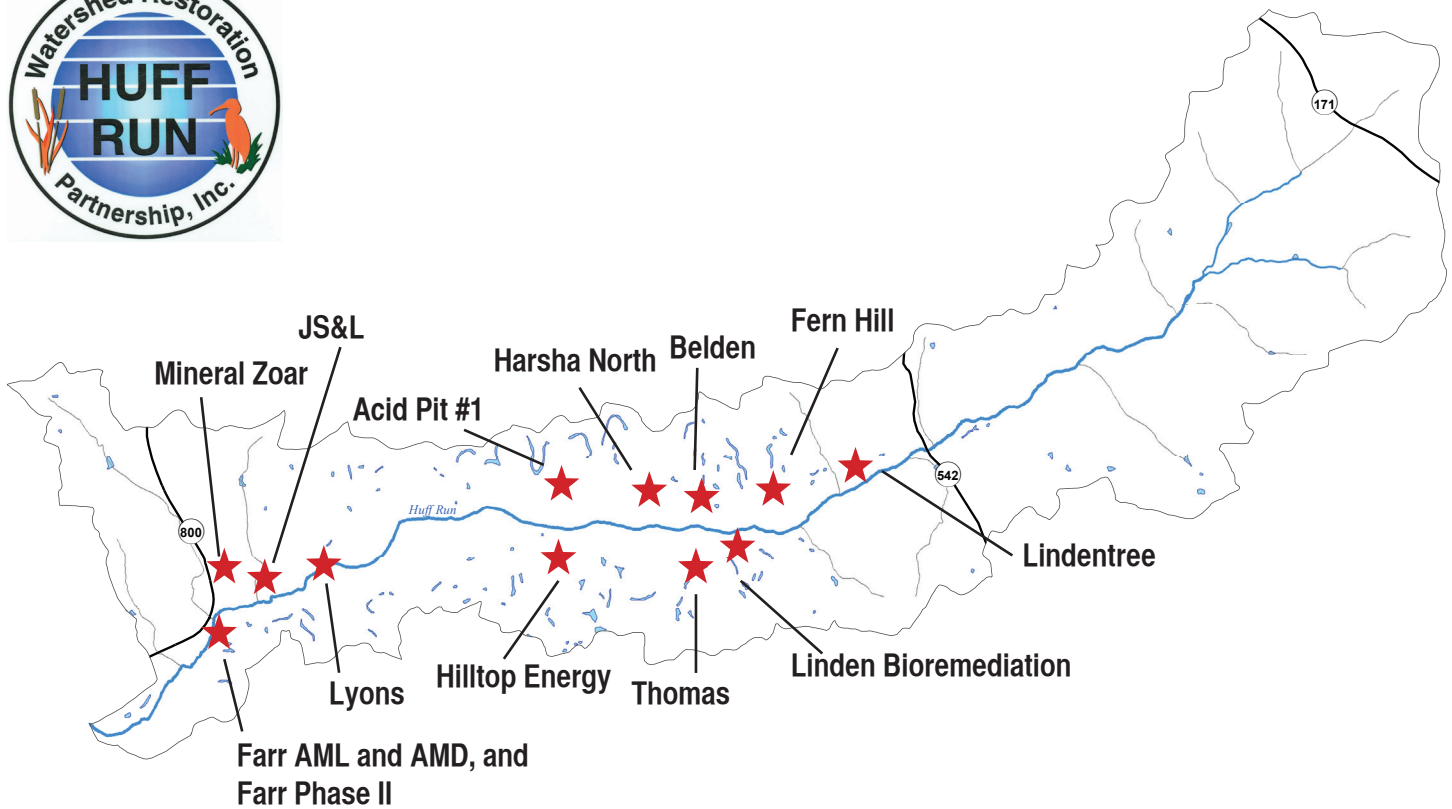


# HUFF RUN WATERSHED REPORT

# 2017–2018 NPS Report - Huff Run Watershed

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Huff Run

## Reductions

**Total acid load reduction 2016\* = 1,129 lbs/day**

**Total metal load reduction 2016\* = 28 lbs/day**

*excluding Mineral Zoar and Farr*

Acid and metal load reductions based on projects monitored during 2016\* listed here: Lyons, Acid Pits, Belden, Fern Hill, Linden, Thomas, Harsha North, Lindentree, and Hilltop Energy.

## Costs

**Design \$724,181**

*(excluding Linden Bioremediation and Lyons II)*

**Construction \$4,584,172**


**Total cost through 2017–2018 = \$5,644,950**

*\*Insufficient data to calculate acid and metal loads for 2017-2018 reporting period.*

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## Timeline of the Huff Run Watershed Project Milestones & AMD Projects

- 
- 1985** • Study funded by ODNR conducted by Benatec Associates to identify acid problems in Huff Run Watershed
  - 1988** • First abandoned mine land project, Jobses, 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  
• Rural Action adds AmeriCorps member to Huff Run staff
  - 2010** • Thomas Project, Fern Hill Pond A & Belden Gob pile constructed
  - 2011** • Lyons II constructed
  - 2012** • Hilltop Restoration Project started
  - 2013** • Completed Hilltop Restoration Project  
• MWCD Partners in Watershed Management Grant awarded for environmental education and community outreach
  - 2014** • Project development for JS&L AMD Reclamation Project and the Farr Phase II
  - 2015** • Constructed JS&L AMD Restoration Project, funded by ODNR-DMRM and OEPA  
• Received \$1.7M ODOT Mitigation
  - 2016** • Huff Run Stream Mitigation project completed by Oxbow River & Stream Restoration, funded by ODOT.

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## Huff Run Projects

Acid mine drainage reclamation projects completed in Huff Run Watershed:

**2003** *Farr Project\* (FAR01/02) – Surface reclamation, limestone channels, anoxic limestone drains, and passive wetland*

Linden Bioremediation Project (LIN08) – Pyrolusite limestone bioremediation bed

**2004** Acid Pit #1 Project (ACP01) – Drain impoundments and surface reclamation

**2005** Lyons Project (LYN01) – Steel slag bed, limestone channels, drain impoundments, and surface reclamation

Lindentree Project (LNT01) – Steel slag bed, limestone channels, and fill acid pits

**2006** Harsha North Project (HAN05) – Surface reclamation, limestone trenches, and reclaimed gob pile

**2008** Fern Hill HR-42 Pits A, B, & C (FRN01) – Surface reclamation, limestone Channels and reclaim 3 acidic pits

Belden and Belden Gob Pile Project (BLD01) – Surface reclamation, steel slag beds, reclaim gob pile, and passive settling ponds

**2009** *Mineral Zoar (MZR08) – Reverse alkaline producing systems (RAPS)*

**2010** Thomas Project (LIN01/THM06) – Surface reclamation and passive settling ponds

**2011** Lyons II maintenance Project (LYN01) – Additional steel slag installed, pipe clean-outs, and added limestone berms to settling pond

**2013** Hilltop Energy Project (HRT21/HR37) – Reclaimed gob pile, surface reclamation, limestone channels, and settling pond

**2015** JS&L AMD Reclamation (HR25) – Limestone channels, limestone leach bed and precipitation basin.

*Italicized indicates projects are not actively monitored for acid and metal load reduction purposes*

*\*Indicates no yearly trend graphs due to lack of pre or post data*

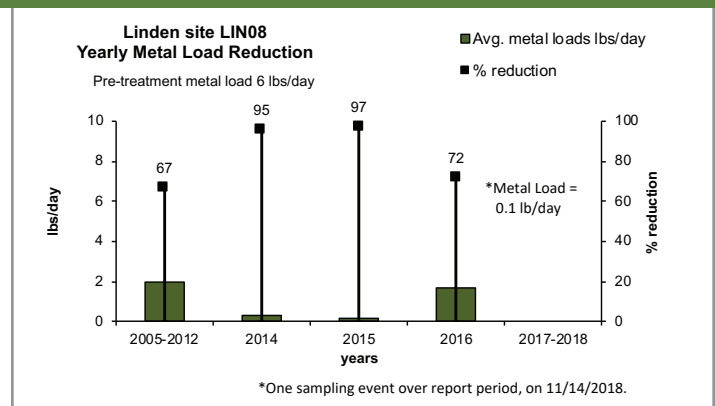
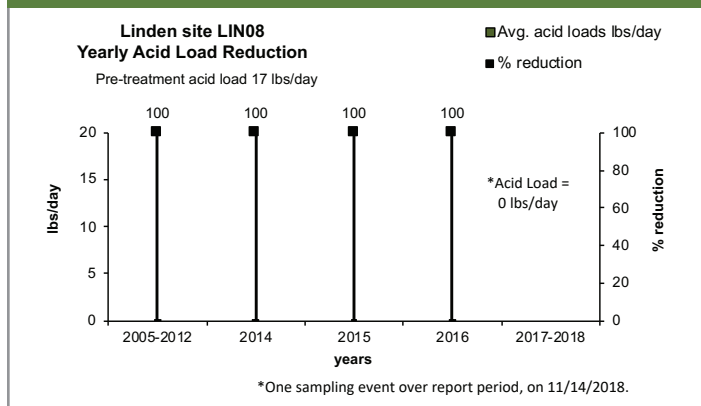
# 2017–2018 NPS Report - Huff Run Watershed

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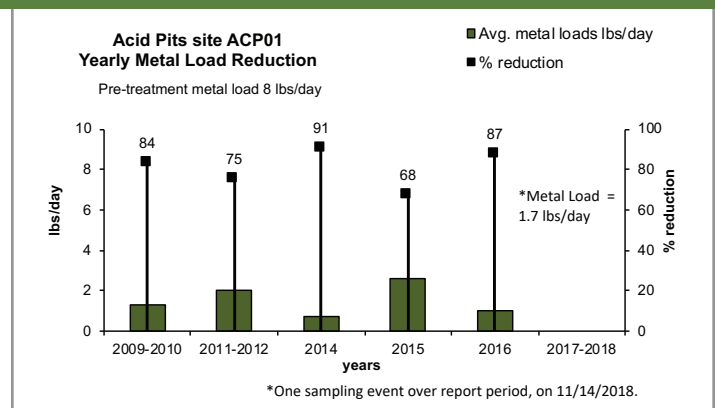
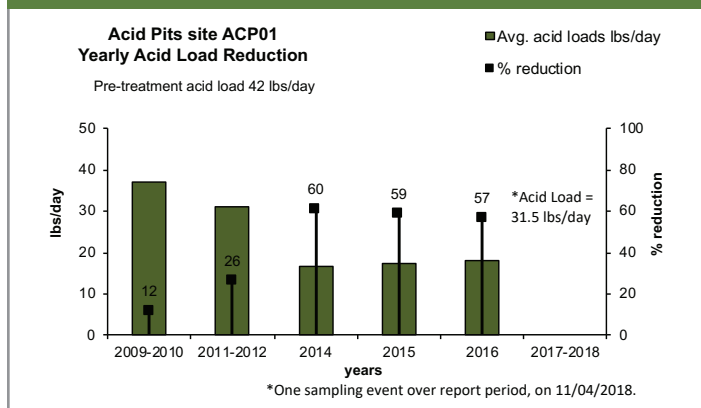
## Yearly acid and metal load reduction trends per project

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.

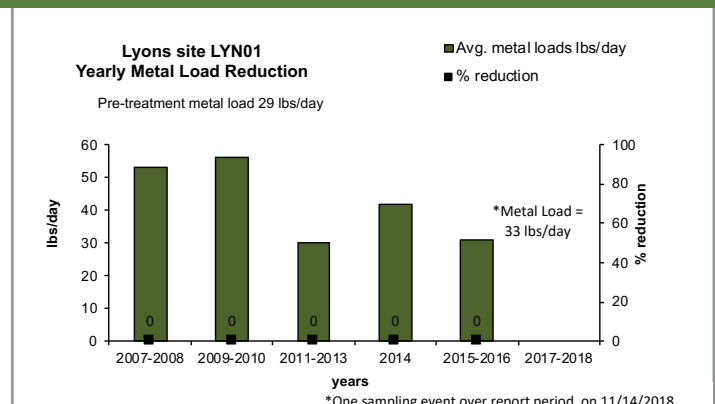
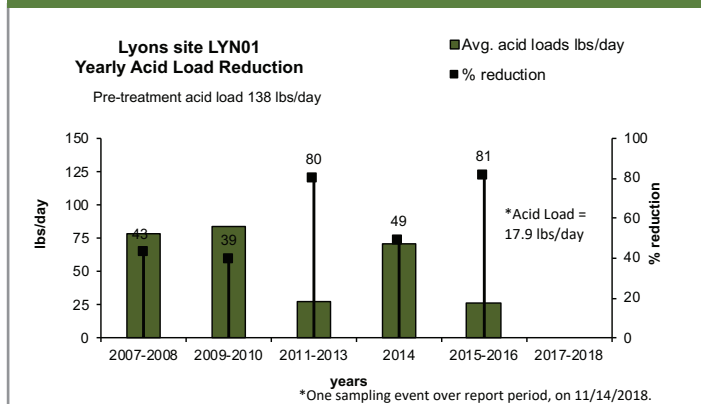
### Linden site LIN08



### Acid Pits site ACP01



### Lyons site LYN01

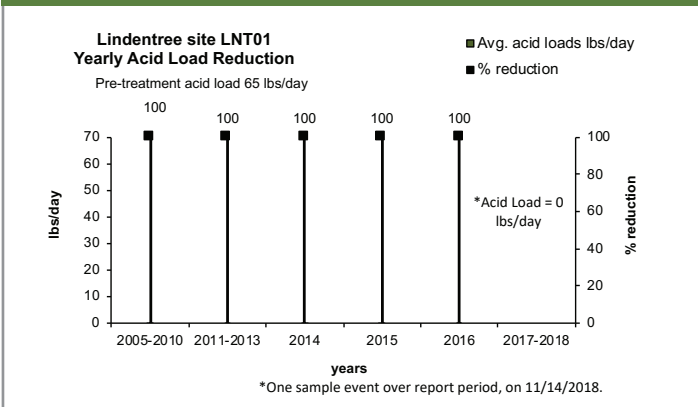


# 2017–2018 NPS Report - Huff Run Watershed

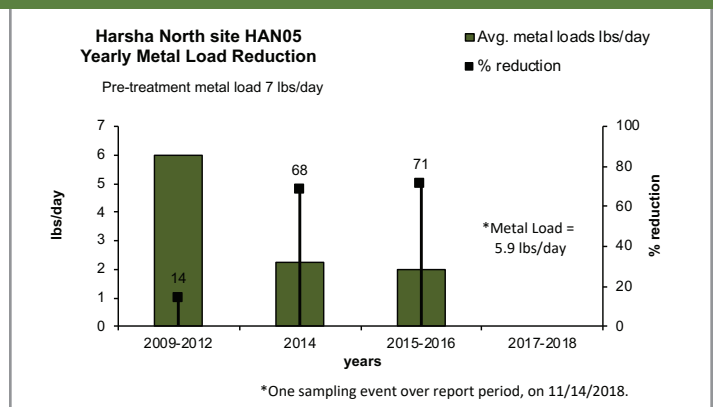
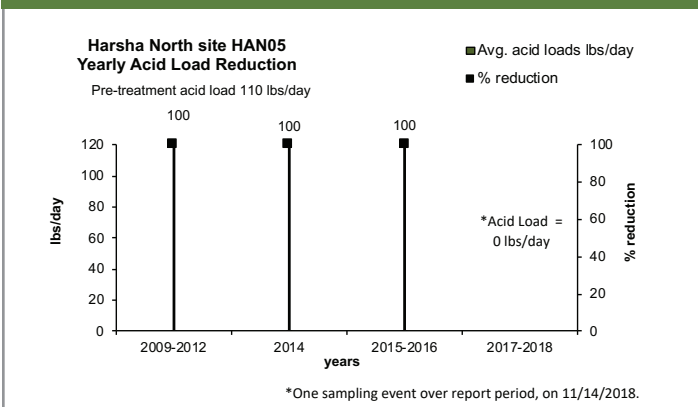
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## Yearly acid and metal load reduction trends per project

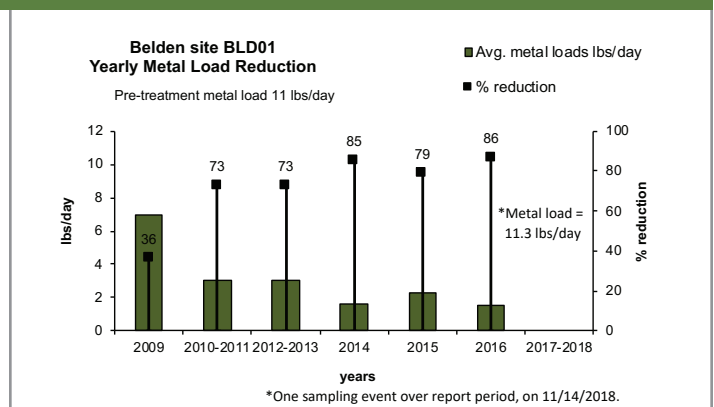
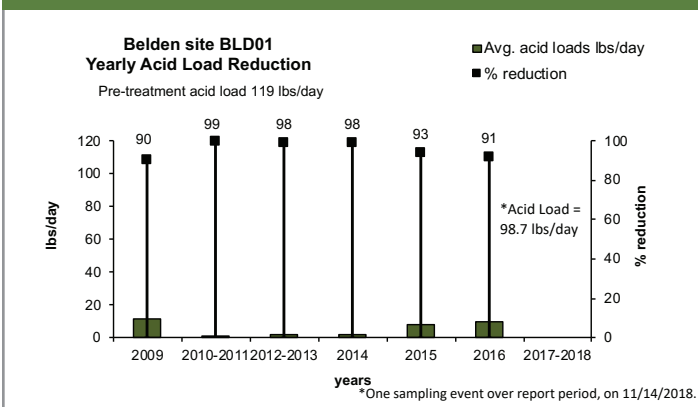
### Lindentree site LNT01



### Harsha North site HAN05



### Belden site BLD01



# 2017–2018 NPS Report - Huff Run Watershed

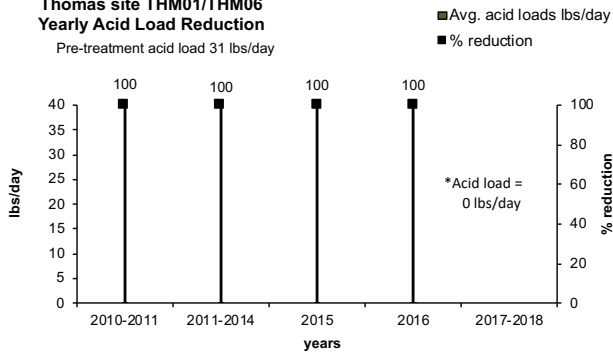
Generated by Non-Point Source Monitoring System  
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## Yearly acid and metal load reduction trends per project

### Thomas site THM01/THM06

#### Thomas site THM01/THM06 Yearly Acid Load Reduction

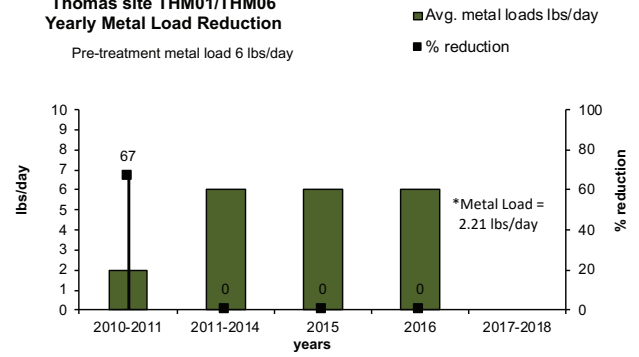
Pre-treatment acid load 31 lbs/day



\*One sampling event over report period, on 11/14/2018.

#### Thomas site THM01/THM06 Yearly Metal Load Reduction

Pre-treatment metal load 6 lbs/day



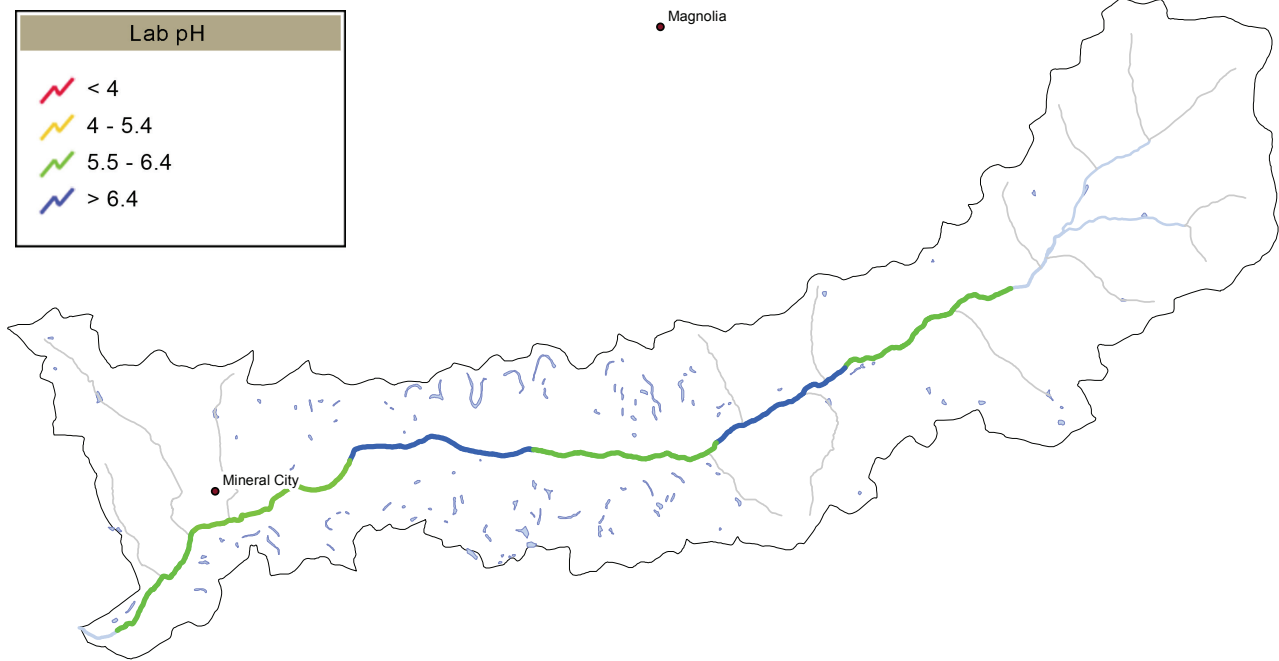
\*One sampling event over report period, on 11/14/2018.

# 2017–2018 NPS Report - Huff Run Watershed

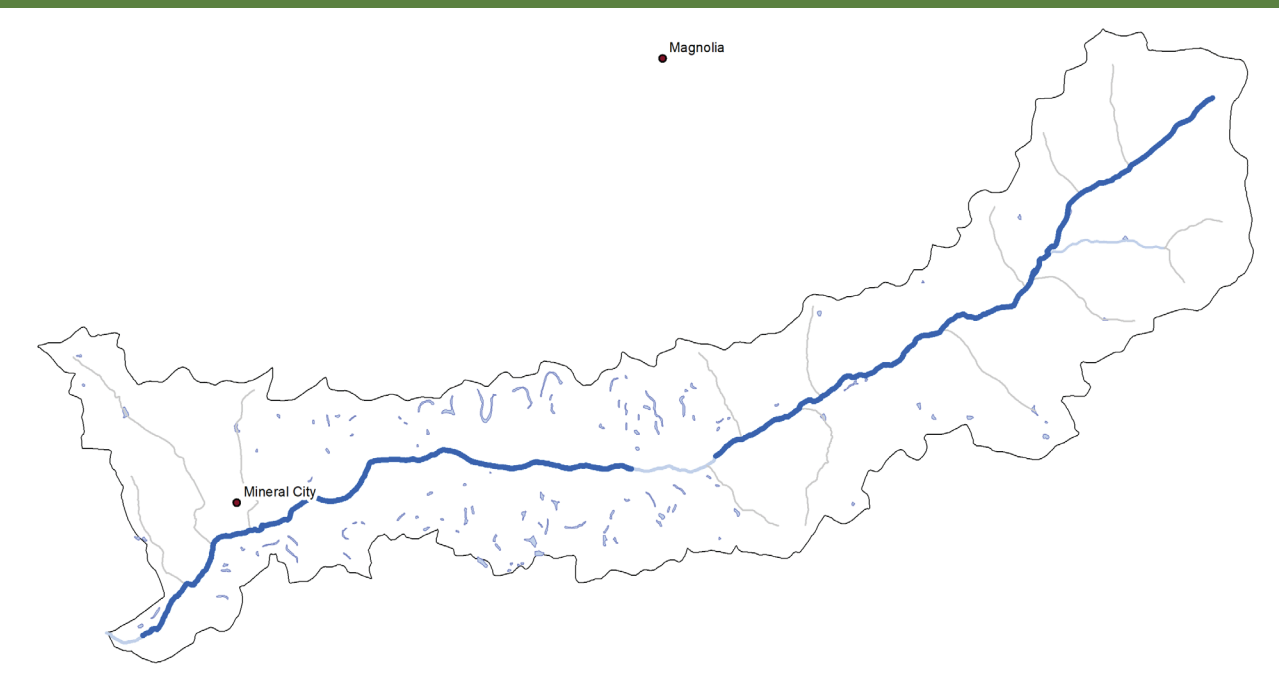
Generated by Non-Point Source Monitoring System  
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## Chemical Water Quality

### Huff Run baseline pH



### Huff Run 2017–2018 pH



Huff Run pH values have improved from baseline conditions (1985-1998) to 2016. All of the 10 miles monitored in Huff Run in the 2017-2018 reporting period met the minimum pH target of 6.5.



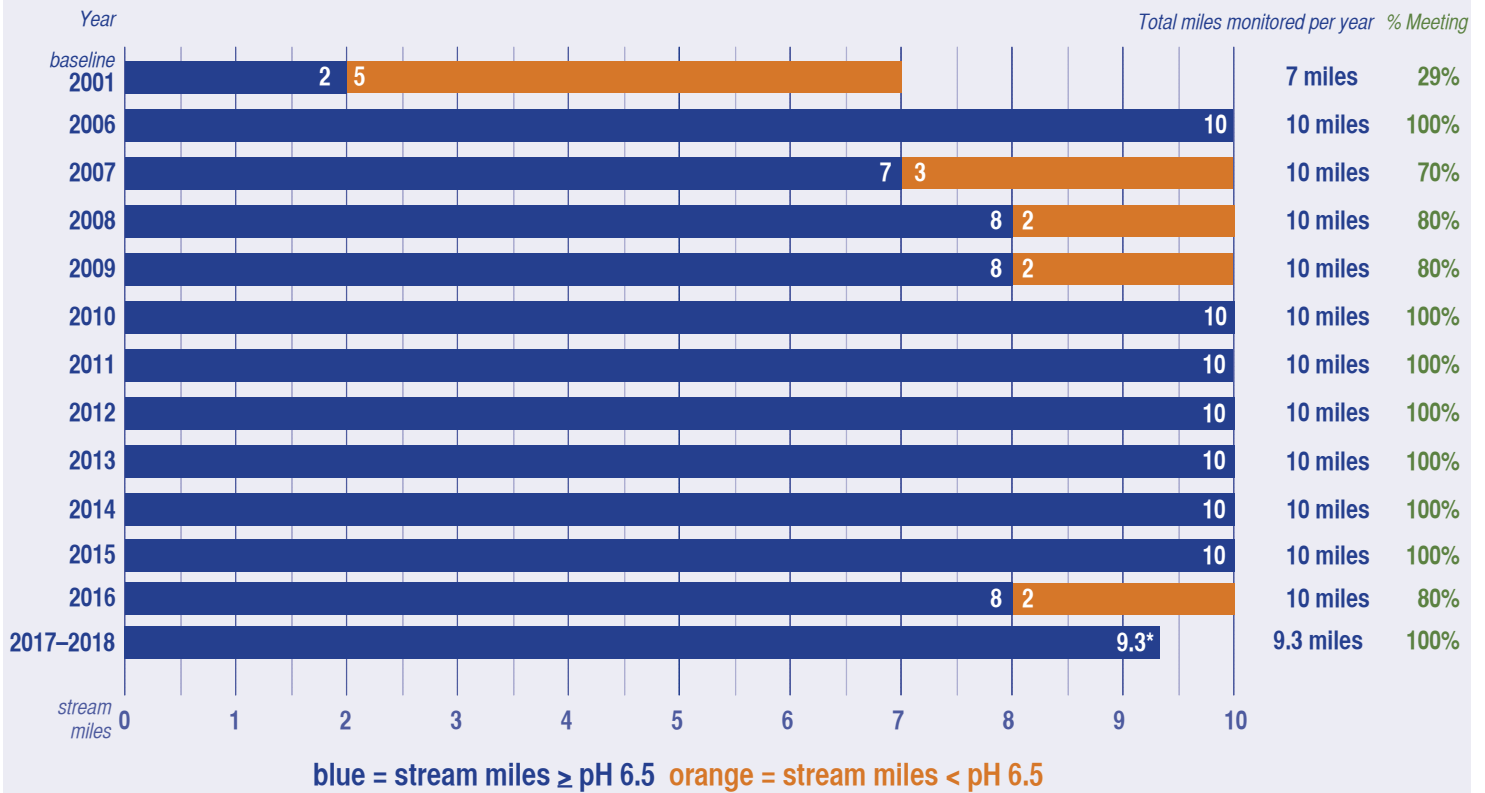
# 2017–2018 NPS Report - Huff Run Watershed

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## Chemical Water Quality

The mainstem of Huff Run is approximately 10 miles in length. In 2009, 8 miles met the pH target of 6.5, while the two downstream reaches (HRR08 and HRR07) fell slightly below the target with an average of 6.4. From 2010 to 2015, all 10 miles met the target. 2016 was similar to the 2008- 2009 stream conditions, where the mouth of Huff Run fell just below meeting the pH target, leaving approximately 8 miles meeting and 2 miles slightly less than 6.5. In the 2017-2018 reporting period, Huff Run once again met the pH targets at all sites monitored, however, site HRR04, a 0.7 mile segment, was not monitored so is not included in total miles.

### Huff Run pH

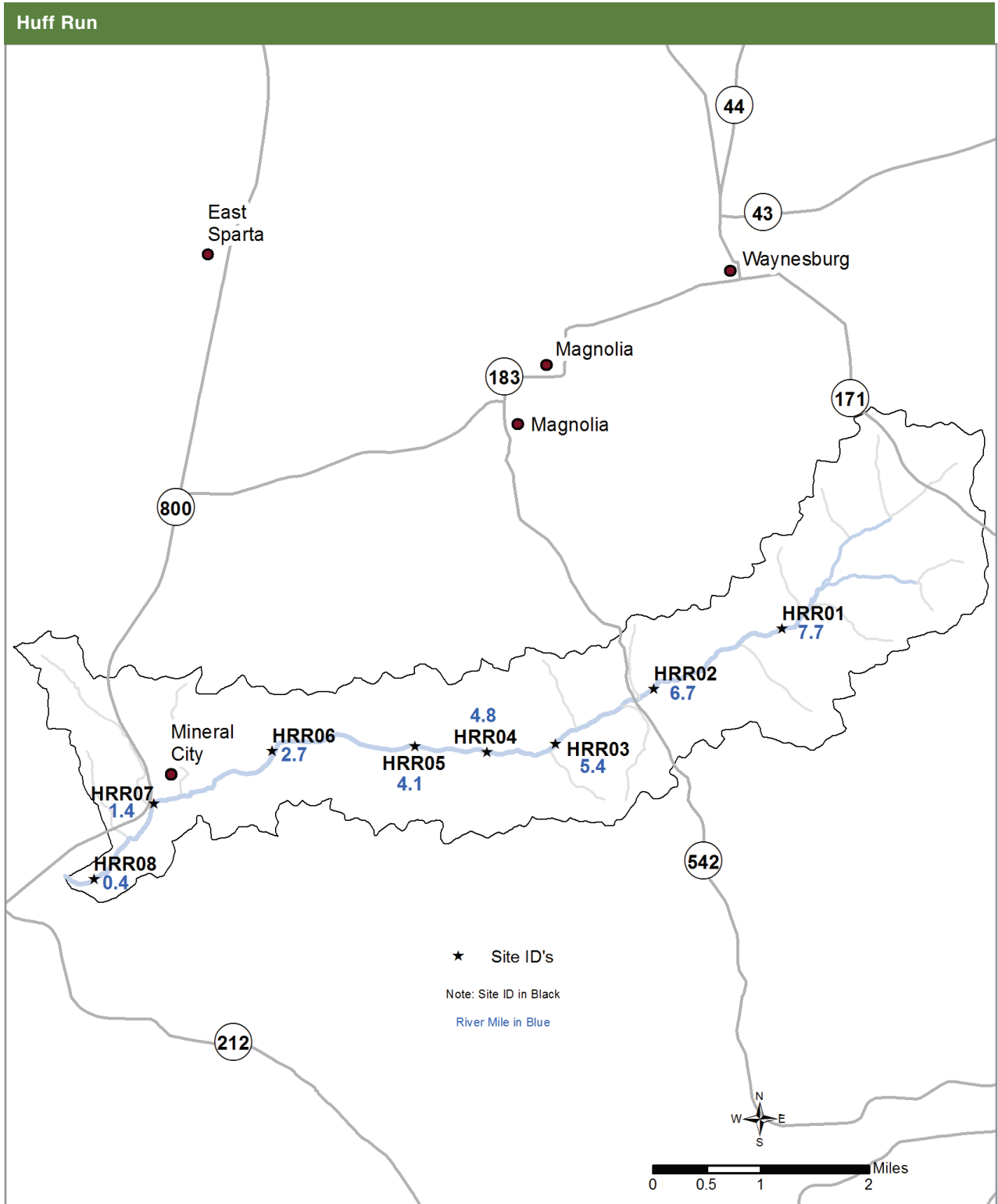


\*Site HRR004 (0.7 mile reach) not monitored during this sample period.

# 2017–2018 NPS Report - Huff Run Watershed

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Chemical water quality analysis per stream reach



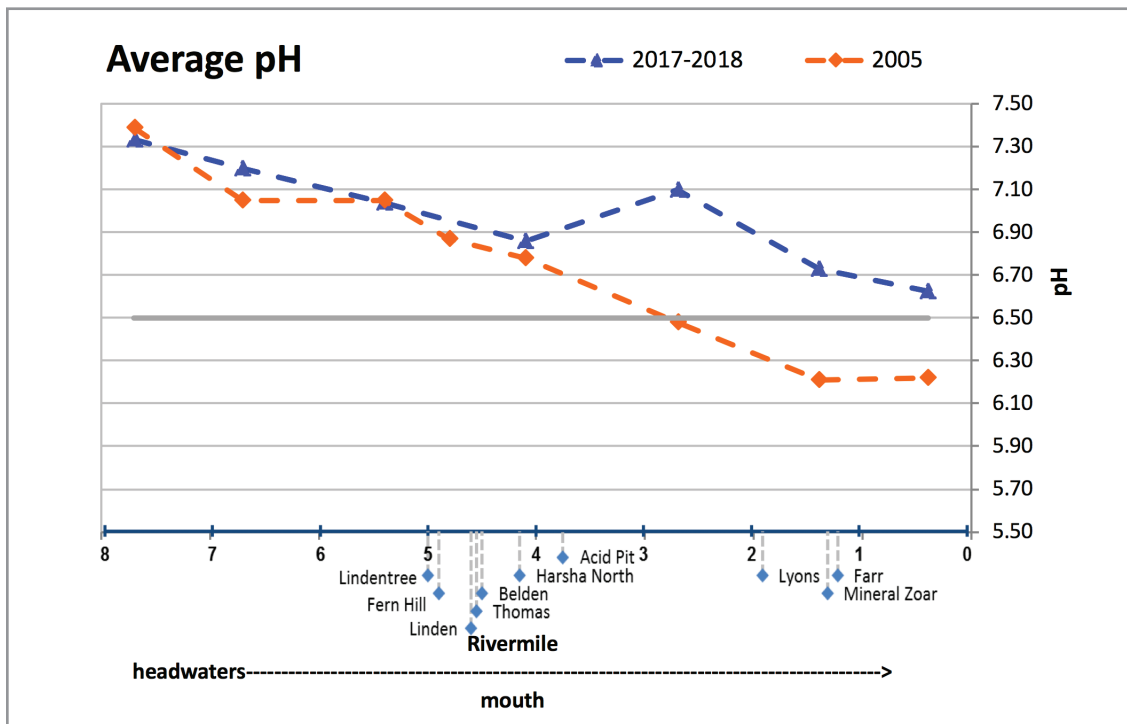
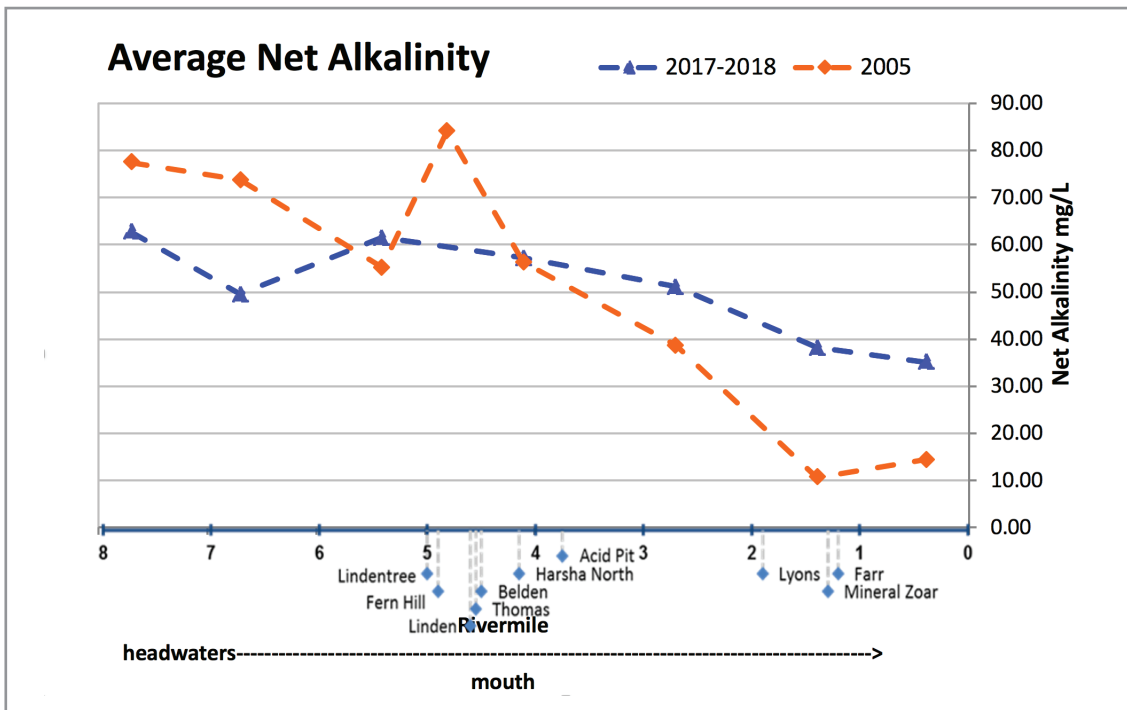
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## Chemical water quality analysis per stream reach

Chemical water quality changes along the mainstem of Huff Run 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.

Huff Run								
Site ID	HRR01	HRR02	HRR03	HRR04	HRR05	HRR06	HRR07	HRR08
Rivermile	7.7	6.7	5.4	4.8	4.1	2.7	1.4	0.4

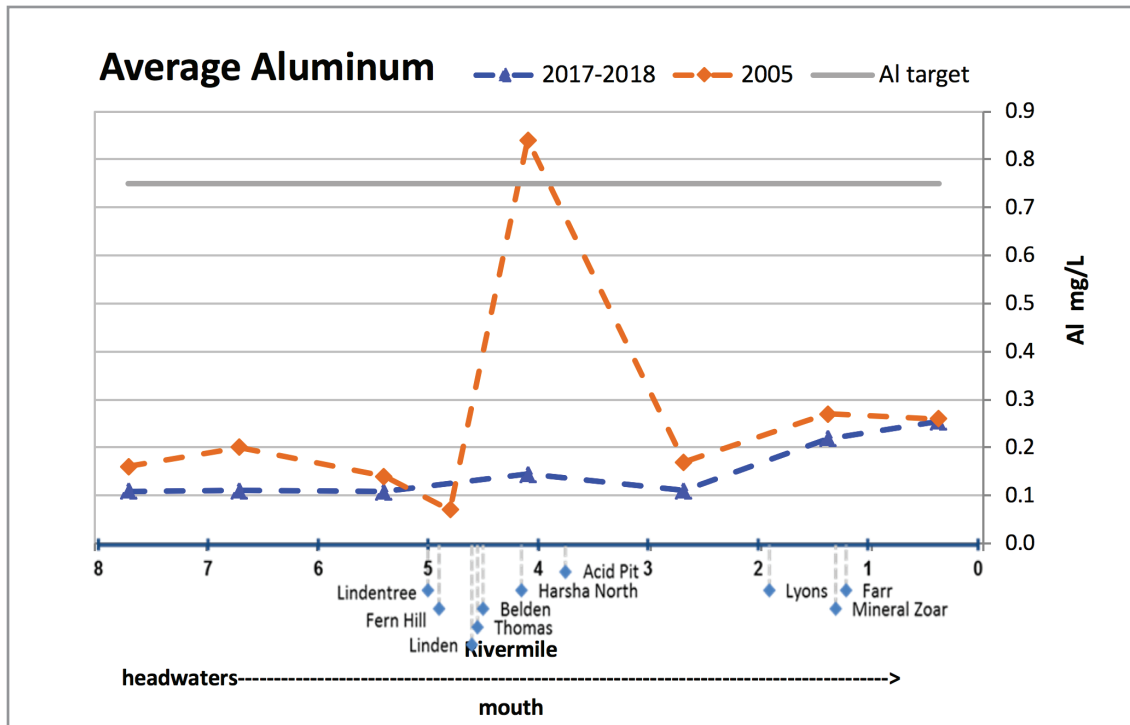
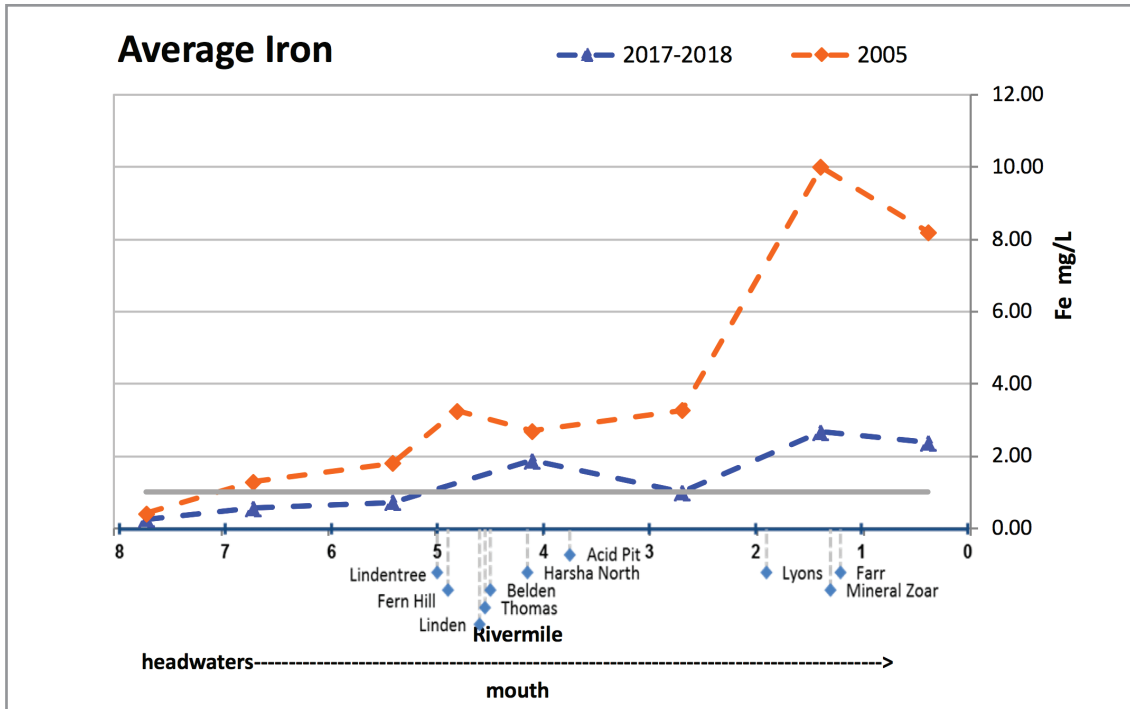


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## Chemical water quality analysis per stream reach

Huff Run								
Site ID	HRR01	HRR02	HRR03	HRR04	HRR05	HRR06	HRR07	HRR08
Rivermile	7.7	6.7	5.4	4.8	4.1	2.7	1.4	0.4

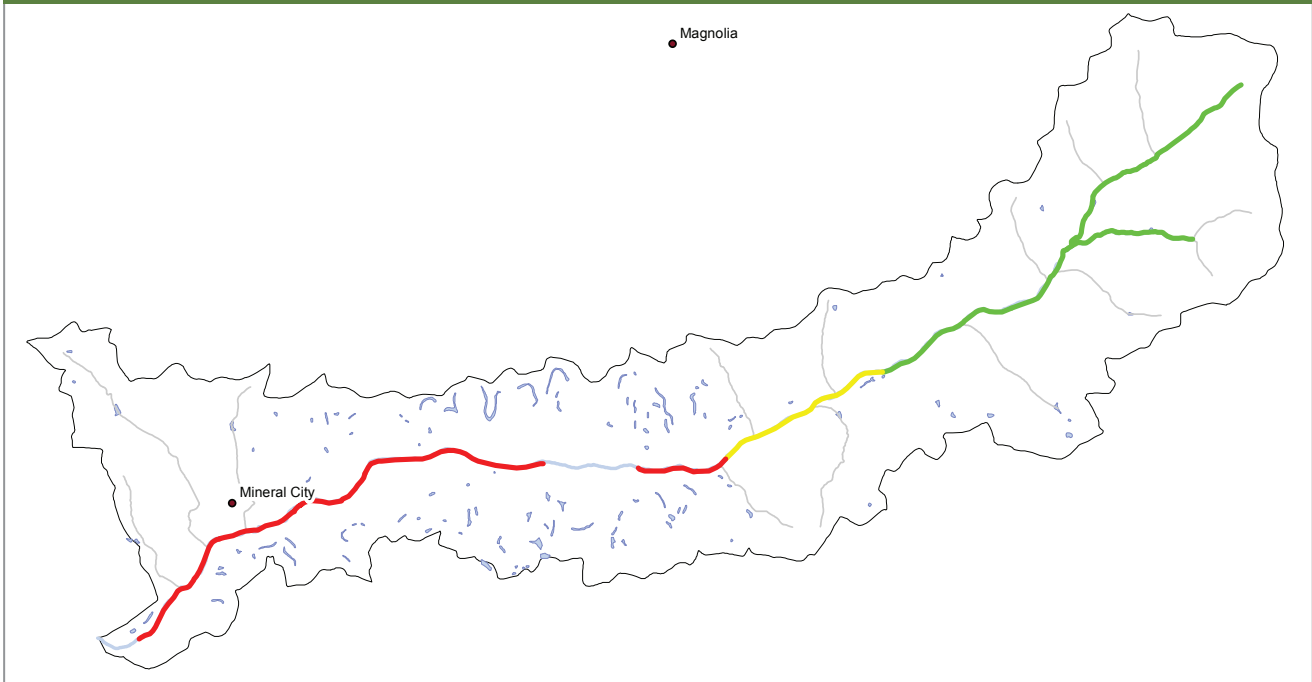


# 2017–2018 NPS Report - Huff Run Watershed

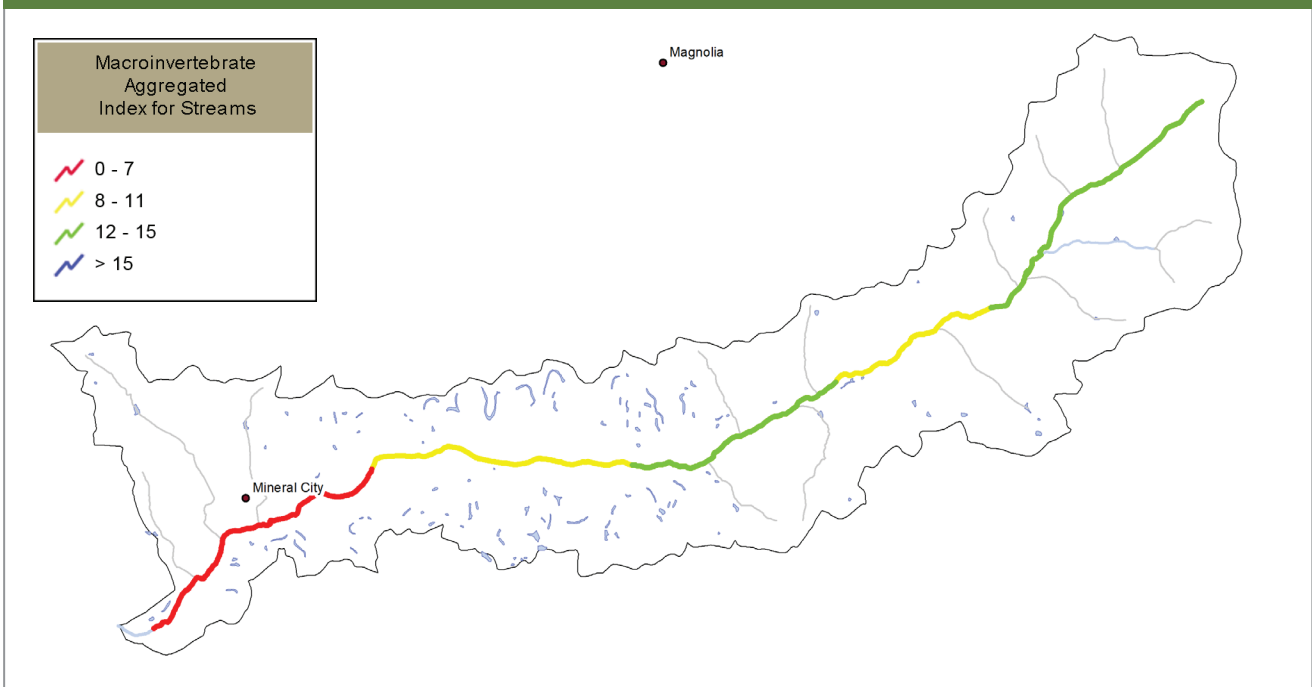
Generated by Non-Point Source Monitoring System  
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## Biological Water Quality

### Huff Run baseline MAIS



### Huff Run 2017–2018 MAIS



Biological quality in Huff Run decreases from headwaters to the mouth.

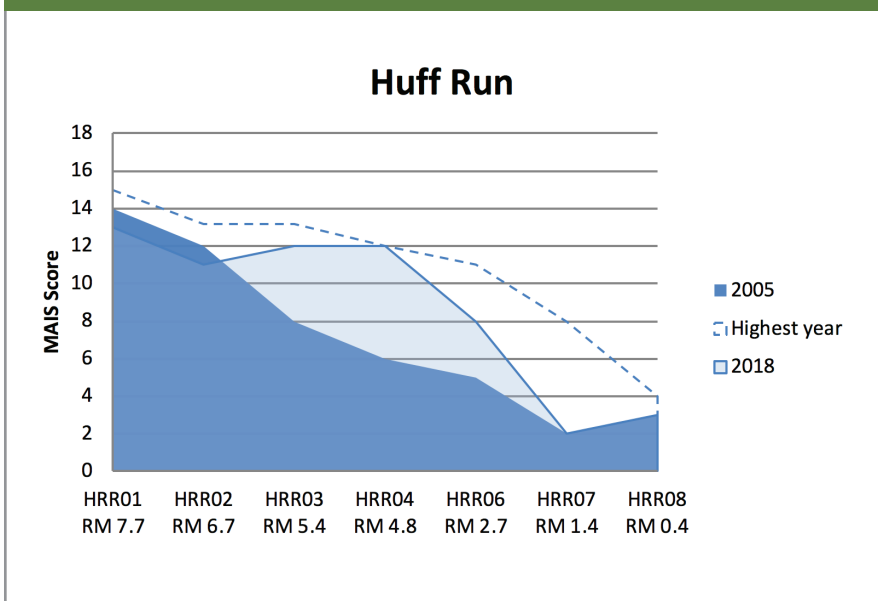
# 2017–2018 NPS Report - Huff Run Watershed

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## Biological Water Quality

Biological recovery of the macroinvertebrate community in Huff run since 2005 has been relatively slow but steady in the upstream portions of the watershed. The uppermost two sites have not changed much, with the most upstream site at RM 7.7 already meeting the MAIS target and the site immediately downstream (RM 6.7) almost meeting it. 2014 was the first year that other sites (RM 5.4) showed sustained and statistically significant improvement in MAIS scores. Three upstream sites (RM 7.7, 4.8 and 2.7) achieved their highest scores that year. In 2015, RM 5.4 met the biological restoration target of a MAIS score >12. Between 2016 and 2018, all four of the upstream monitoring sites (RM 7.7, 6.7, 5.4 and 4.8) had met the restoration target of an MAIS score > 12 at least once. The biology at RM 2.7 has improved significantly since 2012 but has not met the restoration target of 12 yet. The two downstream sites (RM 1.4 and 0.4) show no improvement in MAIS scores.

### Area of Degradation 2005-2018



### Huff Run MAIS Regressions

	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16	'18	Linear trends	R square	P-value	No. of observations
HRR01 RM 7.7	14	11	12	12	13	9	13	6	10	15	9	12	13	no change	0.00946	0.751908	13
HRR02 RM 6.7	12	8	8	8	9	11	11	11	10	9	7	13	11	no change	0.05783	0.428672	13
HRR03 RM 5.4	8	6	7	6	8	9	7	9		11	13	13	12	improved	0.76331	0.000204	13
HRR04 RM 4.8	6	7	9	8	9	9	6	7		11	9	8	12	improved	0.36064	0.038940	13
HRR06 RM 2.7	5	4	5	3	4	5	3	4		7	11	10	8	improved	0.52724	0.007496	13
HRR07 RM 1.4	2	3	3	2	8	2	2	3		7	2	4	2	no change	0.00450	0.835864	13
HRR08 RM 0.4	3	0	4	3	4	3	3	3		4	4	2	3	no change	0.04433	0.489862	13