

MONDAY CREEK WATERSHED REPORT

2017–2018 NPS Report - Monday Creek Watershed

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Monday Creek Restoration Project



Reductions

**Total acid load reduction
2017–2018= 4,006 lbs/day**

**Total metal load reduction
2017–2018= 393 lbs/day**

Data derived using the Stoertz Water Quality Evaluation Method (Kruse et al. 2014)

Acid and metal load reductions based on projects monitored during 2017/2018: Jobs Doser, Rock Run Gob Pile, Lost Run Phase I & II, Coe Hollow, Big Four, and Monkey Hollow Doser.

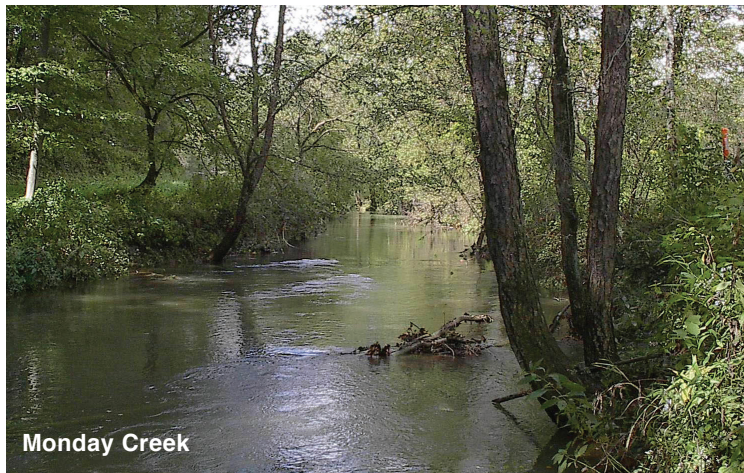
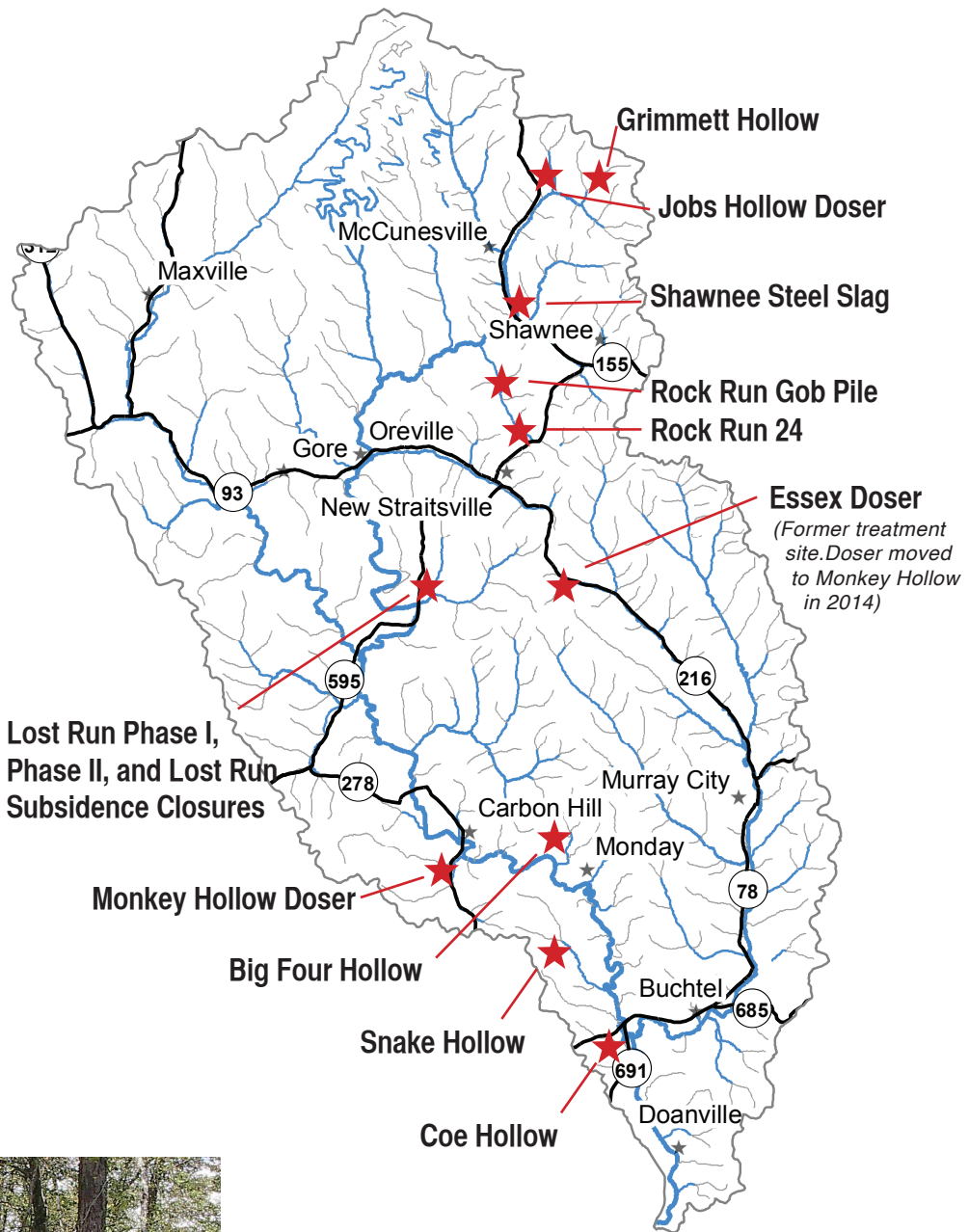
Cost

Design \$448,545

(excluding Jobs Doser & Lost Run maintenance and Snake Hollow)

Construction \$7,047,825

Total costs through 2018 = \$7,496,369



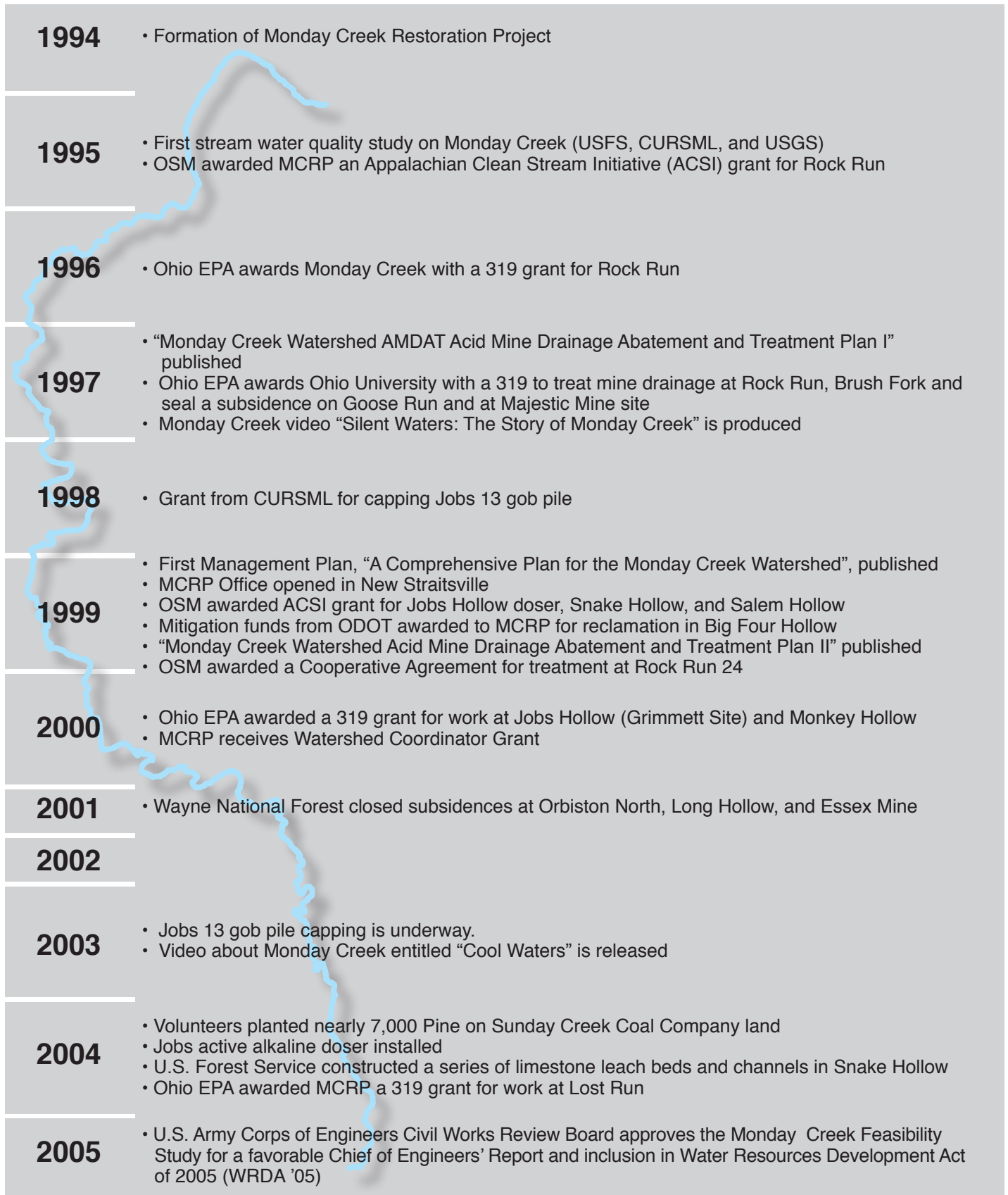
Monday Creek

363,425,000 gallons of stream water per year eliminated from entering into the deep mines as the result of conducting seven stream capture closure projects in Monday creek.

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Timeline of the Monday Creek Watershed Project Milestones & AMD Projects



continued on next page

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Timeline of the Monday Creek Watershed Project Milestones & AMD Projects (continued)

2006	<ul style="list-style-type: none">• Acid Mine Drainage Abatement and Treatment (AMDAT) Plan III approved• Essex Doser (319 grant) is operational• U.S. Forest Service constructed open limestone channels, closed subsidence and established positive drainage at New Straitsville North area, Monkey Hollow, and Elm Rock area• The MCRP Watershed Management Plan was fully endorsed by the Ohio DNR and Ohio EPA• Lost Run Phase I reclamation and OEPA 319 grant was completed
2007	<ul style="list-style-type: none">• Ohio EPA awarded MCRP a 319 grant for construction of a steel slag leach bed at Shawnee• U.S. Forest Service closed subsidences near State Route 216 and Snake Hollow• The Water Resources Development Act of 2007 is approved, Congress authorized \$21 million for ecological restoration of Monday Creek
2008	<ul style="list-style-type: none">• U.S. Forest Service completes reclamation in Valley Junk area• ODOT mitigation funds in the amount of \$200,000 secured for work at Lost Run Phase 2
2009	<ul style="list-style-type: none">• ODOT mitigation funds are in place for work in Big Four Hollow and at Rock Run• U.S. Forest Service completed reclamation work along State Route 278, New Straitsville South area, Lost Run headwaters, Brush Fork, and Coe Hollow.• Ohio DNR completes phase II of Shawnee steel slag leach bed
2010	<ul style="list-style-type: none">• U.S. Forest Service closed subsidences along Snow Fork, Rock Run, and New Straitsville South
2011	<ul style="list-style-type: none">• U.S. Forest Service closed subsidences in the Cawthorn area• Ohio DNR conducted reclamation and needed maintenance at Rock Run• U.S. Forest Service and ODNR completed reclamation in Sand Run• Ohio DNR completes construction to minimize sediment transport at Big Four Hollow
2012	<ul style="list-style-type: none">• 3 limestone leach beds installed in Big Four Hollow.• MCRP, Perry Co. Health Department, Village of New Straitsville and watershed residents installed a community garden in New Straitsville.• Major AMD maintenance projects completed in Lost Run and Jobs Hollow
2013	<ul style="list-style-type: none">• Five new fish species found in Monday Creek and the first annual Monday Creek Canoe Float with 54 people in 27 boats!
2014	<ul style="list-style-type: none">• The Essex Doser moved to Monkey Hollow and two new species of fish found in the Carbon Hill area: Brown Bullhead and the Banded Darter.
2015	<ul style="list-style-type: none">• Monkey Hollow Doser began operating August 26, 2015. This project will help improve 6.5 miles of Monday Creek.• The Smallmouth Bass (<i>Micropterus dolomieu</i>) was found for the first time in Monday Creek since restoration project. Two other native species were also found, greenside darter (<i>Etheostoma blennioides</i>) and spotted sucker (<i>Minytrema melanops</i>).
2016	<ul style="list-style-type: none">• USFS closed subsidence holes in Salem Hollow and Sand Run• The Longear Sunfish (<i>Lepomis megalotis</i>) was found for the first time in Monday Creek.• Lost Run 3 East steel slag leach bed began operating.• USFS identified the Kitchen Run - Monday Creek 12 digit HUC as a priority watershed and completed a Watershed Restoration Action Plan to identify ways to continue improving the target area.
2017 2018	<ul style="list-style-type: none">• New fish species, Stonecat Madtom, (<i>Noturus flavus</i>) found in Monday Creek.• ODNR and OSM funded maintenance on existing projects.

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Monday Creek Projects

Acid mine drainage reclamation projects completed in Monday Creek Watershed:

- 1999** Rock Run Gob Pile revamped 2011 (RR02100) – Gob pile reclamation
- 2001** *Rock Run 24 (RR00820) – Limestone channel*
- 2003** *Grimmett Hollow (JH09020) – Enhanced wetland with lime and limestone channels*
- 2004** Jobs Hollow Doser (JH00500) – Active calcium oxide doser
Big Four Hollow (BF00100) – 2 limestone beds and limestone channels
Snake Hollow (SH00100) – Close 9 subsidence features, 2 steel slag beds, enhance wetland, and limestone channels
- 2006** *Essex Doser (SY00706) – Active calcium oxide doser shutdown in 2008*
Lost Run Phase I (LR01020) – limestone leach beds and limestone channels
- 2007** Lost Run Phase II (LR00020) – Steel slag beds, limestone leach beds, and limestone channels
Lost Run Subsidence and Portal Closures – closed ten subsidence features
- 2008** *Shawnee Steel Slag Bed (MC00900) – Steel slag bed, limestone channels, and sand filter*
- 2010** Jobs Hollow Doser Maintenance II – Clean out of source pond, supply lines, and installed safety cage to hatch and ladder
Coe Hollow (CH00100) – Limestone leach ponds, passive wetlands,, steel slag leach bed, and 2 subsidence features closed
- 2012** Lost Run II Maintenance – New steel slag installed, additional piping in the underdrain, and improve water delivery to SSLB.
Big Four Hollow LLB (BF00400) – 3 limestone leach beds
- 2015** Monkey Hollow Doser (MH00100) – Active calcium oxide doser
Big Four Wetland Enhancement (BF00100) - Three wetlands installed for metal retention

Italicized indicated projects are not actively monitored for acid mine drainage and metal load reduction purposes

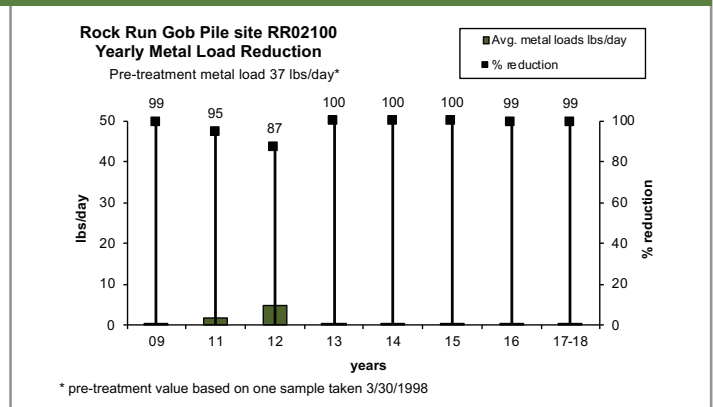
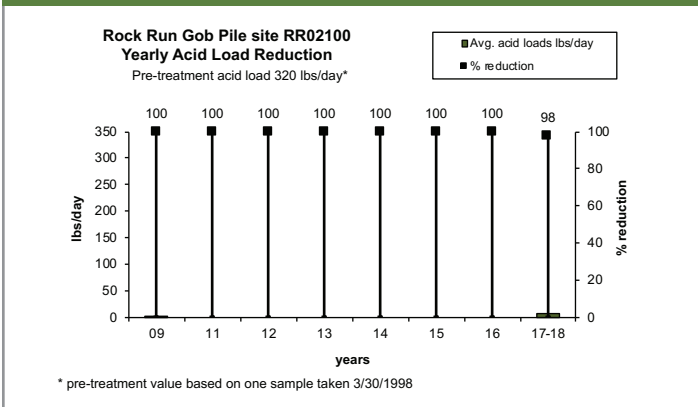
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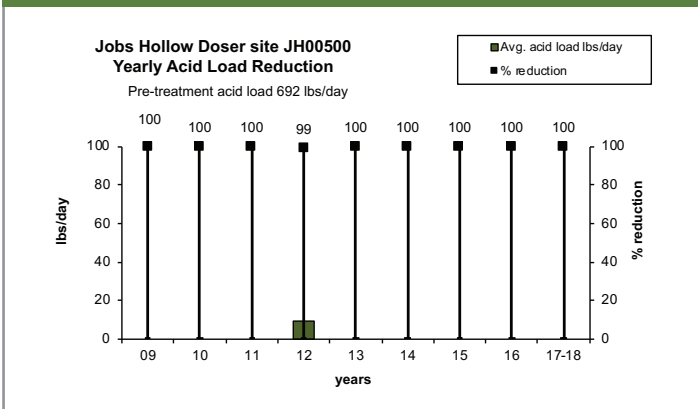
Yearly acid and metal load reduction trends per project

Similar to other environmental best management practices (BMPs), performance of passive acid mine drainage reclamation projects are also expected to decline with time. Active treatment systems are not expected to decline with time but sometimes need to be maintained to perform adequately. Currently, operation and maintenance plans are being designed for each existing system and are planned for future projects. The graphs below show the mean annual acid and metal load reduction using the Stoertz Water Quality Evaluation Method (Kruse et al., 2014) for each year (or group of years) during post-reclamation from the project effluent. From these graphs the rate of decline (and/or improvement) with time of the treatment system is implied. Knowing the rate of decline will aid in the implementation of operation and maintenance plans.

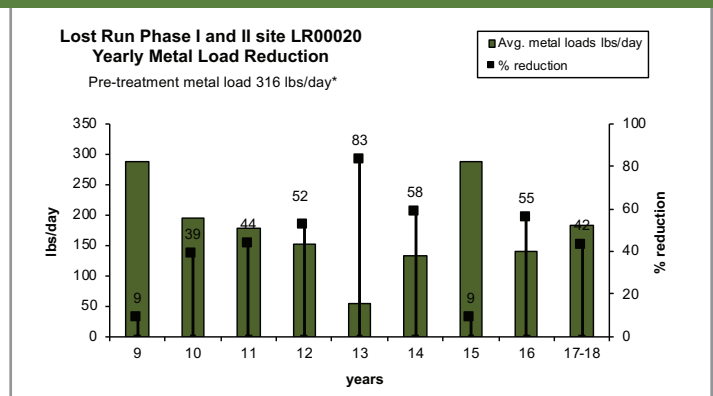
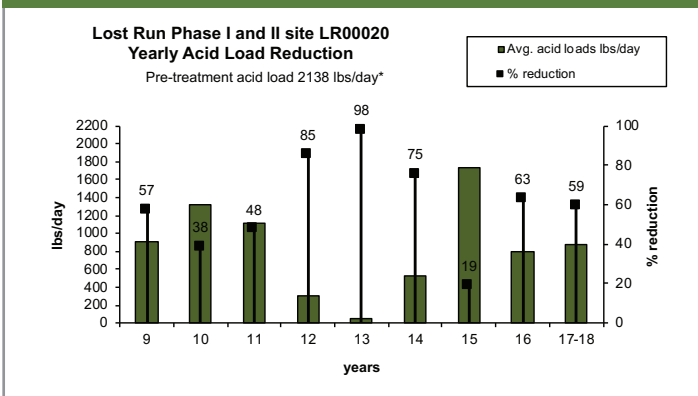
Rock Run Gob Pile site RR02100



Jobs Hollow Doser site JH00500



Lost Run Phase I and II site LR00020

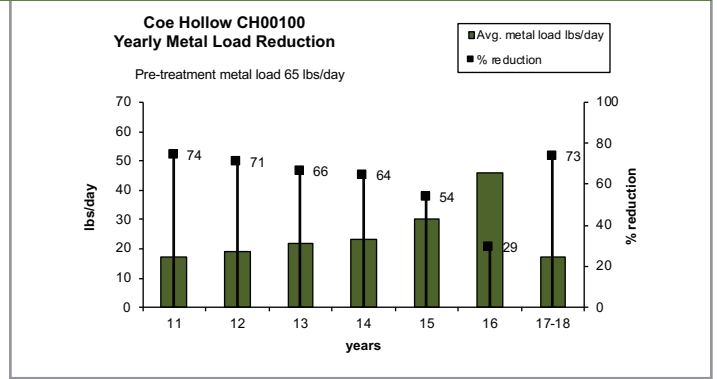
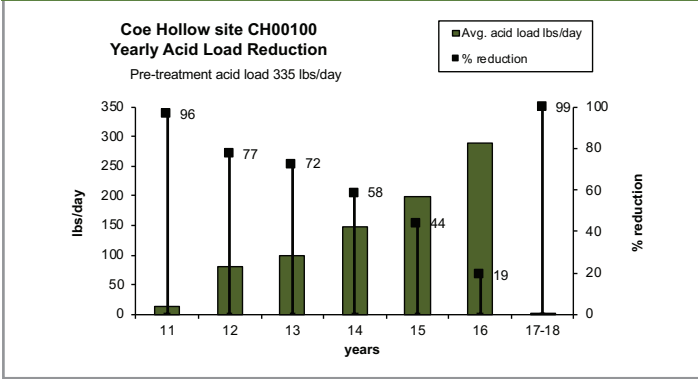


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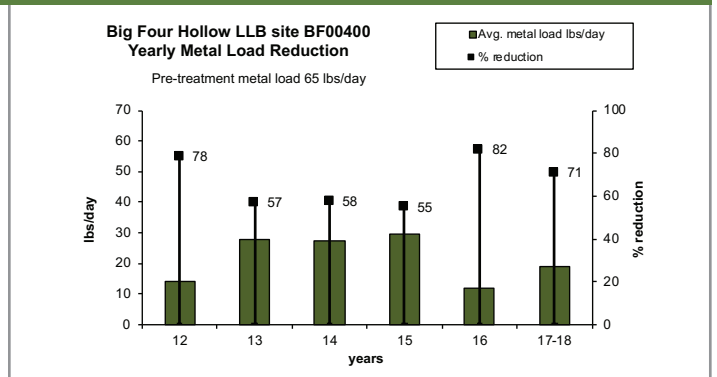
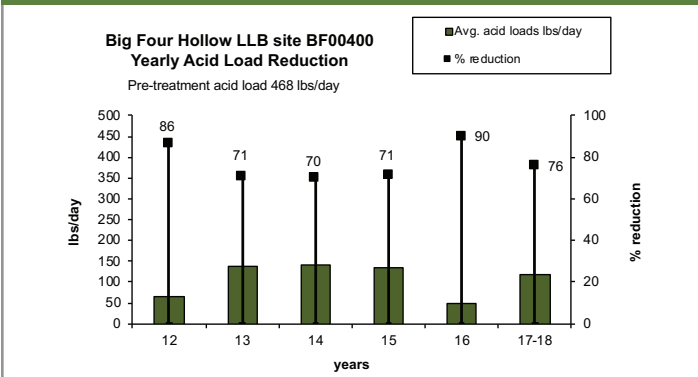
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Yearly acid and metal load reduction trends per project

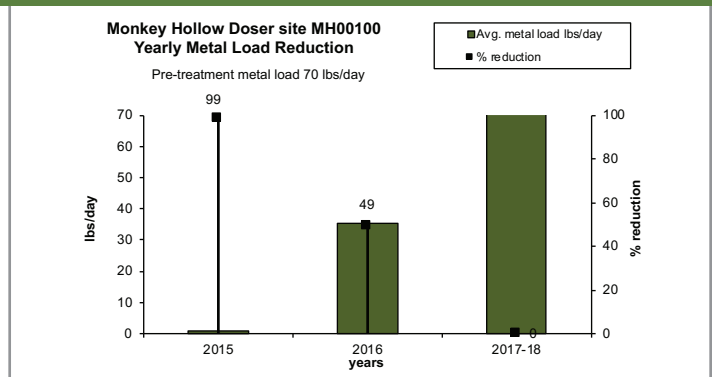
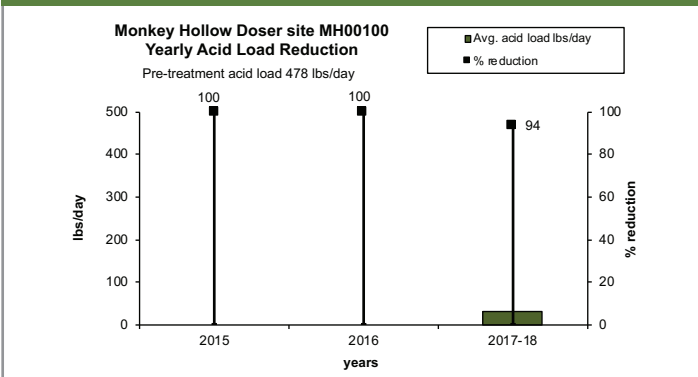
Coe Hollow site CH00100



Big Four Hollow LLB site BF00400



Monkey Hollow Doser site MH0010



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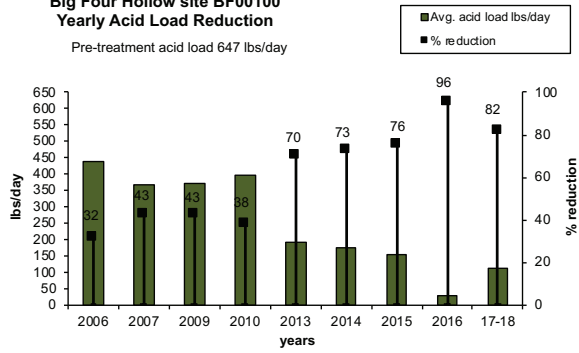
Yearly acid and metal load reduction trends per project

Big Four Hollow site BF00100

Big Four Hollow site BF00100

Yearly Acid Load Reduction

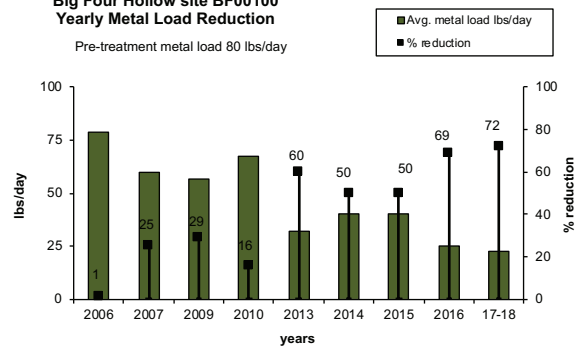
Pre-treatment acid load 647 lbs/day



Big Four Hollow site BF00100

Yearly Metal Load Reduction

Pre-treatment metal load 80 lbs/day

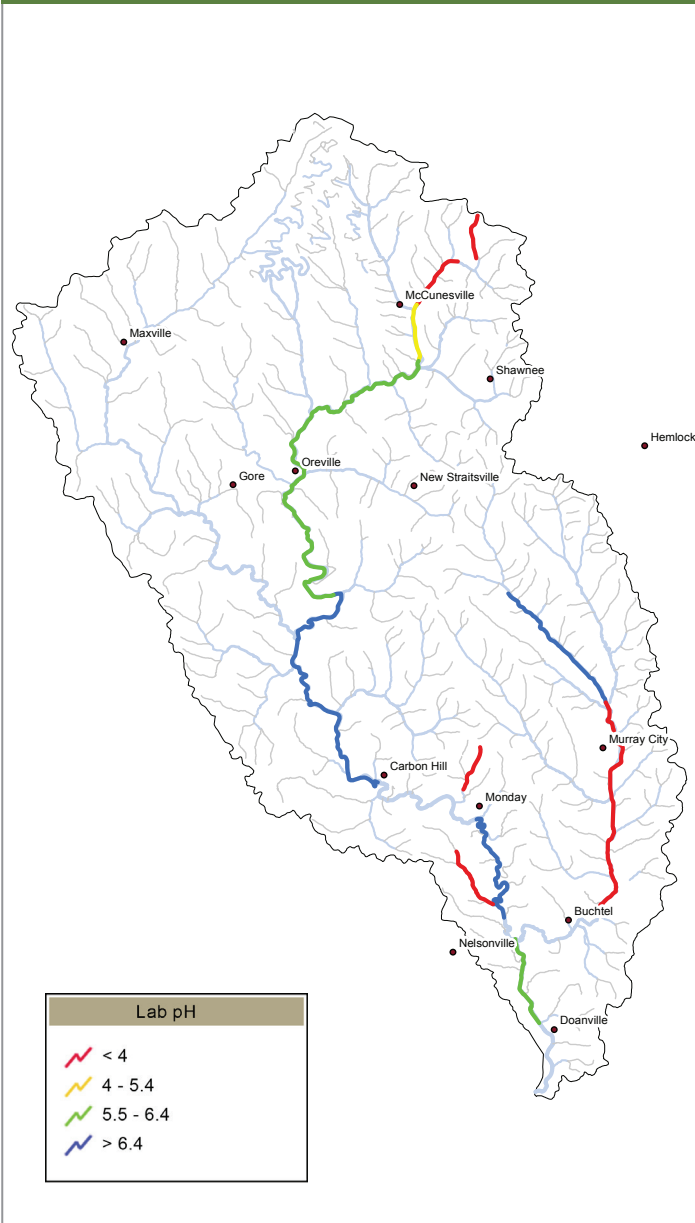


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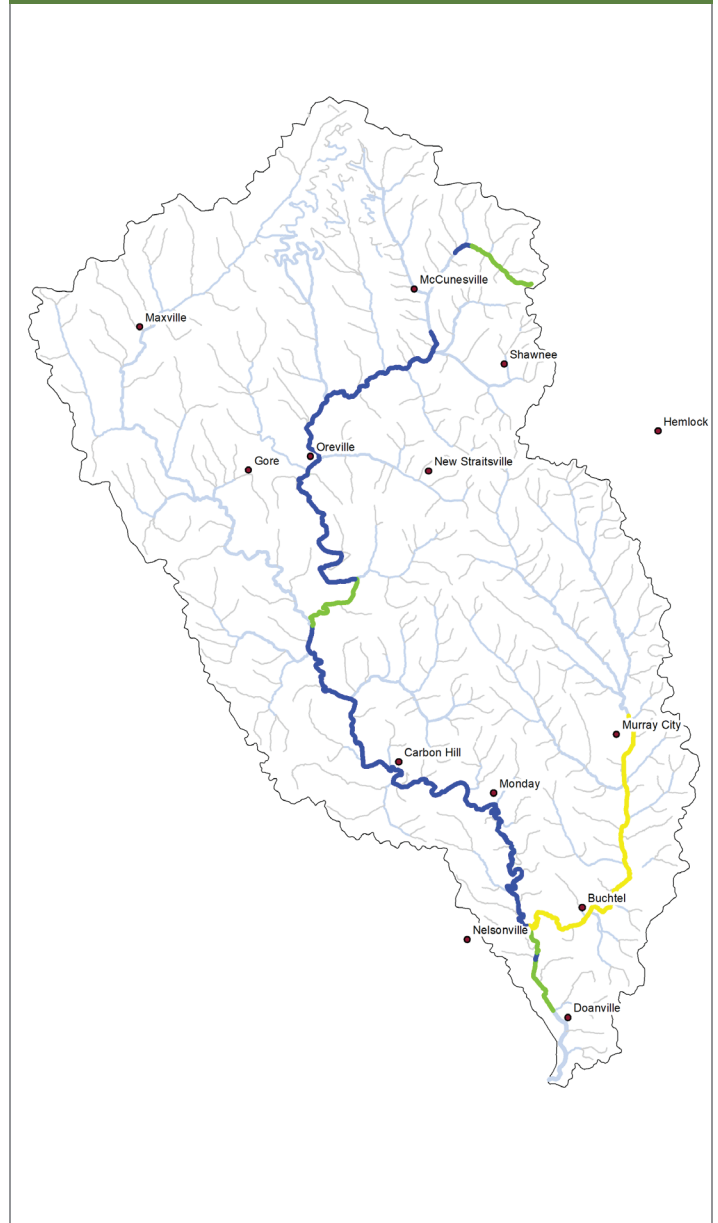
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Chemical Water Quality

Monday Creek baseline pH



Monday Creek 2017–2018 pH



In Monday Creek pH values have improved throughout the watershed from baseline conditions (2001) to 2018. In 2017–2018, stream miles meeting pH target of 6.5 is approximately 27.5 miles of the 33 miles monitored (83%).

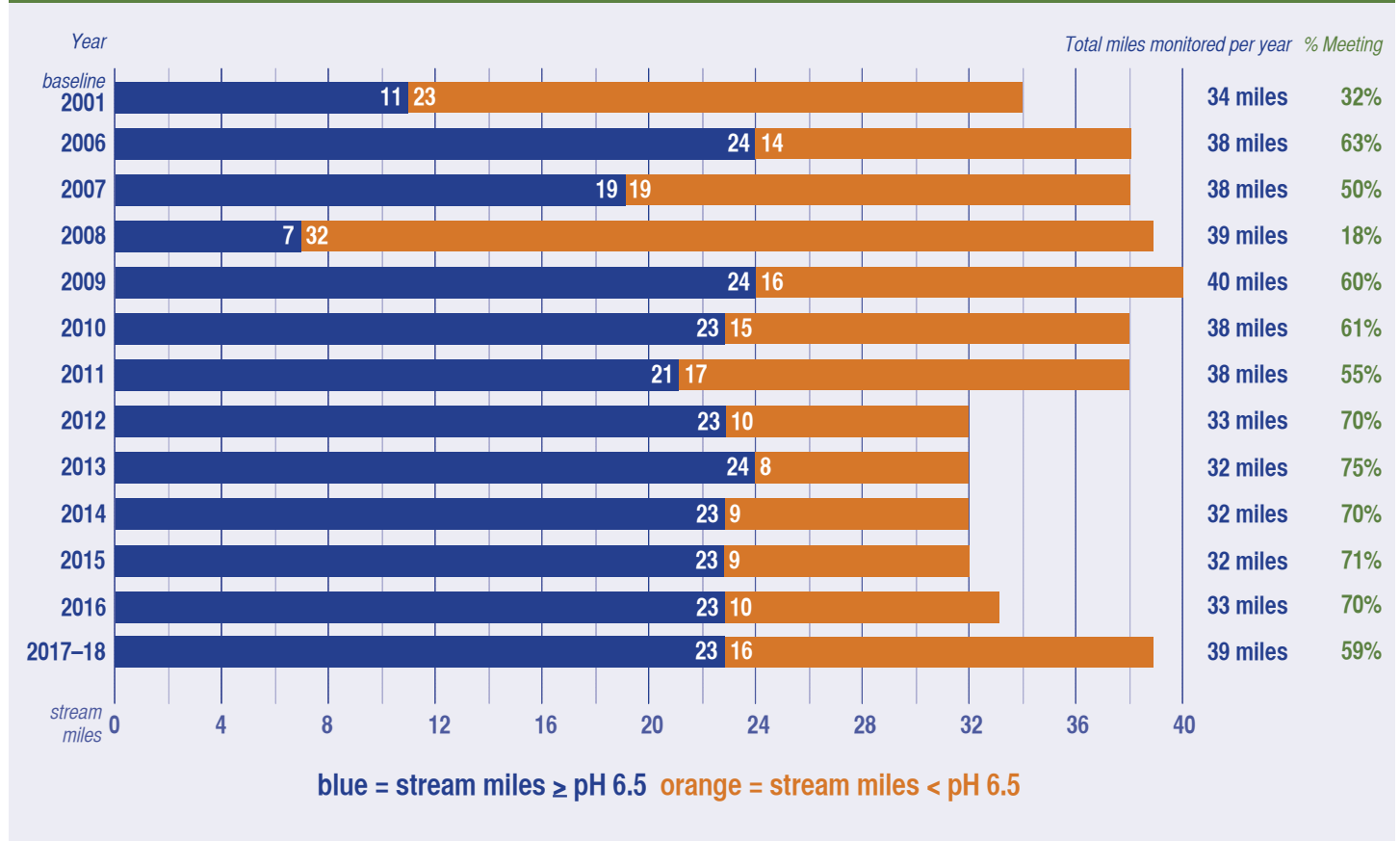
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Chemical Water Quality

There are approximately 33 stream miles monitored each year along the mainstem of Monday Creek, 38 miles when major tributary Snow Fork is included. The restoration target for pH is 6.5. 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. In 2009 and 2010 data shows an increase again with approximately 24 of the 39 miles monitored meeting the pH target. In 2011, the site near Lost Run MC00500 dropped below the pH target, and this site has continued to fluctuate across the pH target, averaging 6.3 for 2017-2018. From 2012 -2018, the rest of the stream miles meeting the pH target have remained relatively constant. The mainstem of Snow Fork, downstream of Essex Doser has been discontinued for monitoring, as treatment in this basin is unlikely. Snow Fork was sampled in the 2017-2018 period, however, and is therefore shown with its average below the target pH.

Figure 1. Monday Creek pH

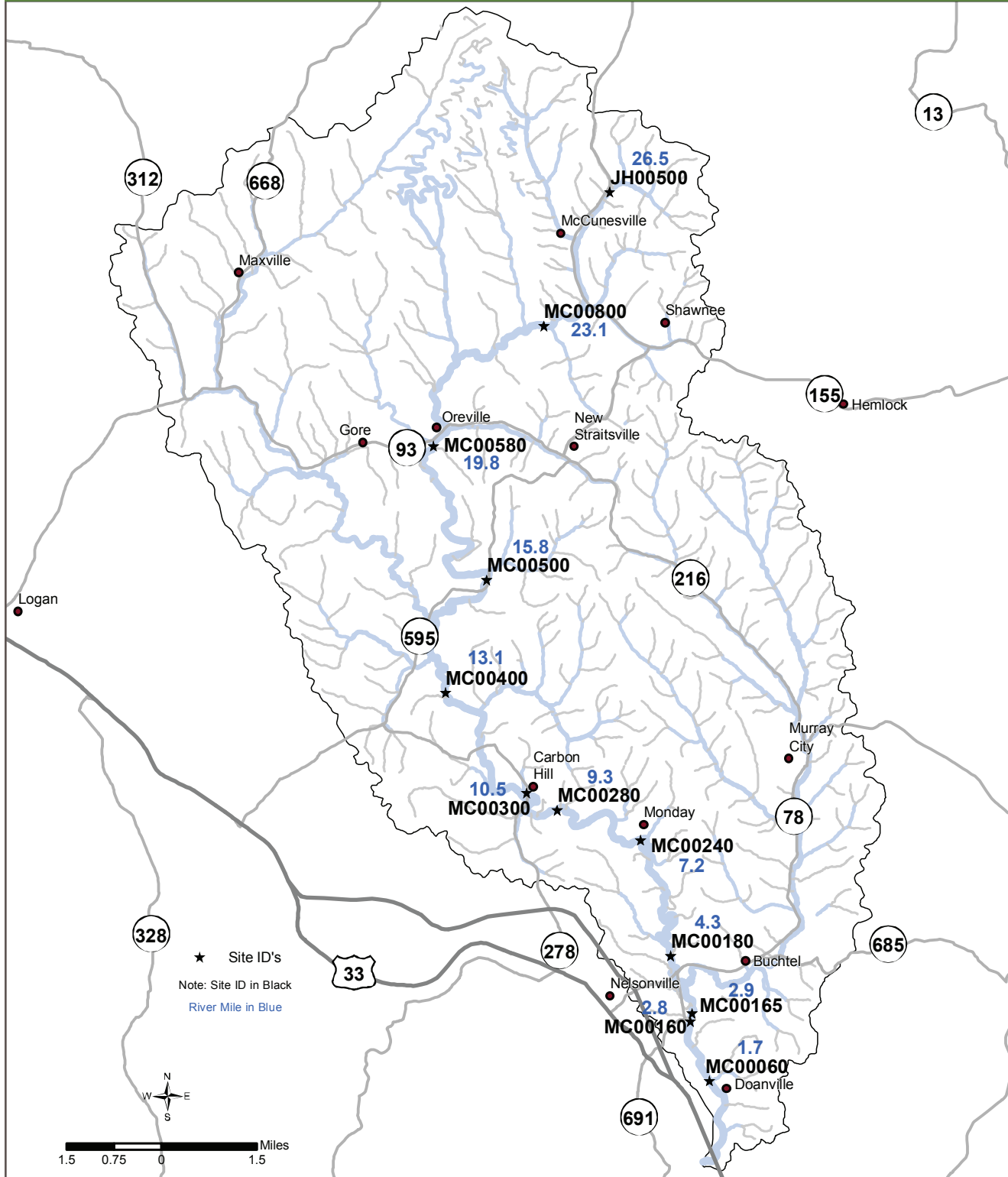


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Chemical Water Quality

Monday Creek



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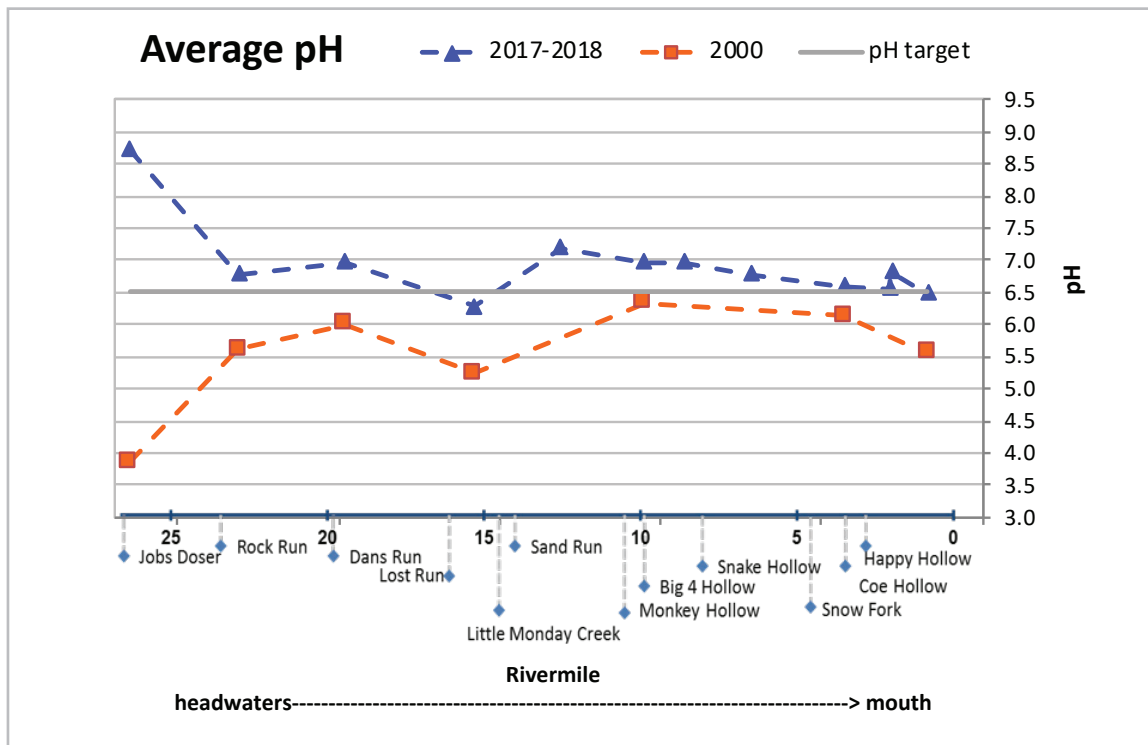
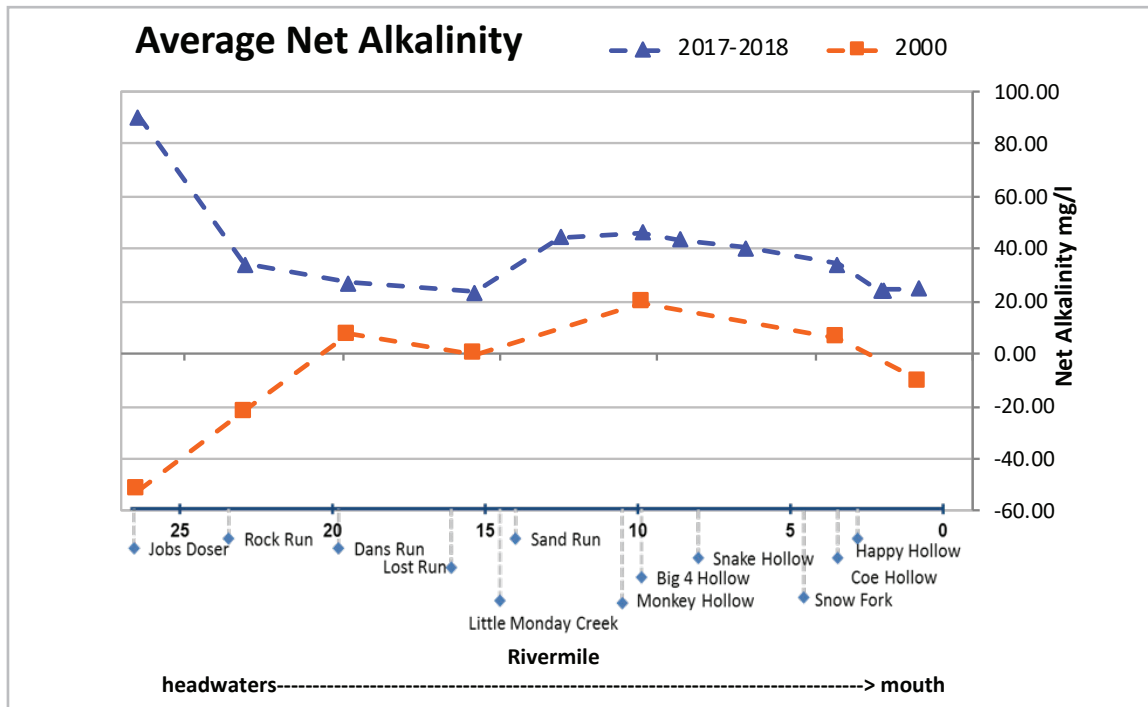
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Chemical water quality analysis per stream reach

Chemical water quality changes along the mainstem of Monday Creek are shown in the stream reach graphs below. Chemical long-term monitoring data is utilized to generate line graphs along the stream gradient from headwaters to the mouth. Along the x-axis named tributaries are shown to illustrate sources of water entering the mainstem. A list of long-term monitoring sites utilized to generate the graphs with their river miles are shown below.

Monday Creek Mainstem

Site ID	JH00500	MC00800	MC00580	MC00500	MC00400	MC00300	MC00280	MC00240	MC00180	MC00165	MC00160	MC00060
Rivermile	26.5	23.1	19.8	15.8	13.1	10.5	9.3	7.2	4.3	2.9	2.8	1.7



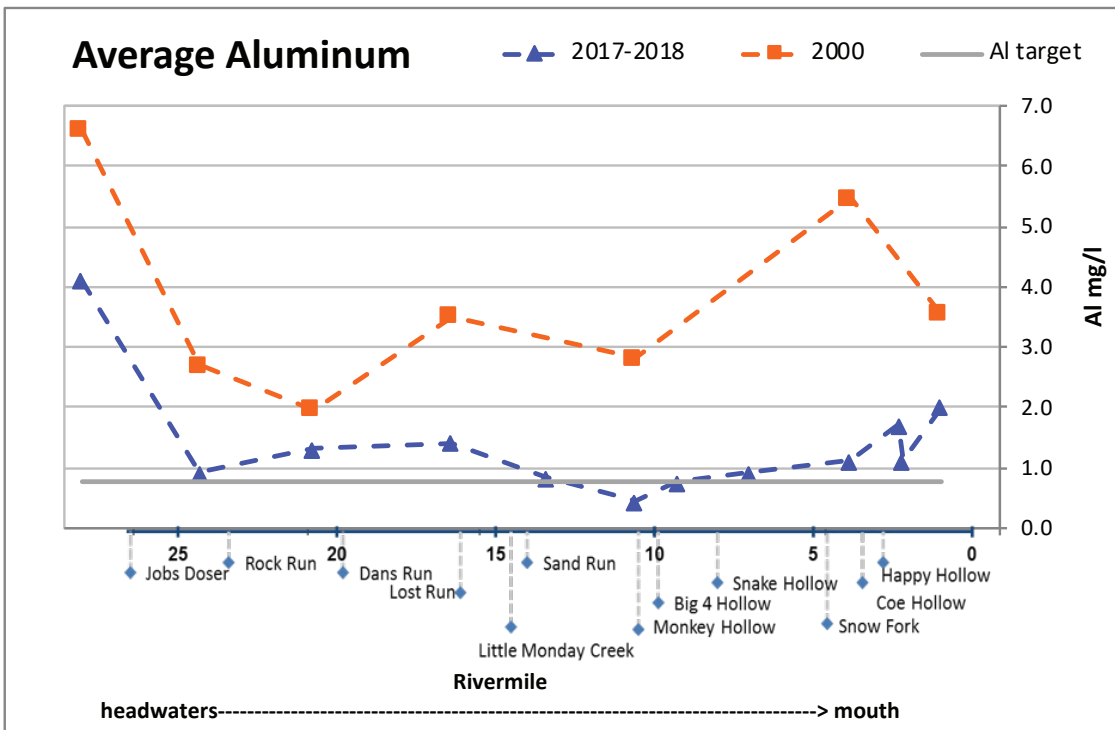
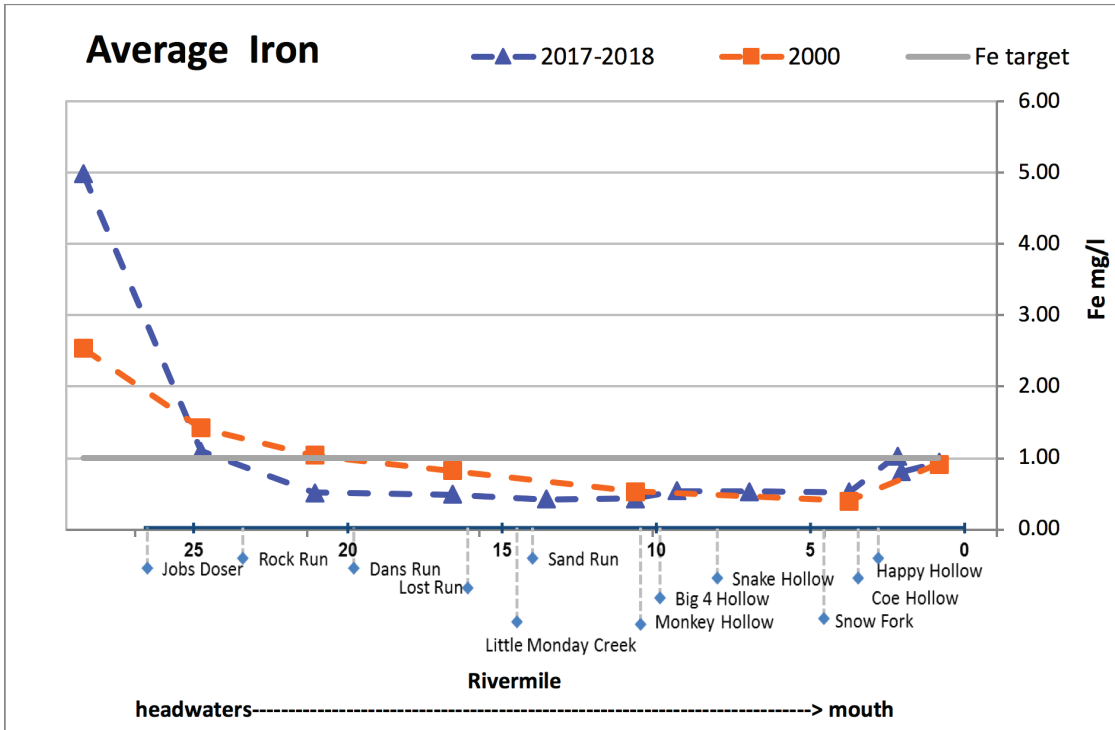
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Chemical water quality analysis per stream reach

Monday Creek Mainstem

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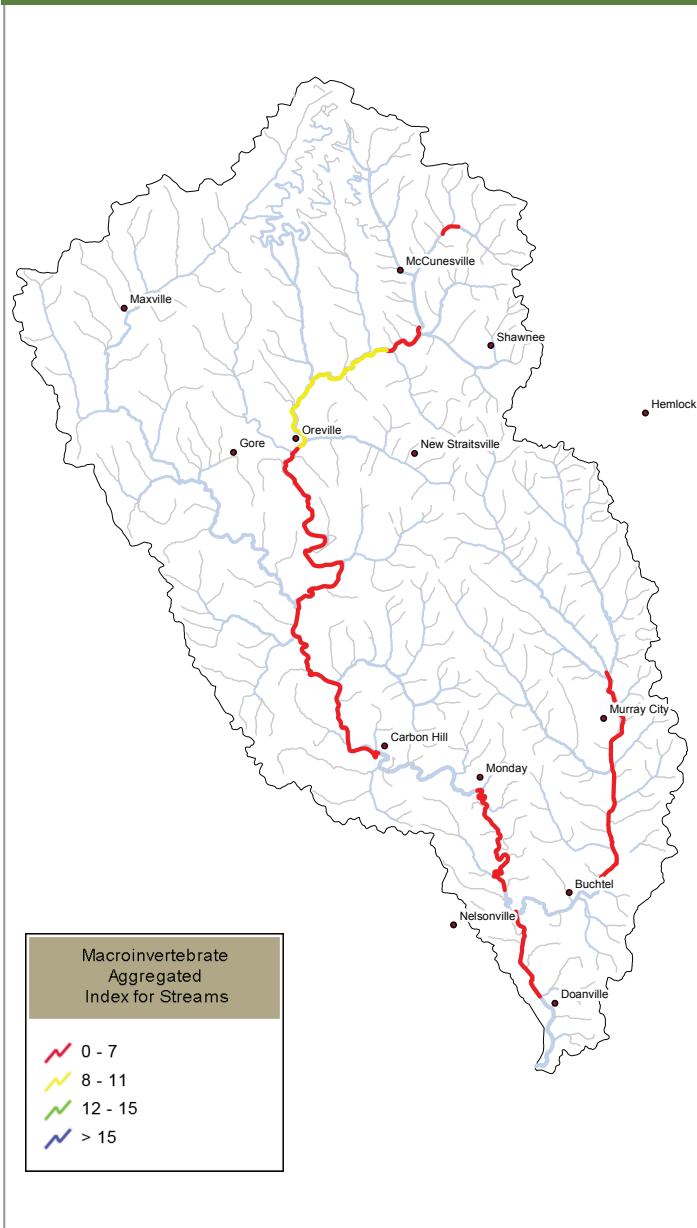


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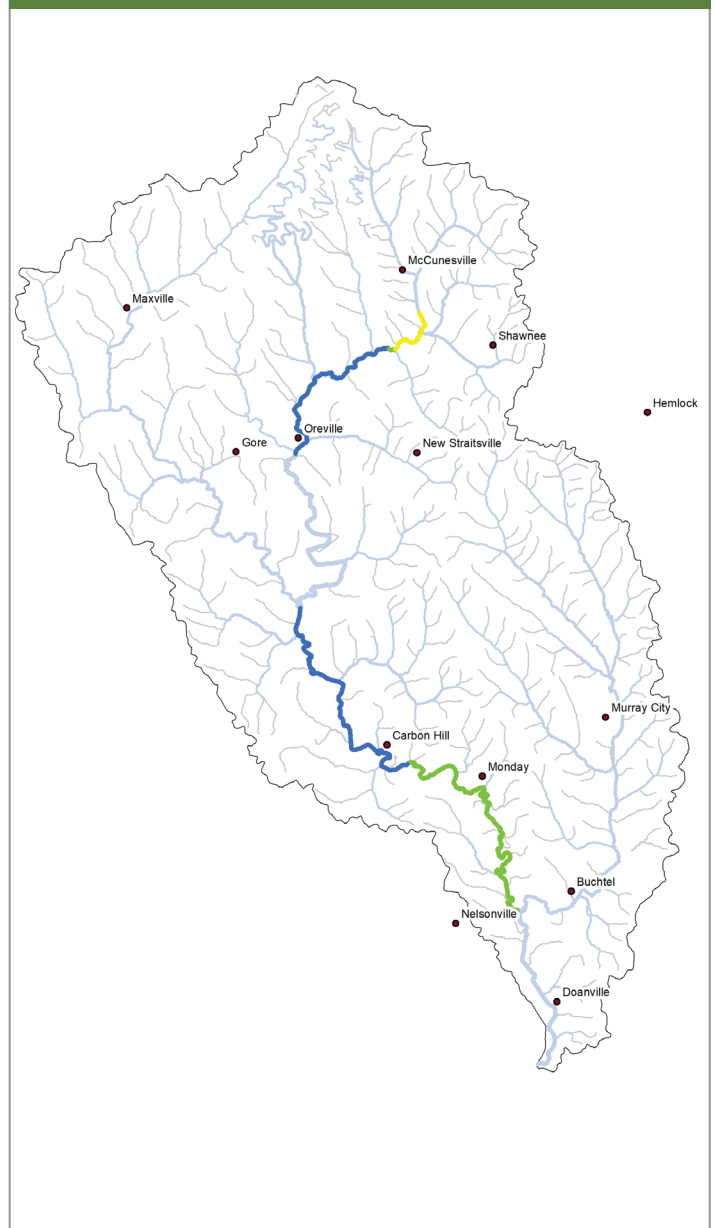
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Biological Water Quality

Monday Creek baseline MAIS



Monday Creek 2017–2018 MAIS



MAIS samples were collected throughout Monday Creek at established annual monitoring stations from 2001 through 2017-2018.

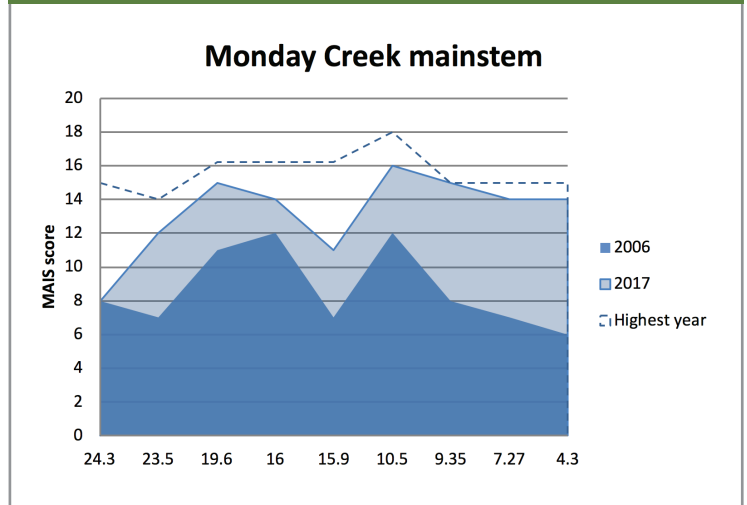
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Biological Water Quality

The Monday Creek mainstem continued to maintain the improvements in biological quality observed over the last ten years. One exception was an unusually low score at RM 24.3 (MC00900), downstream of the Shawnee wastewater treatment plant, which received an '8' in 2017 when it normally scores above '12'. A second site with a persistently low biological score (RM 15.9, MC00500) has room for improvement. In 2012 and 2013 this section of stream earned high scores of '15' and '16', respectively, suggesting that it has restoration potential. A closer examination of specific causes of impairment at this site may help with future improvements.

Area of Degradation



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

Monday Creek MAIS Regressions

MONDAY	RM	'01	'02	'03	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17	Linear trends	R square	P-value	No. of observations	
JH 0902					8	6	6	4	4	4	4											
MC 148		4	6	4	7	6	5	4	7	8	9	11	10	13	8	5						
MC 0095	25.3				7	8	7	4	9	6	10	10	10	12	13	11						
MC 0090	24.3				6	8	12	12	11	11	12	12	14	12	15	12	8	no change	0.193930	0.132059	13	
MC 0083	23.5	5	3	1	11	7	9	12	7	13	11	13	12	14	14	13	12	improved	0.675235	9.44249	17	
MC 103	19.6	8	9	10	13	11	12	12	13	16	14	16	15	14	16	15	15	improved	0.778725	6.06063	17	
MC 0051	16	2	6	6		12	11	10	10	10		14	14	14	14	14						
MC00500	15.9					7	8		5			15	16	9	13	11						
MC 153	10.5	5	10	13	13	12	14		12	16	16	15	16	16	18	16	16	improved	0.698982	5.46974	17	
MC 154-B	9.4					8	9	10	9	14	12	10	15	11	14	12	15	improved	0.534246	0.00692	12	
MC 152	7.3					8	7	7	8	10	14	10	8	11	13	11	12	14	improved	0.557603	0.00336	13
MC 151	4.3	2	6	2	8	6	9	7	4	13	9	9	15	11	13	12	14	improved	0.696600	5.78834	17	