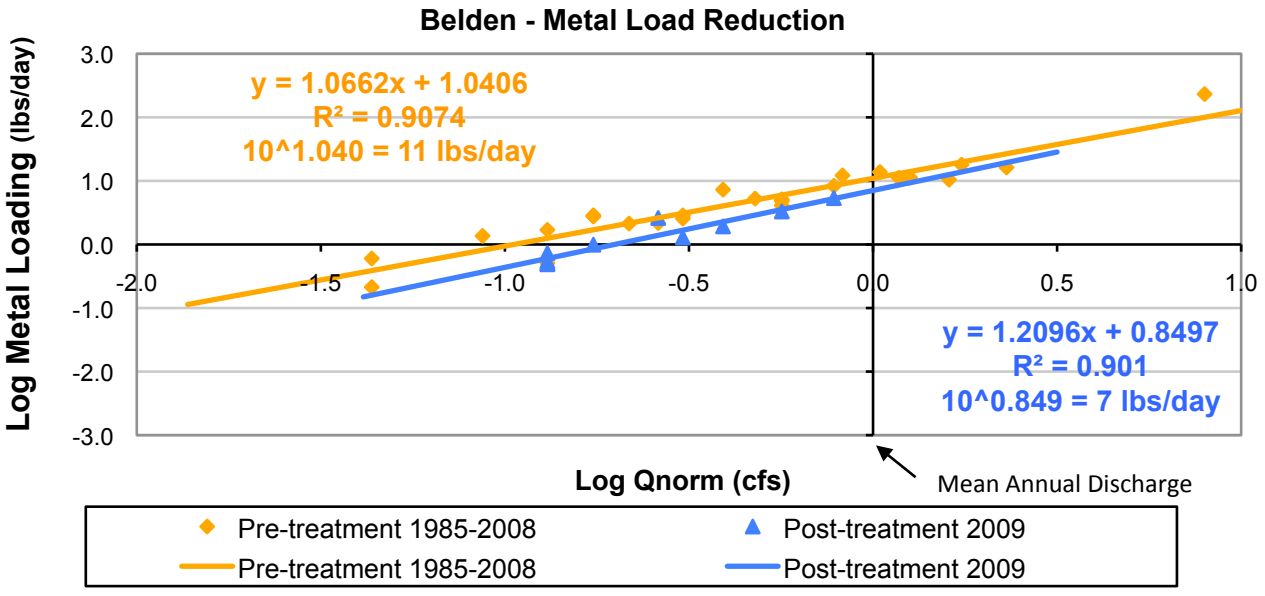


Figure 4. Dissolved Metal Load Reduction



2009 NPS Report - Huff Run Watershed - Thomas

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Expected Completion 2010 Project Number: CR-RS-08

Pre-construction

Southern area with large beaver ponds, Photo by Maureen Wise

Post-construction

Site two settling pond, Photo by Paul Greco

Thomas reclamation project is located in Section 33 of Rose Township in Carroll County and lies within the 14 digit HUC unit #05040001080050. Thomas reclamation project discharge is site THM01. The Thomas site consists of approximately 20 acres of surface mine water impoundments and toxic mine spoil. The impoundments are recharging a shallow deep mine, allowing for metals such as iron to flow into Huff Run. The design was completed by ODNR-DMRM in-house for a cost of $60,620. Plans for reclamation include surface mine and gob pile reclamation, limestone channels, and two settlings ponds. The project goal will be evaluated in 2010 annual report after construction is complete. Construction is expected to be complete in 2010 by Red Malcuit Inc. for a cost of $495,000. Funding source for the project design and construction is ODNR-DMRM , OEPA 319, and OSM. After construction and monitoring are complete the acid and metal load reduction will be reported in the 2010 annual report.

2009 NPS Report - Huff Run Watershed - Thomas

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Project Status: Expected Completion 2010 Project Number: CR-RS-08

Water Quality Report

Water quality data was collected at the project discharge as well as multiple stations pre-construction. The graphs below show changes in pH (Figure 1) and acidity (Figure 2) along the mainstem of the receiving stream upstream and downstream of the project discharge as a result of the AMD reclamation project. Post construction monitoring will begin 2010, results will be reported in 2010 annual report.

Data analysis

Thomas reclamation project monitoring show pH and net acidity at site THM01, Figure 1. Pre-construction data shows average pH of 6.73 and net alkaline at site THM01 before discharging into Huff Run. Post-construction data will be reported in 2010 annual report.

Figure 1. Pre pH

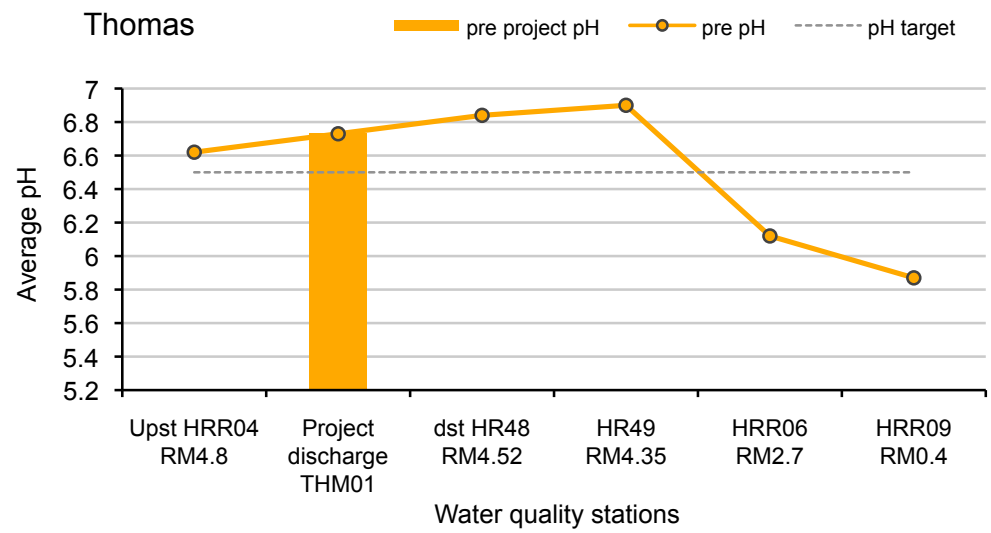
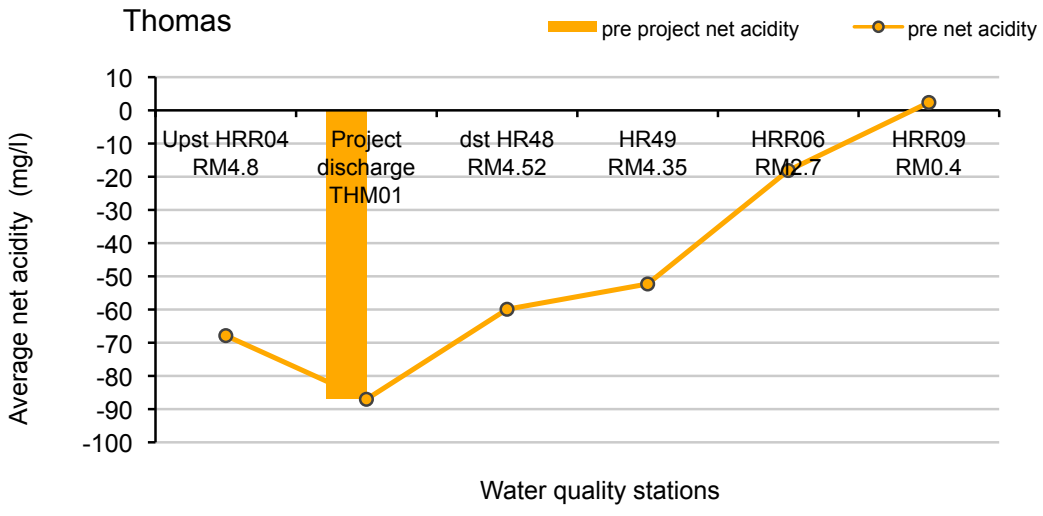


Figure 2. Pre Acidity



2009 NPS Report - Huff Run Watershed - Mineral Zoar

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: completed November 2009 Project Number: TS-Sn-23

Pre-construction

Future Reserve Alkaline Producing System and Aerobic Wetland site, Photograph by Maureen Wise

Post-construction

Mineral Zoar Overview and Aerobic Wetland Photograph by Maureen Wise

Mineral Zoar is located in Sandy Township in Tuscarawas County. The Mineral Zoar project discharge, site MZR08, is located under the railroad bed at the Mineral Zoar Road final project exit point. Mineral Zoar is the largest tributary to Huff Run and runs through the Mineral City Park. The project consists of two deep mines that discharge acidic water. The design was completed by Baker Consulting and ODNR in-house for $53,780. The treatment approach for this site is to treat the two deep mines with a reverse alkaline producing system (RAPS) (1,400 sq. ft) while utilizing an existing wetland and 100 linear feet of open limestone channels. The goal of the design is to reduce 100% of the acidity on site. Construction was complete Fall 2009 by Beaver Consulting for a cost of $335,086. Funding source for the project design and construction is ODNR-DMRM and OSM.

References

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Stoertz, Mary W. and Douglas H. Green, 2004. Mean Annual Acidity Load: A Performance Measure to Evaluate Acid Mine Drainage Remediation. Ohio Department of Natural Resources Conservation and Restoration Innovations 2004 Applied Research Conference at Ohio University

US Geological Survey (USGS) StreamStats website – flow characteristics http://water.usgs.gov/osw/streamstats version 2