Lambert Run: – A Watershed Scale Approach to Remediation

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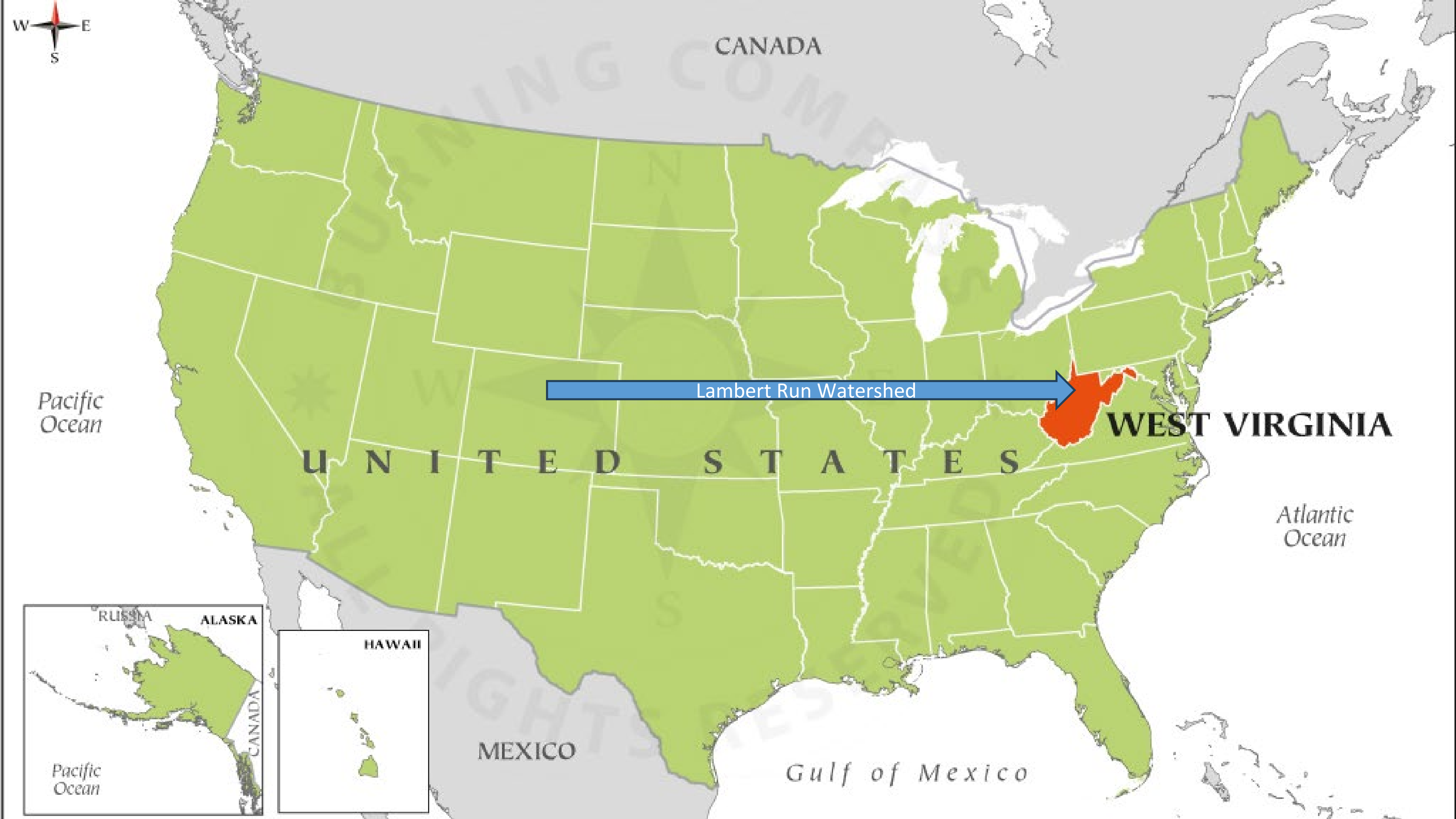
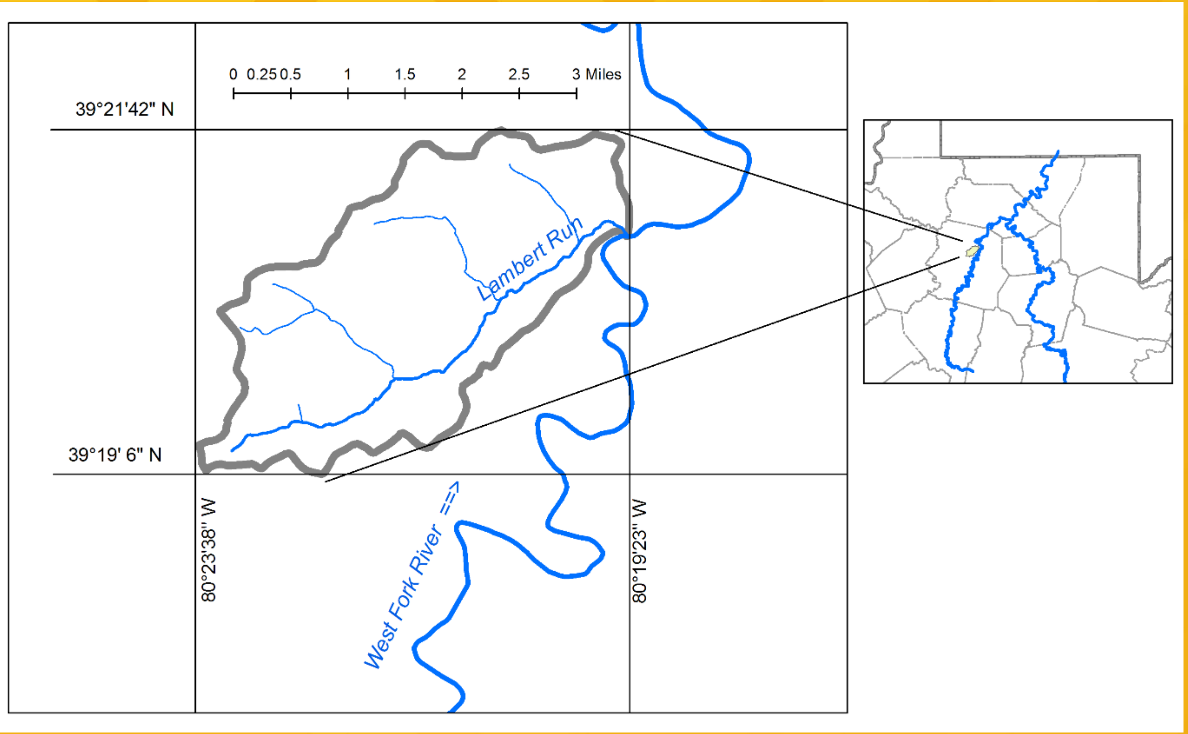

W
E
S
CANADA
Lambert Run Watershed
WEST VIRGINIA
Pacific Ocean
UNITED STATES
Atlantic Ocean
RUSSIA
ALASKA
CANADA
Pacific Ocean
HAWAII
MEXICO
Gulf of Mexico

Lambert Run Watershed

Located in Harrison County, West Virginia

Drains to the West Fork River

Flows another 22.6 miles from the confluence to Fairmont, where it and the Tygart River form the Monongahela River



Lambert Run Background

- 8 sq. mile subwatershed of the West Fork
- Harrison County, WV
- Nearby communities:
  - Fairmont
  - Clarksburg
- Low population density
- Land uses:
  - Hayfields, pasture, woodlots, low density residential,
  - Modern use - Marcellus Shale development

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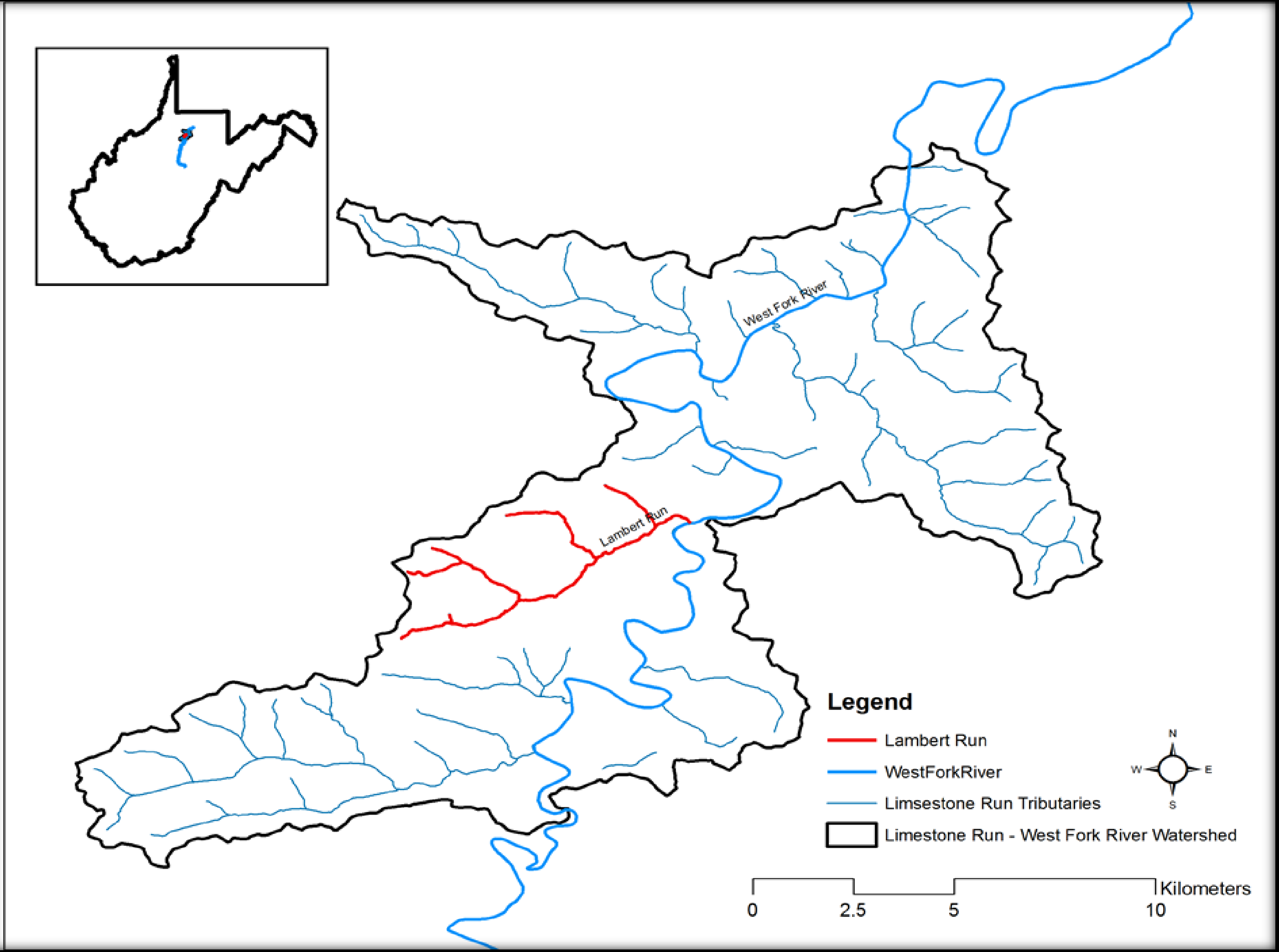

West Fork River
Lambert Run
Legend
Lambert Run
WestForkRiver
Limsestone Run Tributaries
Limestone Run - West Fork River Watershed
N
W
E
S
Kilometers
0
2.5
5
10

Background - Causes of Impairment

- Mining has occurred in the watershed since the 1950s
  - Majority in Pittsburgh Coal Seam
- This pre-law (SMCRA) mining has left a legacy of Title IV AMD discharges within the watershed
- Water chemistries vary from acidic mine drainage to alkaline mine drainage

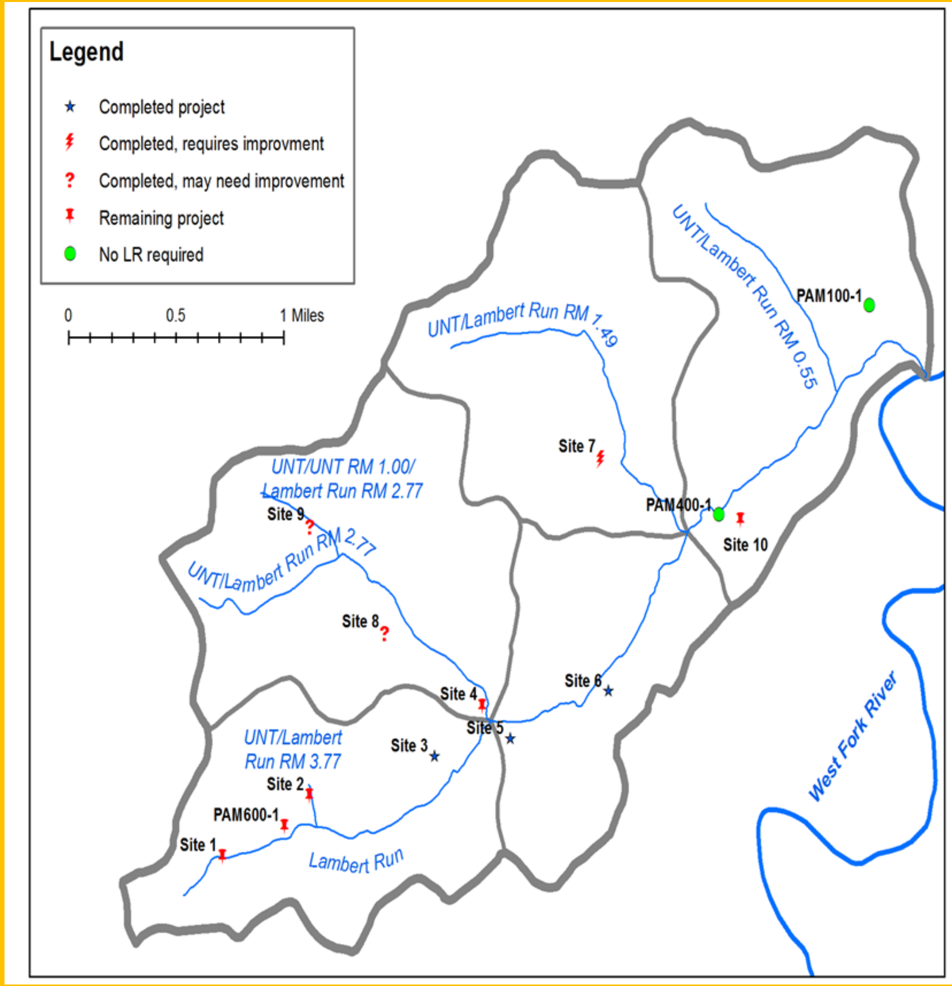
History

- The Guardians of the West Fork (GWF)
  - Local watershed group dedicated to restoring Lambert Run and the West Fork River
- 2002 - total maximum daily load (TMDL) for the West Fork River was approved by the EPA
  - Lambert Run was listed as impaired by pH, iron, and aluminum
- Provided the impetus for the creation of the first Lambert Run Watershed Based Plan (WBP) in 2003
  - Plan allowed the GWF to pursue funding for passive treatment

Partnerships

- In 2004 a partnership was formed between:
  - WVU National Mine Land Reclamation Center (NMLRC)
  - GWF
- Funding partners include:
  - WVDEP –Watershed Improvement Branch
  - Office of Surface Mining (OSMRE)
- Started working towards restoration of multiple sites by installing passive treatment systems
- Six passive systems installed in the Lambert Run watershed to date

Site Locations



Project #1 - Site 3 Muzzleloader Club

Chemistry - Source Water Prior to Treatment

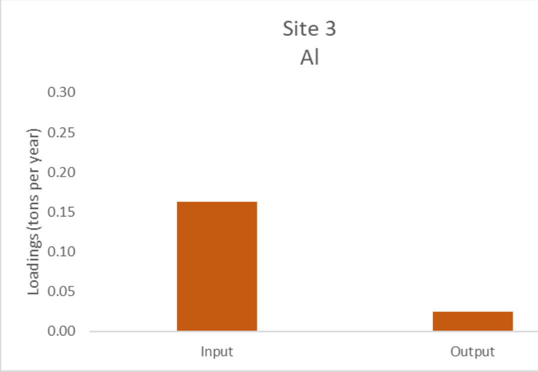
- pH = 6.5
- 1.5 tons per year of Iron
- 0.2 tons per year of aluminum

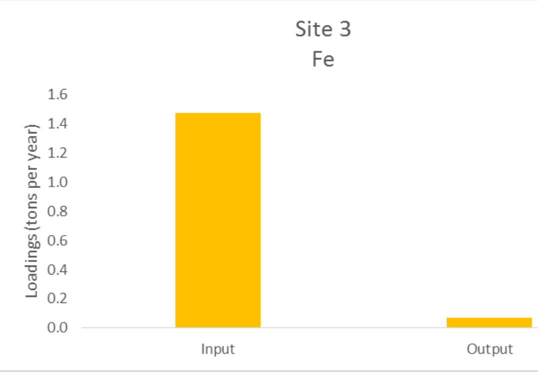
Project #1 – Site 3 Muzzleloader Club

- Completion – 2006
- Cost - $142,000 for construction (319 and WCAP)
- Treatments
  - Steel slag leach bed used to add alkalinity and increase pH
  - 2 large baffled wetlands
    - Uses biological processes to treat mine drainage
    - Wetlands are used as a sink for collection of metals

Post-Construction Results – Effluent Water after Treatment

- pH = 7.1
- 93% reduction in iron
- 95% reduction in aluminum
- Fish living in the bottom wetland and downstream of the project site





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Project #2 - Site 8 (Oldaker)

Chemistry - Source Water Prior to Treatment

- pH = 6.4
- Net Alkaline
- 4.6 tons per year of Iron

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Project 2 – Site 8 (Oldaker)

Completion – 2007

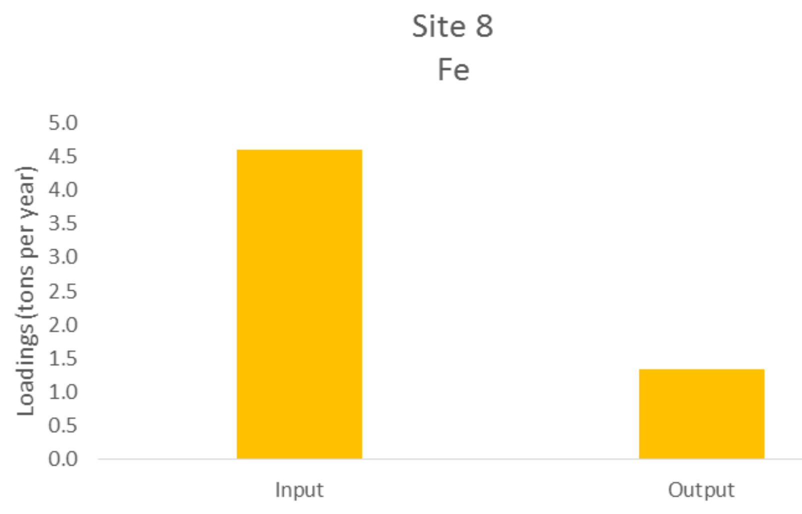
Cost – $147,000 for construction (319 and WCAP)

Treatments

- Settling ponds
- 2 large baffled wetlands w/Agridrains

Site 8 Chemistry - Post-Construction Results after Treatment

- pH = 7.2
- Increased alkalinity
- 80% reduction in iron



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Project #3 - Site 5 (Allen Meadows)

Chemistry - Source Water Prior to Treatment

•pH = 6.7

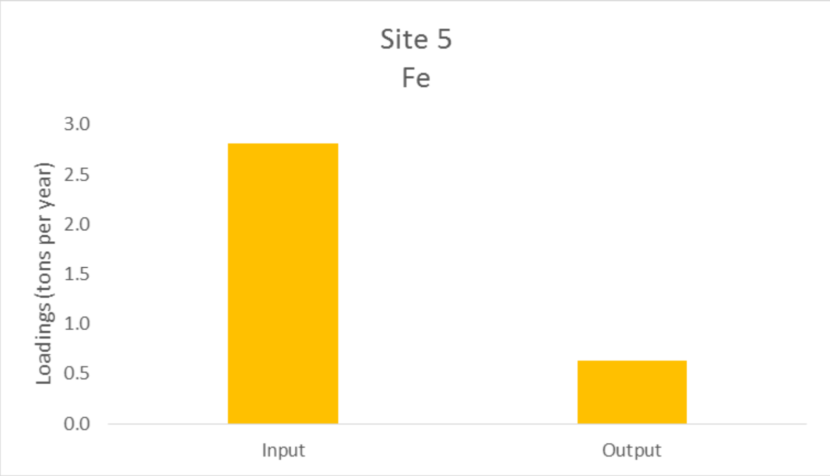
•Fe load: 2.8 tons/year

•Al load: <0.1 tons/year

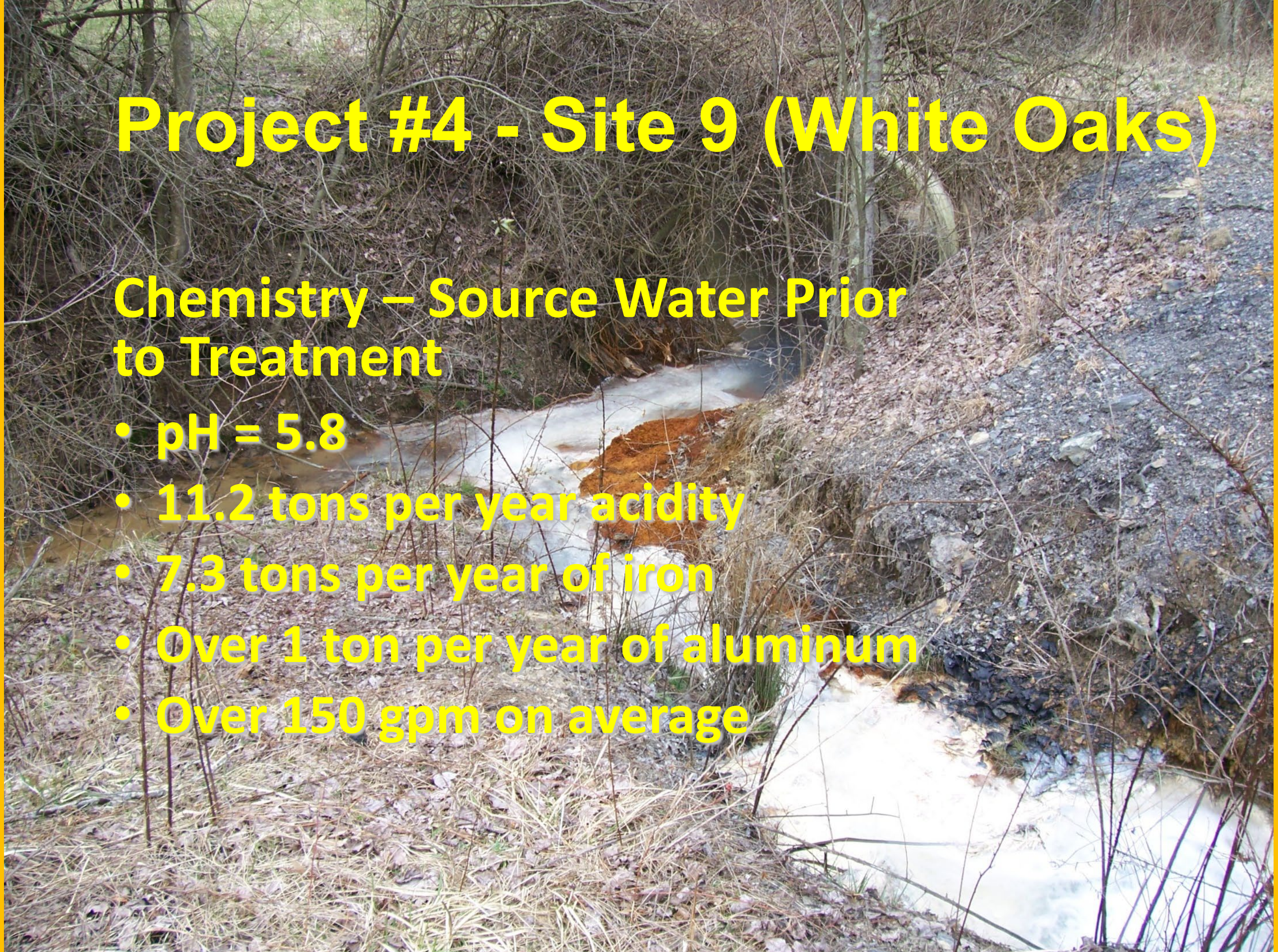
- Completion – 2008
- Cost – $168,000 for construction (319 and WCAP)
- Treatments
  - Grouted limestone channel
  - Retention pond
  - 2 baffled wetlands w/Agridrains

Site 5 Chemistry - Post-Construction Results after Treatment

- pH 7.0
- 80% reduction in iron



Project #4 - Site 9 (White Oaks)



Chemistry – Source Water Prior to Treatment

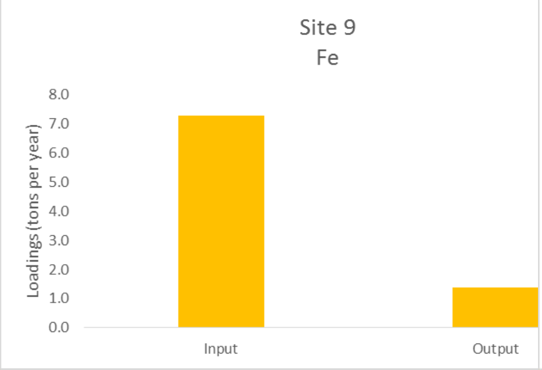
- pH = 5.8
- 11.2 tons per year acidity
- 7.3 tons per year of iron
- Over 1 ton per year of aluminum
- Over 150 gpm on average

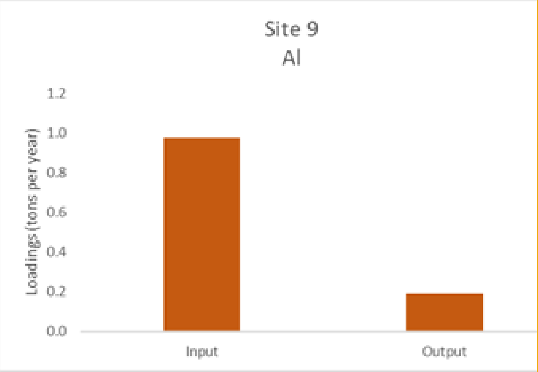
Project 4 – Site 9 (White Oaks)

- **Completion – 2009**
- **Cost – Appx. $500,000 (319 and Compensatory Mitigation)**
- AMD is piped into a vertical flow reactor which is composed of a layer of organic matter above a layer of limestone
    - Organic matter is used to remove oxygen from the mine water, prohibiting metals from precipitating on the limestone within the bed
- Final treatment is a large (3-4 acre) wetland

Site 9 chemistry – Post Construction Results after Treatment

- pH = 7.3
- Greater than 100% acidity reduction
- 81% reduction in iron
- 80% reduction in aluminum






2011/06/24

Project #5 – Site 6 (Guinn Portals)

- Completion – 2012
- Cost - $185,000 Engineering and Construction (319 and WCAP)
- Treatments
  - Grouted limestone channel
  - 2 large baffled wetlands

Project #5 – Site 6 (Guinn Portals)

- Chemistry - Source Water Prior to Treatment
  - pH = 5.75
  - Iron load = 5.4 tons per year
  - Aluminum load = 0.3 tons per year

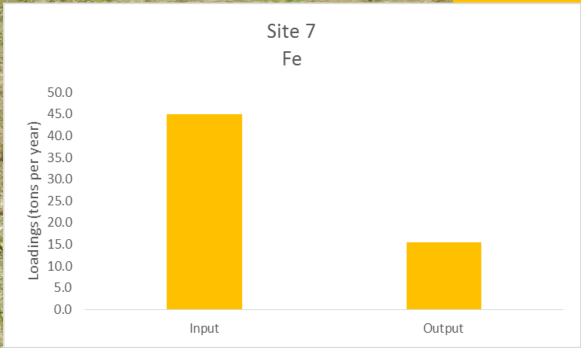
- Post-Construction Chemistry – Results after Treatment
  - pH = 6.6
  - 90 % reduction in Iron
  - Slight reduction in Aluminum

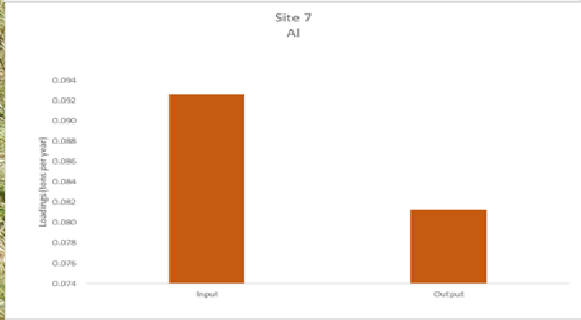
Project #6 – Site 7 (Barnhart Property)

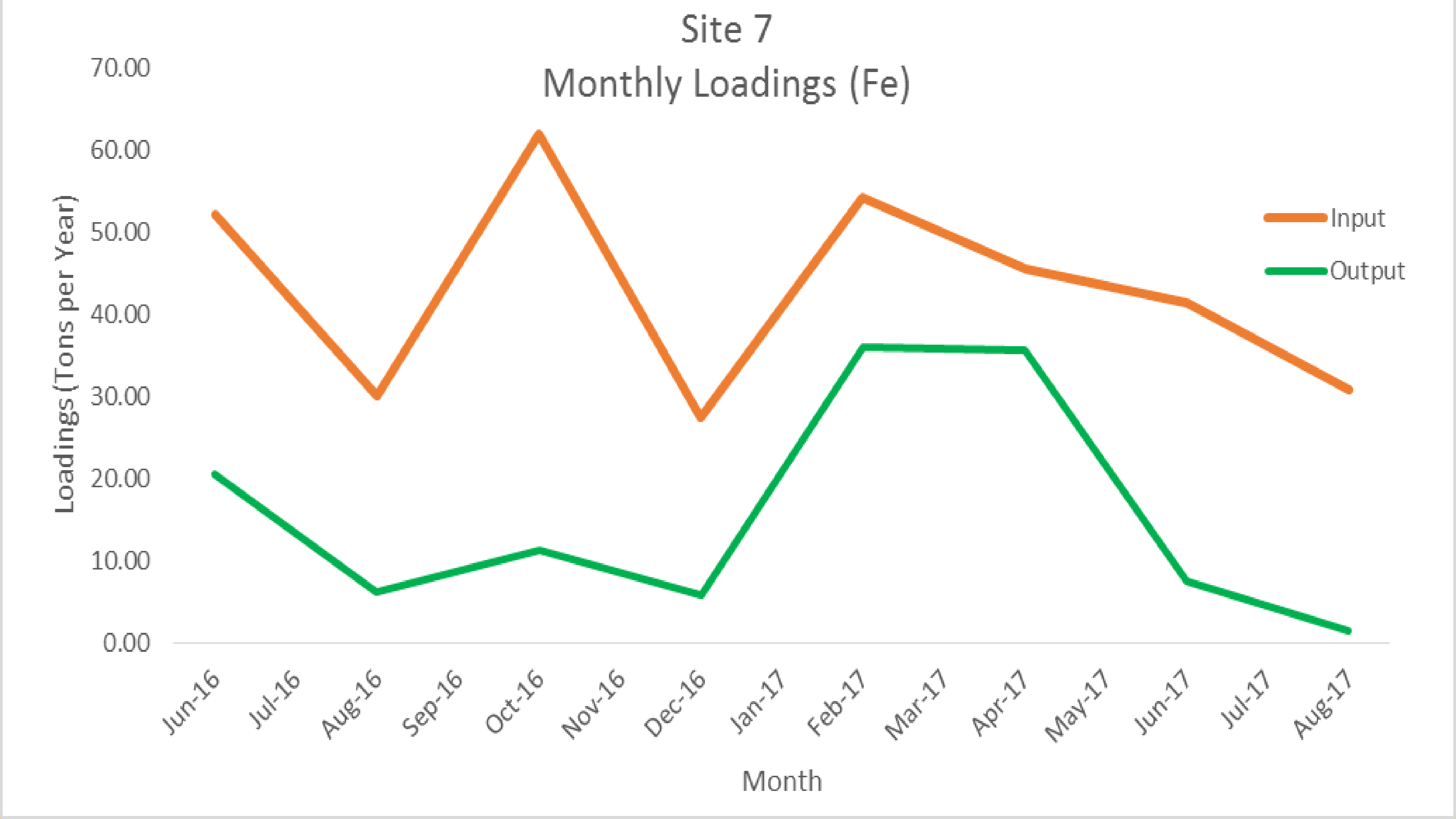
- Chemistry – Source Water Prior to Treatment
  - pH = 6.6
  - Aluminum load = 0.25 tons per year
  - Iron load = 45 tons per year
  - Discharge is close to 1,000 gpm
- Completed – September 2015
- Cost – $400,000 for Engineering and Construction (319, SRF, WCAP)
- Treatment - 5 aerobic wetland cells
  - Total wetland area is appx. 4 acres

Project #6 – Site 7 (Barnhart Property)

- Post-Construction Results after Treatment
  - pH = 7.2
  - 70% reduction in iron
  - Slight reduction in aluminum



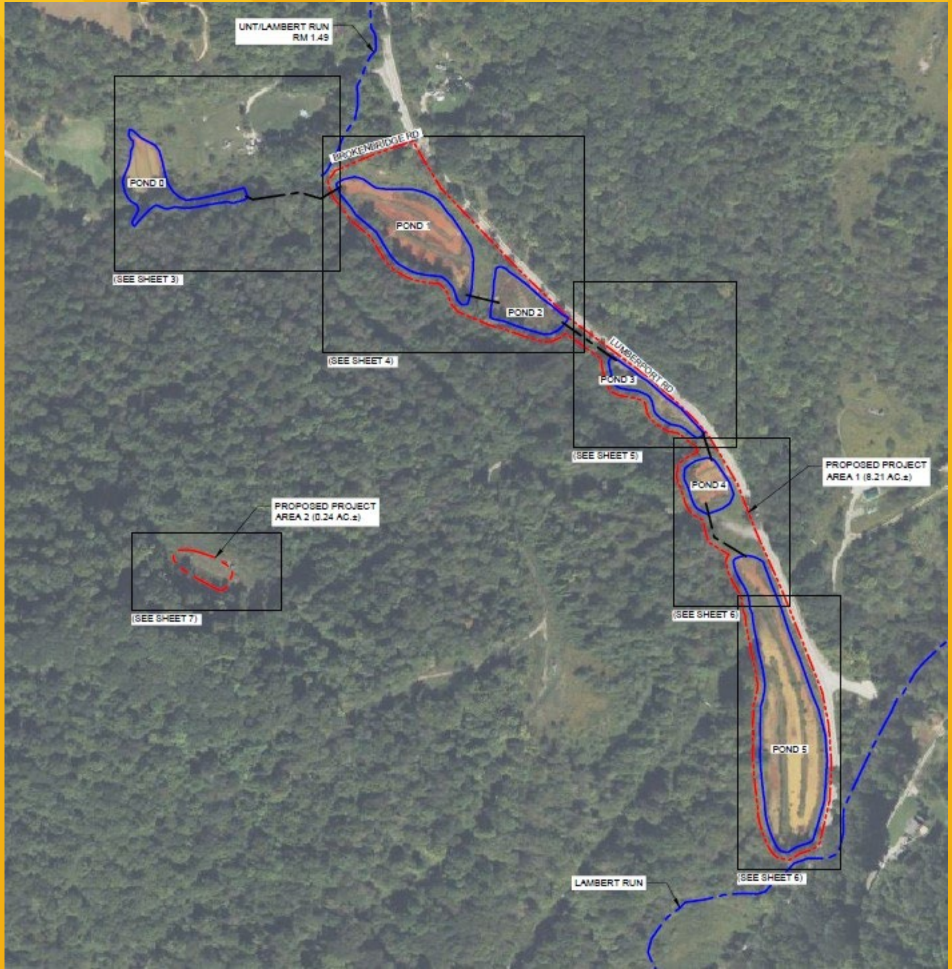



Site 7
Monthly Loadings (Fe)
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Loadings (Tons per Year)
Input
Output
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Month

Site 7 Redesign and Upgrade Project

- 2020-2022 Site 7 Data indicates total iron removal at 84%; however, the remaining load entering Lambert run is over 5 tons per year
- Site 7 will be upgraded to make the most efficient use of the 4 acres of available space
- Treatment goal is 95% reduction in iron

Site 7 – Redesign – Overall View



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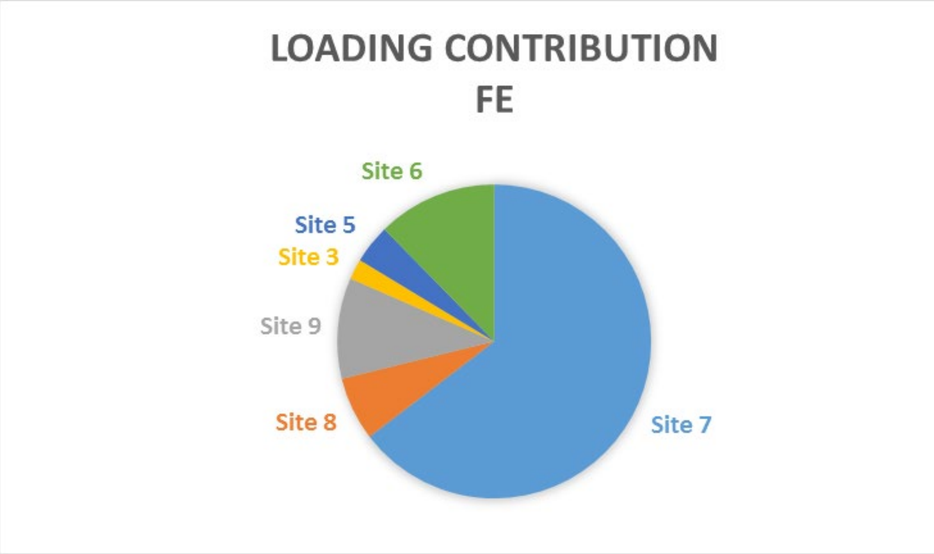
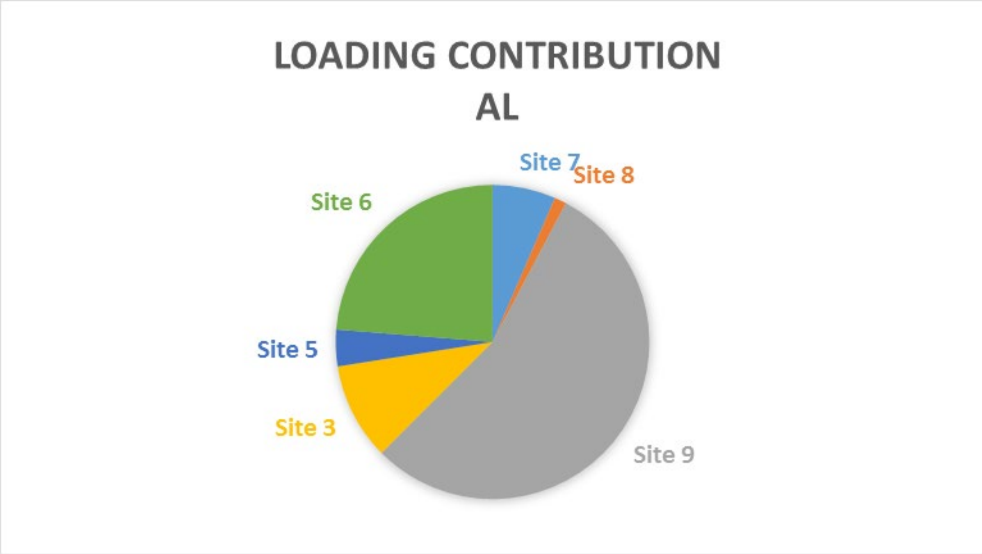
Summary: Metal Loadings – Overall Indication of Combined Source Inputs





Summary: Loadings Data – Overall Glimpse of Combined Treatment

Date	Site Nomenclature	*pH*	Discharge (flow) gal/min	t.Al mg/L	t.Fe mg/L	t.Mn mg/L	Loadings - tons per year			
							t. Fe	t. Al	t. Mn	Acidity
Site 7 In	Averages	6.6	955.9	0.0	22.0	1.9	45.4	0.1	3.9	-200.0
Site 7 Out	Averages	7.2	988.7	0.0	5.6	1.6	13.9	0.1	3.4	-271.5
Site 8 In	Averages	6.4	173.5	0.0	16.2	1.4	4.6	0.0	0.5	-42.9
Site 8 Out	Averages	7.2	277.4	0.1	1.7	0.8	1.3	0.1	0.4	-75.4
Site 9 In	Averages	5.8	156.7	2.8	21.9	2.7	7.3	1.0	0.9	11.2
Site 9 Out	Averages	7.3	312.4	0.4	2.8	2.5	1.4	0.2	1.4	-52.3
Site 3 In	Averages	6.4	97.6	0.9	8.9	2.5	1.5	0.2	0.5	-12.8
Site 3 Out	Averages	7.1	95.9	0.2	0.5	0.6	0.1	0.0	0.1	-13.5
Site 5 In	Averages	6.7	511.2	0.1	2.6	1.1	2.8	0.1	1.3	-187.5
Site 5 Out	Averages	7.0	521.4	0.1	0.5	0.7	0.6	0.1	0.7	-206.6

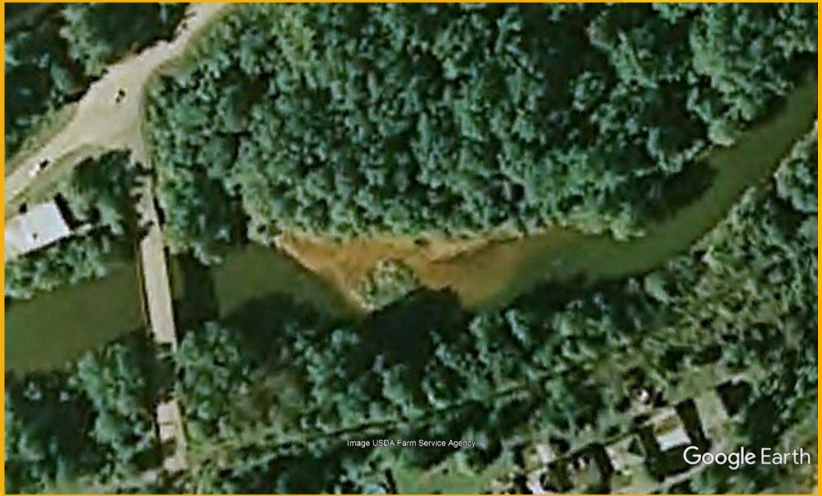
Summary: Cumulated Impact

- Iron: 70.2+ total tons/yr. from sources
  - 13.4 tons/yr. at the mouth
  - =81% reduction from sources to the mouth
- Aluminum: 2.5+ total tons/yr. from sources
  - 1.6 tons/yr. at the mouth
  - =36% reduction from sources to the mouth

Prior to Treatment vs: Post Treatment

2007 imagery of the mouth of Lambert Run in Google Earth reveals a plume of turbid, red water in the West Fork

2016 imagery at the same site shows a delta of sediment below Lambert Run, but relatively clear water



Prior to treatment – post treatment

- **Prior**

- **Post**

Post treatment

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Summary of Costs and Improvements

- Roughly **2 million** dollars in funding has been secured for remediation in the Lambert Run watershed
- Since 2006, several of the major contributors of mine drainage to the watershed have been remediated and the mainstem of Lambert Run is showing improved water quality
- The West Virginia Draft 2014 Section 303(d) List has removed pH as an impairment to Lambert Run

Future Actions

- 2003 WBP was written before any water quality improvements within the watershed; therefore, an updated WBP was drafted to define the improvements and address other water quality concerns in the Lambert Run watershed
- Installation of a passive treatment system at the Site 4 location – Fall 2024
- Maintenance and upgrades for existing 6 systems – notably Site 7 and 8
- Continued monitoring
- Anticipated removal from the 303(d) list of impaired streams