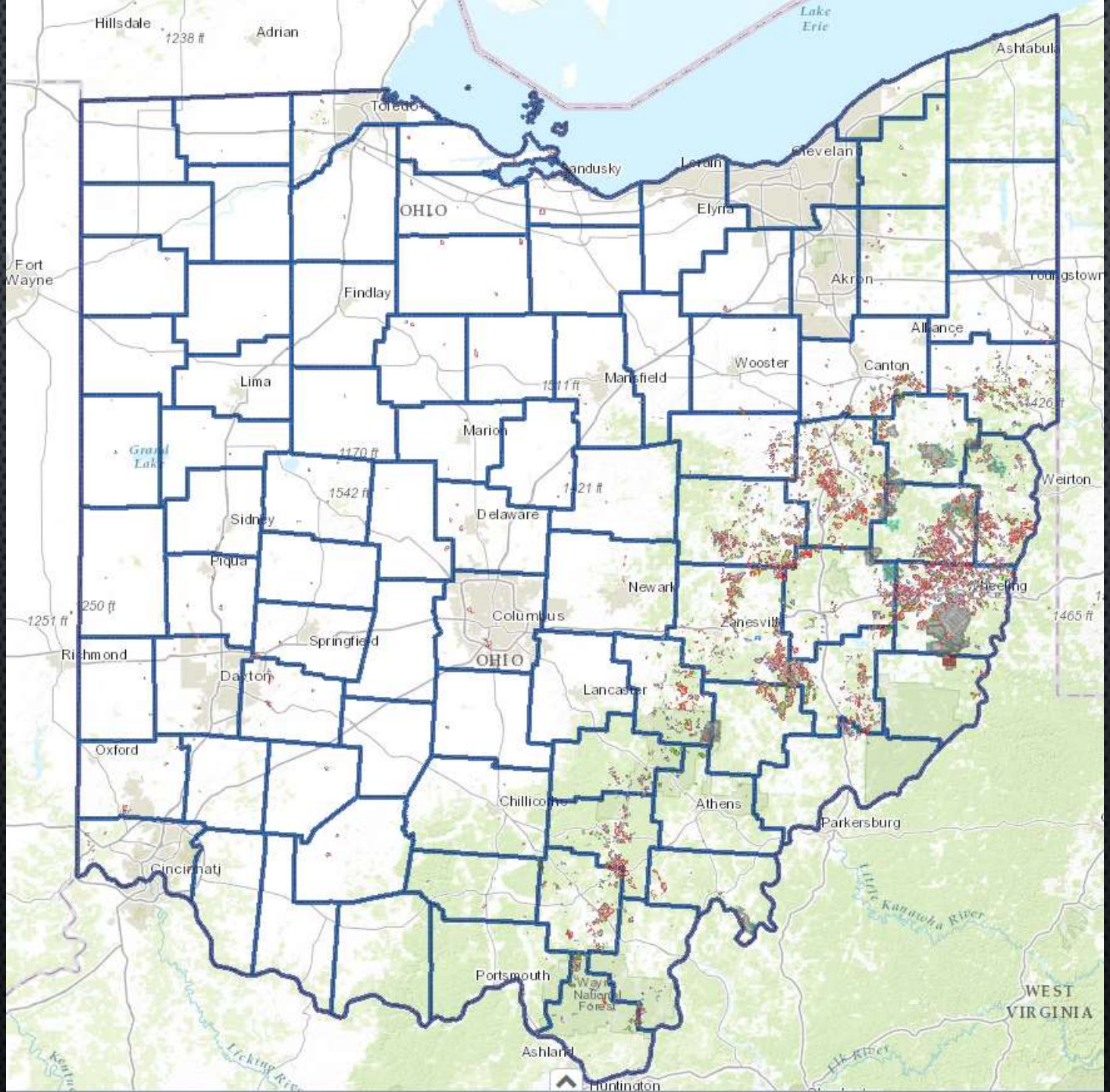
TREATMENT OF ACID MINE DRAINAGE IN HUFF RUN, SUNDAY, MONDAY, LEADING AND RACCOON CREEK WATERSHEDS, OHIO

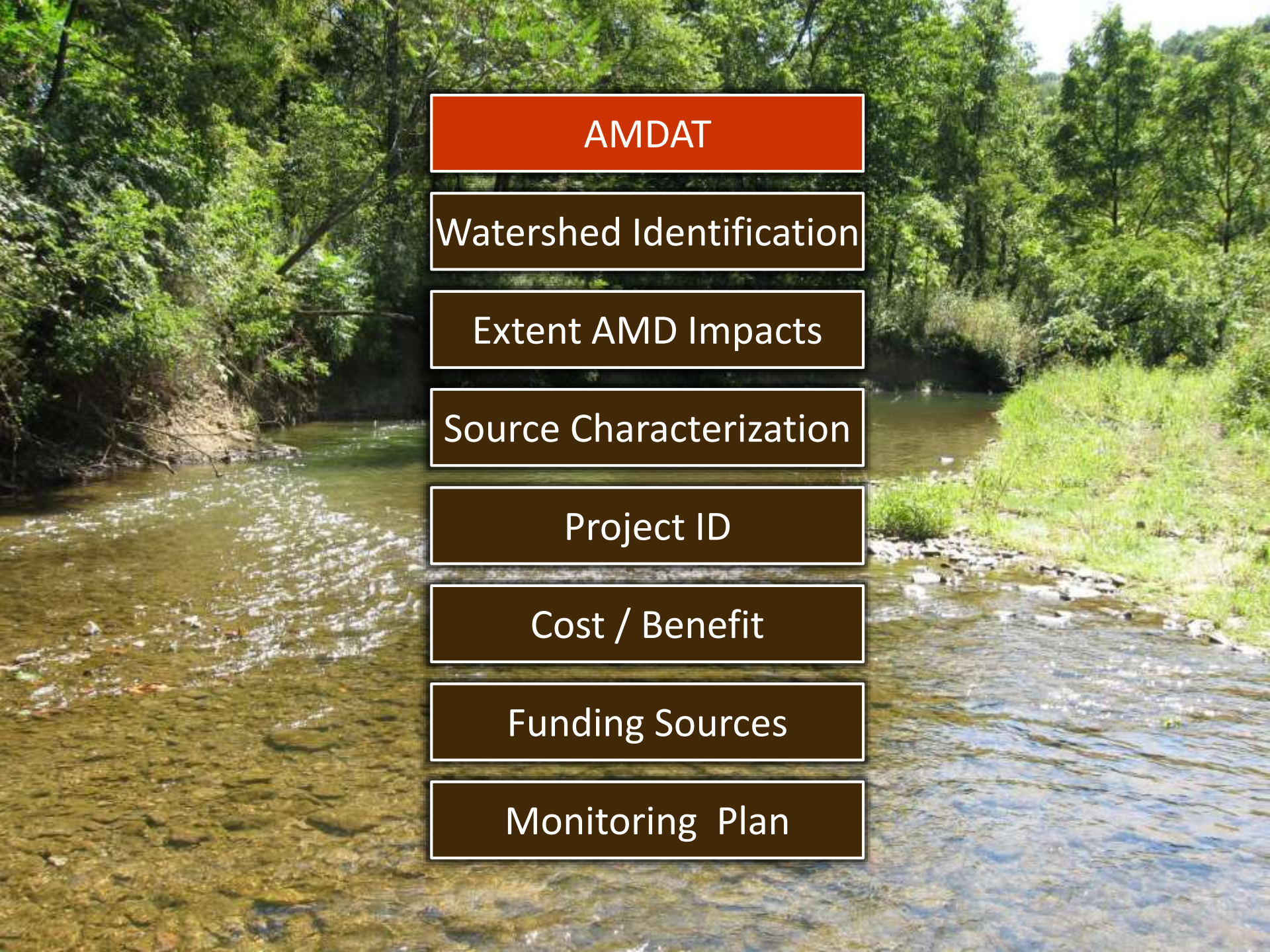
BEN MCCAMENT

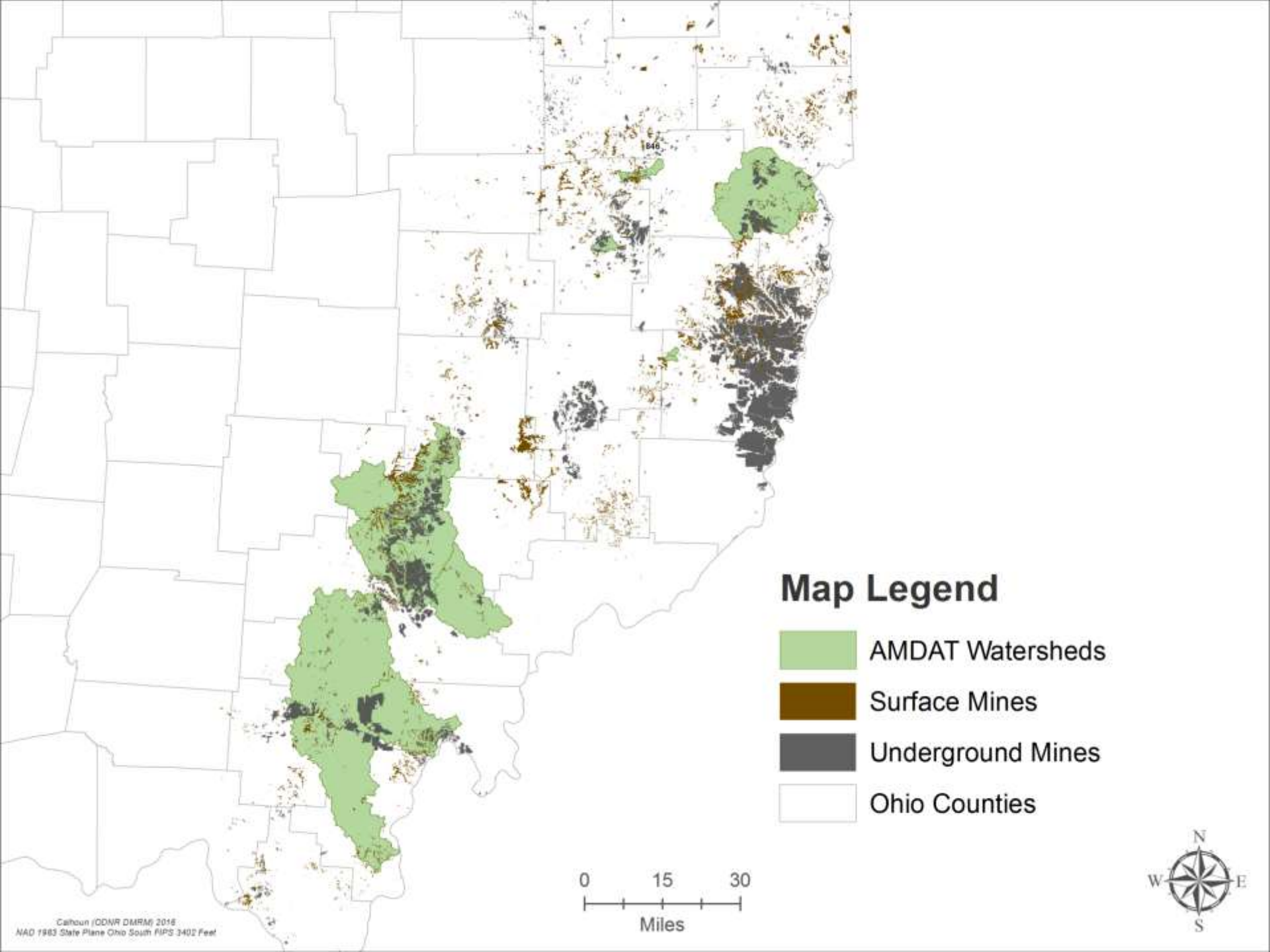
OHIO DEPARTMENT OF NATURAL RESOURCES

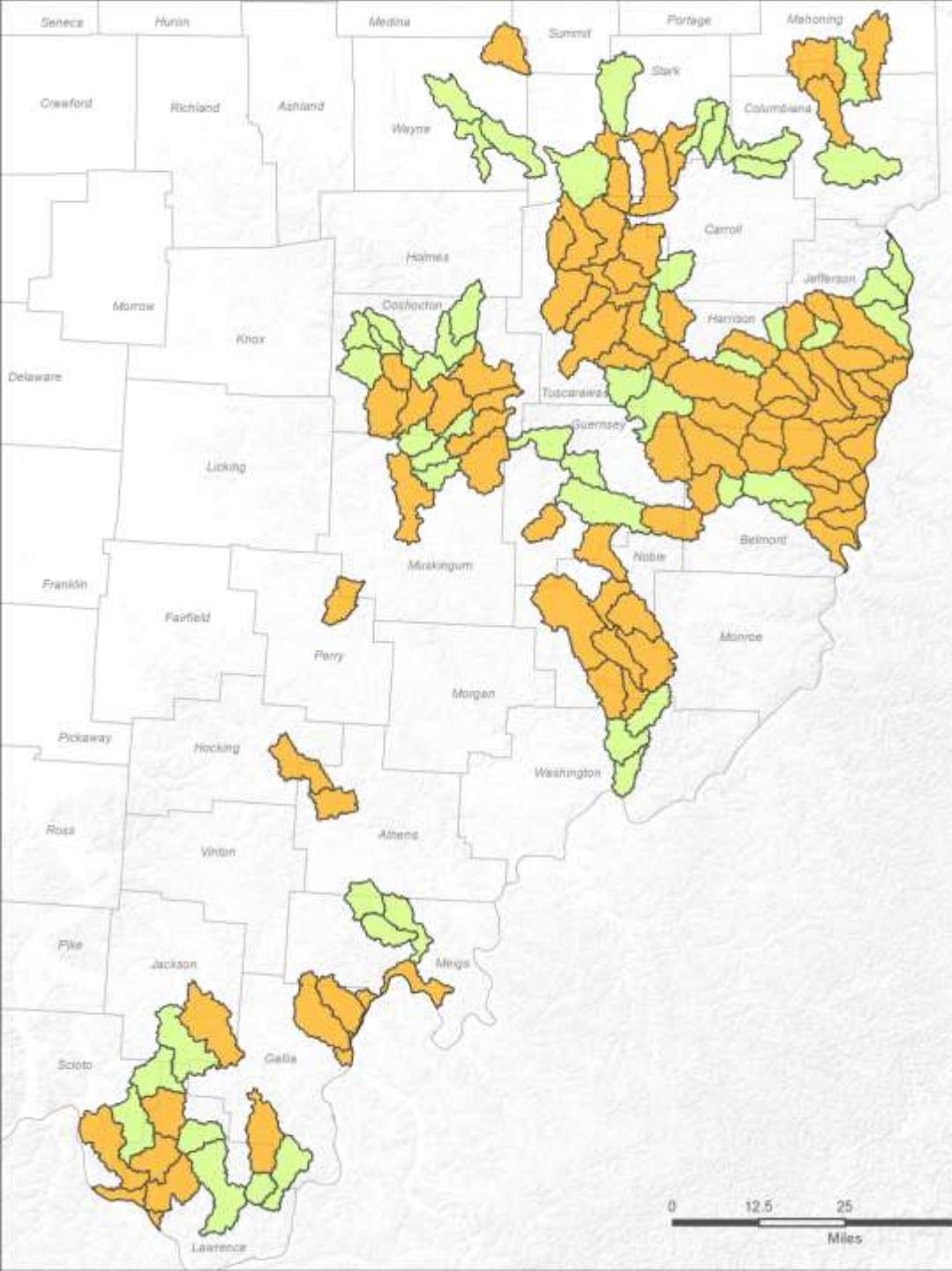
DIVISION OF MINERAL RESOURCES MANAGEMENT

AML PROGRAM


Hillsdale
1238 ft
Adrian
Lake Erie
Ashtabula
Toledo
Sandusky
Lorain
Cleveland
OHIO
Elyria
Fort Wayne
Findlay
Akron
Youngstown
Alliance
Wooster
Canton
Lima
Mansfield
1511 ft
1426 ft
Marion
Grand Lake
1170 ft
1542 ft
1421 ft
Weirton
Sidney
Delaware
Piqua
Newark
Wheeling
1250 ft
1251 ft
Columbus
Zanesville
1465 ft
Springfield
Richmond
OHIO
Dayton
Lancaster
Oxford
Chillicothe
Athens
Parkersburg
Cincinnati
Little Kanawha River
Portsmouth
Wayne National Forest
WEST VIRGINIA
Ashland
Licking River
Elk River
Huntington


AMDAT
Watershed Identification
Extent AMD Impacts
Source Characterization
Project ID
Cost / Benefit
Funding Sources
Monitoring Plan


Map Legend
AMDAT Watersheds
Surface Mines
Underground Mines
Ohio Counties
0
15
30
Miles
N
W
E
S
Calhoun (ODNR DMRM) 2016
NAD 1983 State Plane Ohio South FIPS 3402 Feet



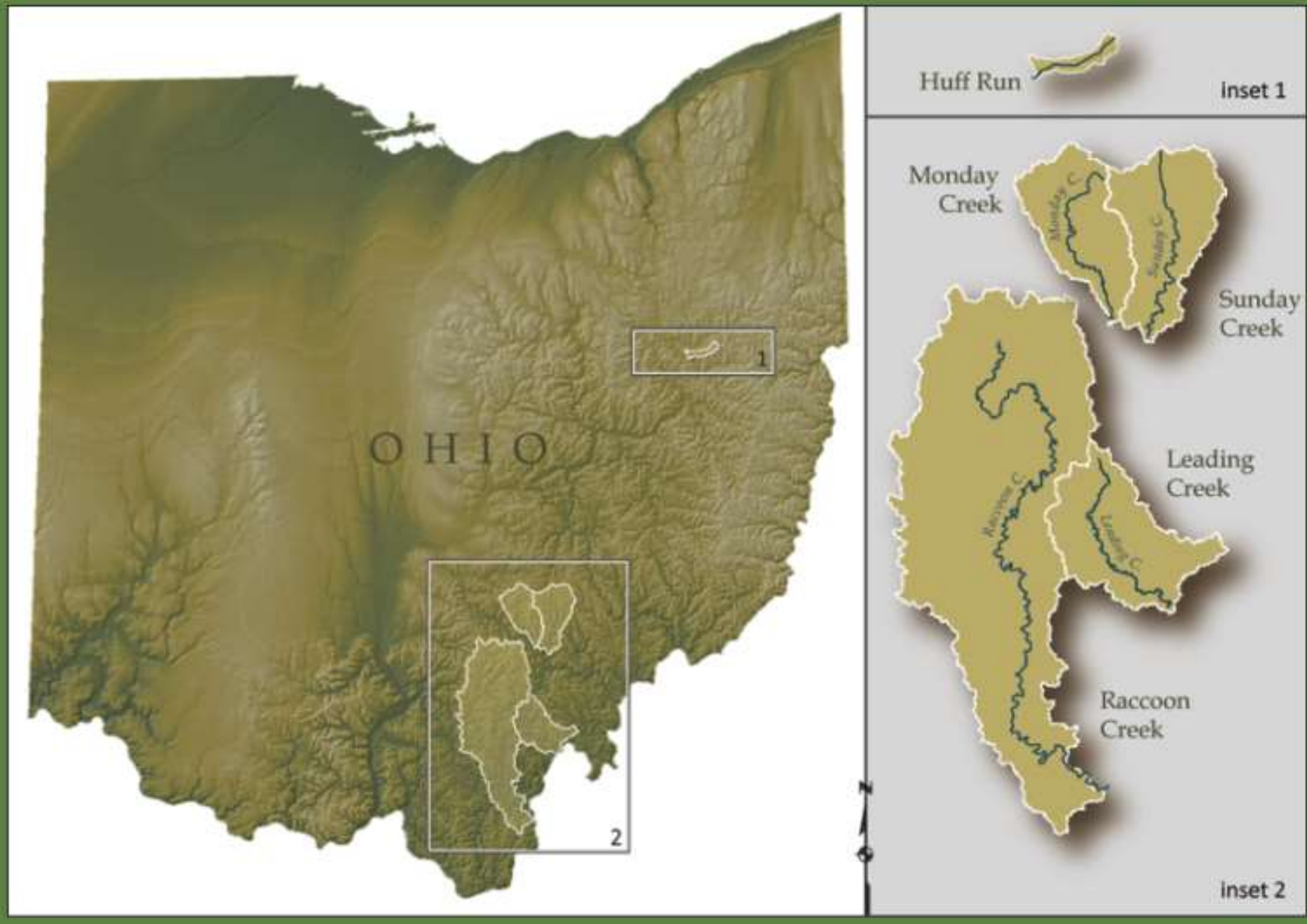
Watersheds Surveyed	AMD Present	AMD Absent
134	83	51

Ohio Counties

12 HUC Watersheds

AMD Absent

AMD Present


OHIO
1
2
Huff Run
Inset 1
Monday Creek
Sunday Creek
Leading Creek
Raccoon Creek
Inset 2

Partnerships

- Ohio Dept. of Natural Resources
- Ohio EPA
- US Office of Surface Mining
- Wayne National Forest
- Muskingum Watershed Conservancy District
- Local Soil and Water Conservation Districts
- Ohio University – Voinovich School
- Rural Action
- Watershed Groups
- Coal Industry
- US Army Corps of Engineers

Watershed	Total number of completed projects	Total costs
Raccoon Creek	20	$14,521,361
Monday Creek	18 (plus 5 subsidence projects, costs are not included)	$7,197,808
Sunday Creek	12 (7 of 10 are sub-sidence projects)	$2,618,273
Huff Run	14	$5,308,353
Leading Creek	2	$728,481
Total	66	$30,374,277


11/18/2011


7 10:43 AM


08/13/2012

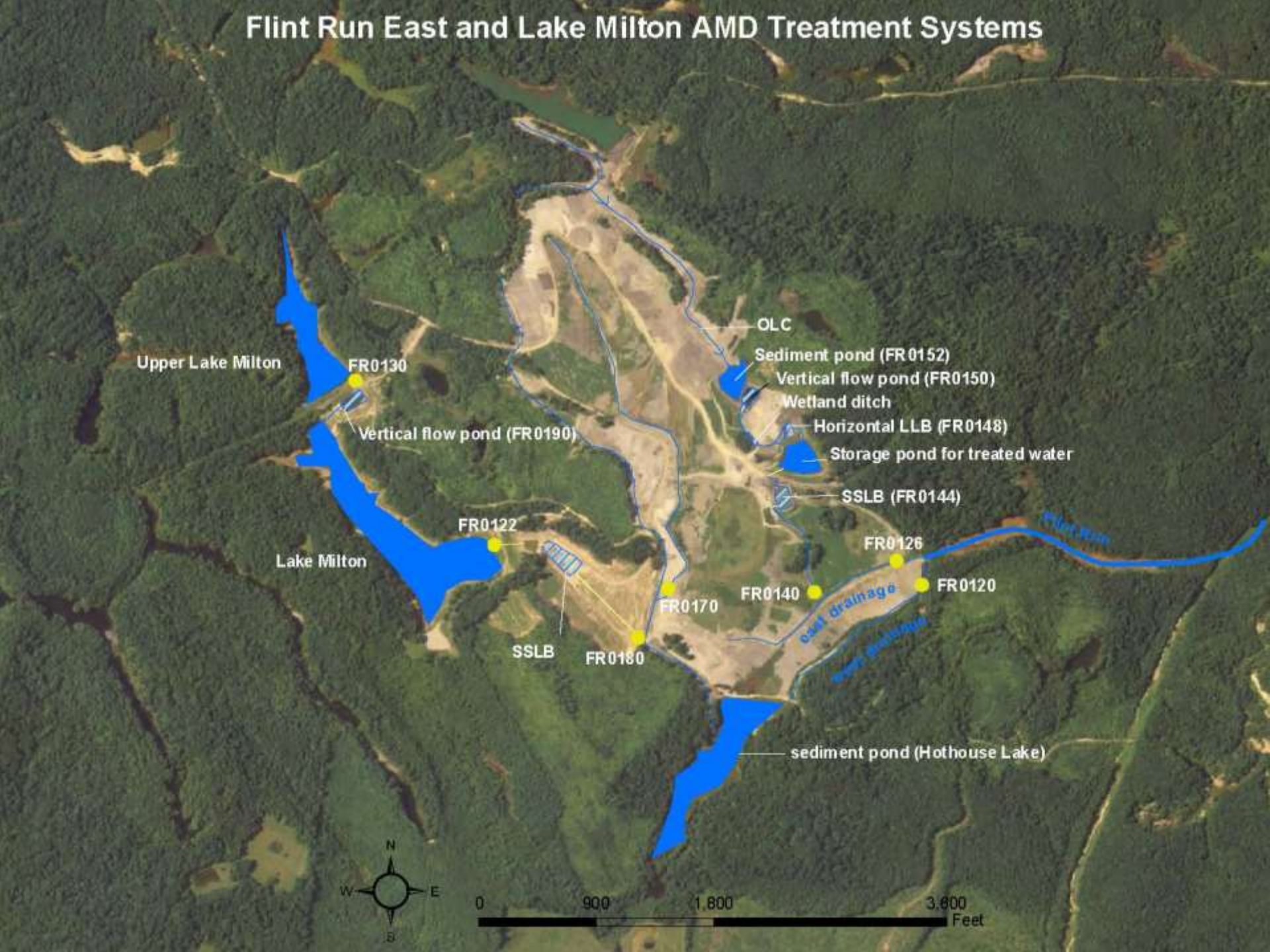

Flint Run East and Lake Milton AMD Treatment Systems
Upper Lake Milton
FR0130
Vertical flow pond (FR0190)
OLC
Sediment pond (FR0152)
Vertical flow pond (FR0150)
Wetland ditch
Horizontal LLB (FR0148)
Storage pond for treated water
SSLB (FR0144)
FR0122
Lake Milton
FR0126
FR0140
FR0120
FR0170
SSLB
FR0180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

Table 1: Types of AMD Treatment Systems in Use in Ohio

	Passive Treatment							Active Treatment	Source Control	
Type of System	SLB	LLB	Wetland	VFP/SAPS	OLC	ALD	Bioreactor	Lime Doser	Reclamation	Stream Capture
# of systems	15	10	9	3	3	1	1	6	16	12

2016 STREAM HEALTH REPORT

AN EVALUATION OF WATER QUALITY, BIOLOGY, AND ACID MINE DRAINAGE RECLAMATION IN FIVE WATERSHEDS: RACCOON CREEK, MONDAY CREEK, SUNDAY CREEK, HUFF RUN, AND LEADING CREEK.

CREATED BY:
VOINOVICH SCHOOL OF LEADERSHIP AND PUBLIC AFFAIRS
AT OHIO UNIVERSITY
JENNIFER BOWMAN, NORA SULLIVAN, AND KELLY JOHNSON
6-30-2017

Watershed	Total number of completed projects	Total costs	Total acid load reduction lbs/day	Total stream miles improved in 2005/2010/2016 to meet IBI & MAIS Biological stream health targets	Stream miles that met the pH target	Total stream miles monitored
Raccoon Creek	20	$14,521,361	4,267	23.3/18.4/40.3 (82.0)	110	117
Monday Creek	18 (plus 5 subsidence projects, costs are not included)	$7,197,808	4,360	0/0	23	32
Sunday Creek	12 (7 of 10 are sub-sidence projects)	$2,618,273	22	0/5.3/6.2 (11.5)	43	43
Huff Run	14	$5,308,353	1,129	0/0	8	10
Leading Creek	2	$728,481	663	NA/0	9	9
Total	66	$30,374,277	10,441	23.3/23.7/46.5 (93.5)	193	211

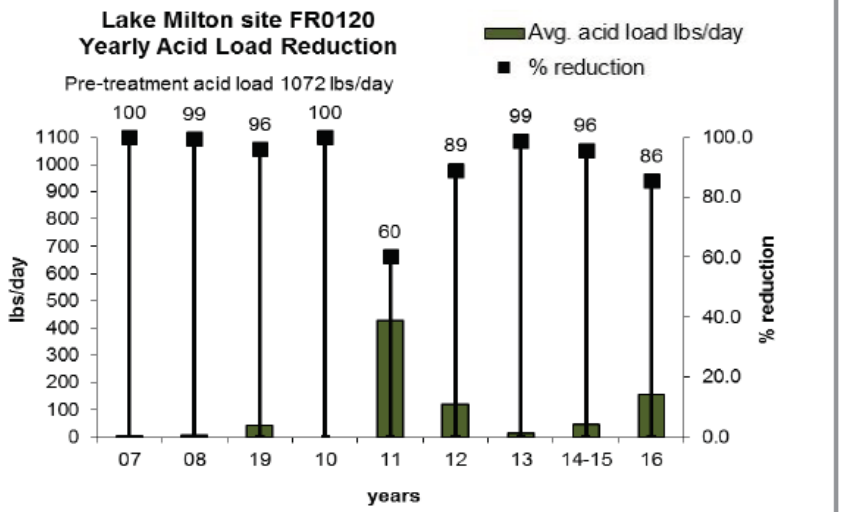
Reductions

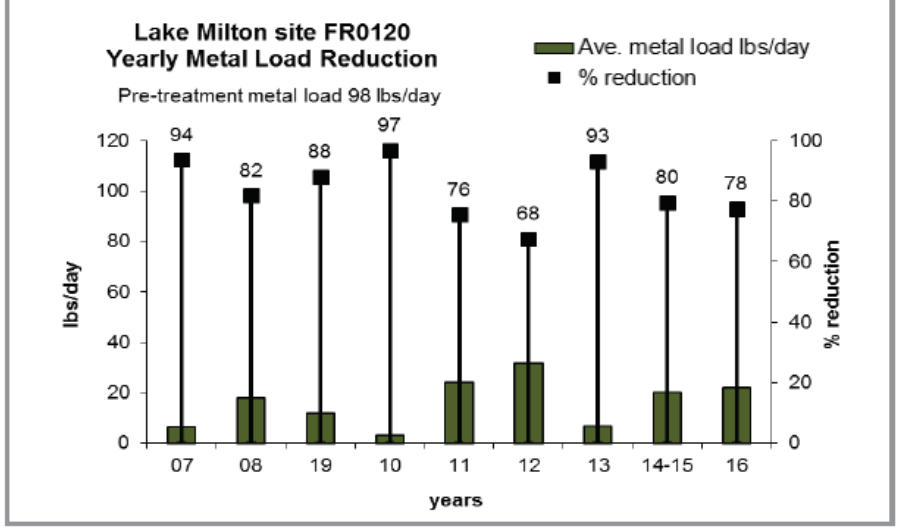
Total to date acid load reductions = 10,441 lbs/day

Costs

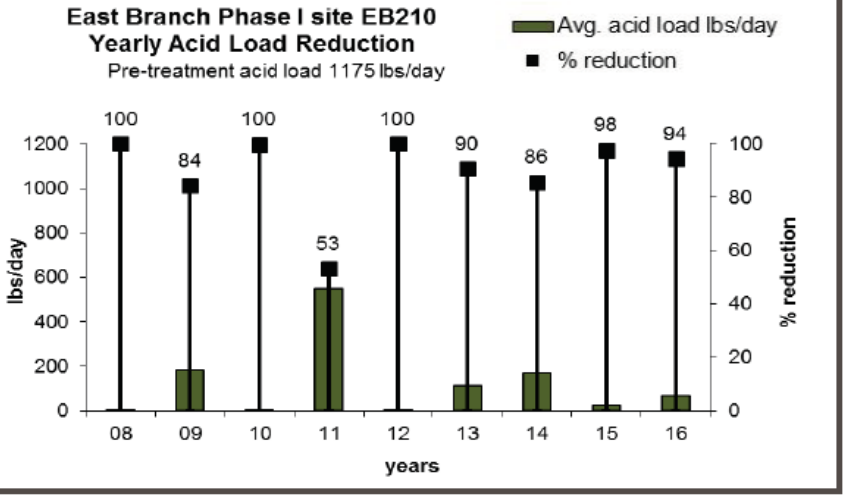
Total to date reclamation costs = $30,374,277

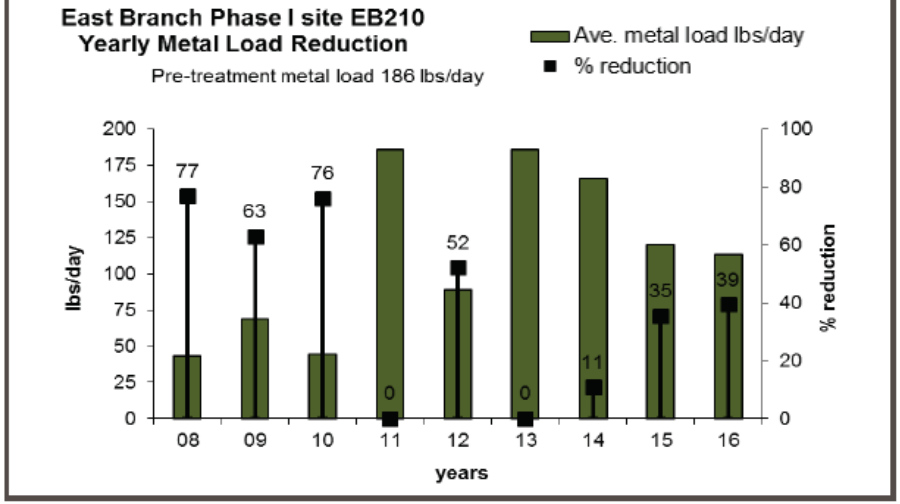
Lake Milton site FR0120



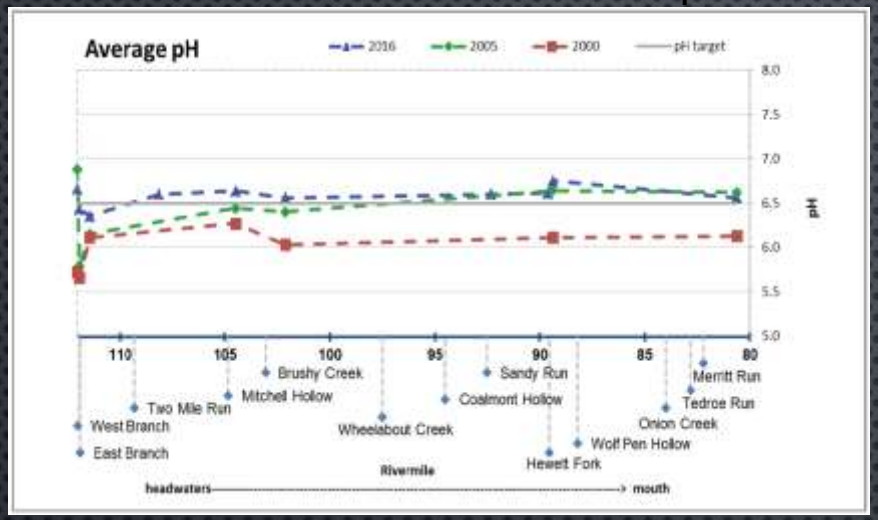


East Branch Phase I site EB210

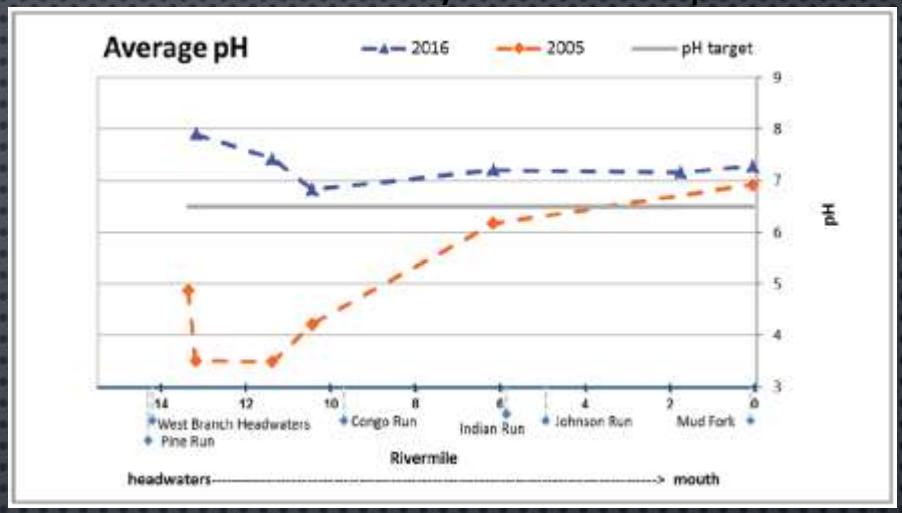




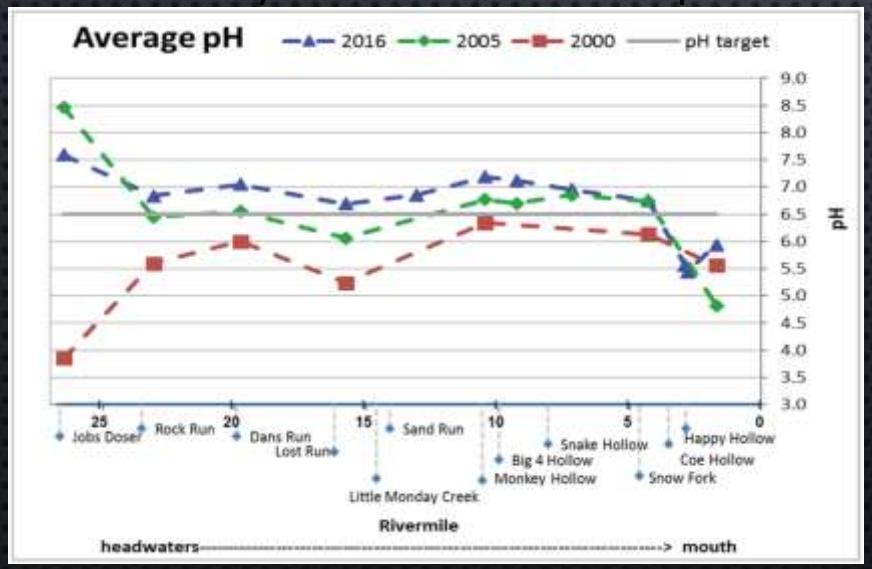
Raccoon Creek Headwaters Mainstem pH



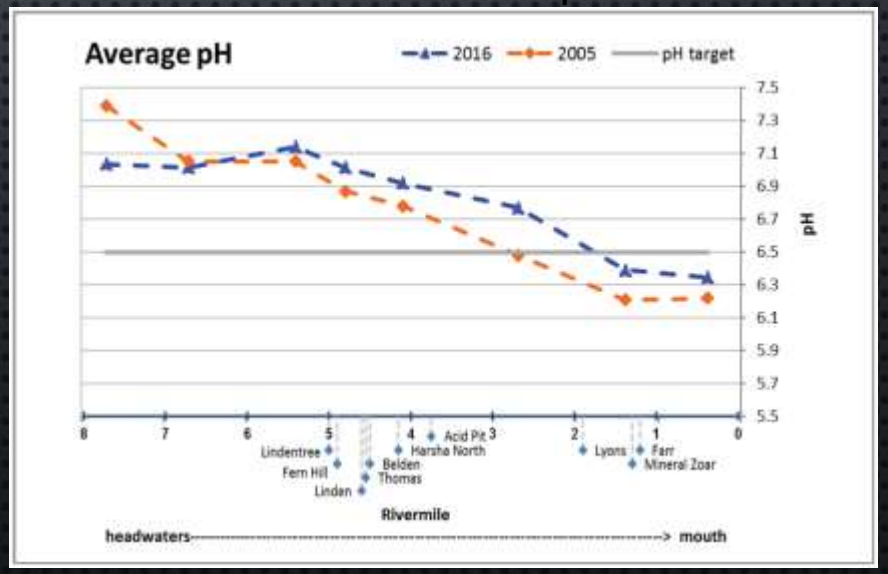
West Branch Sunday Creek Mainstem pH



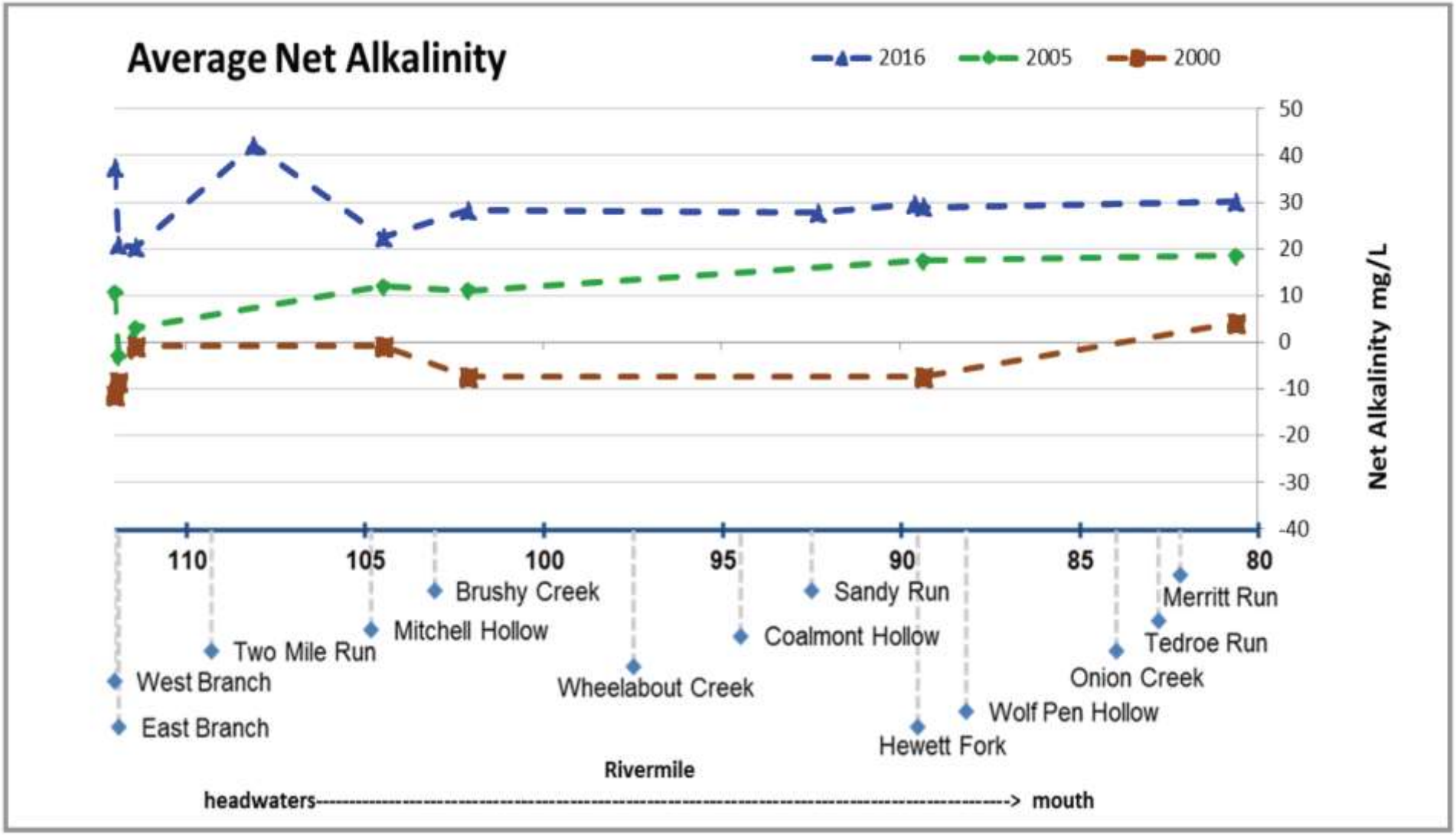
Monday Creek Headwaters Mainstem pH



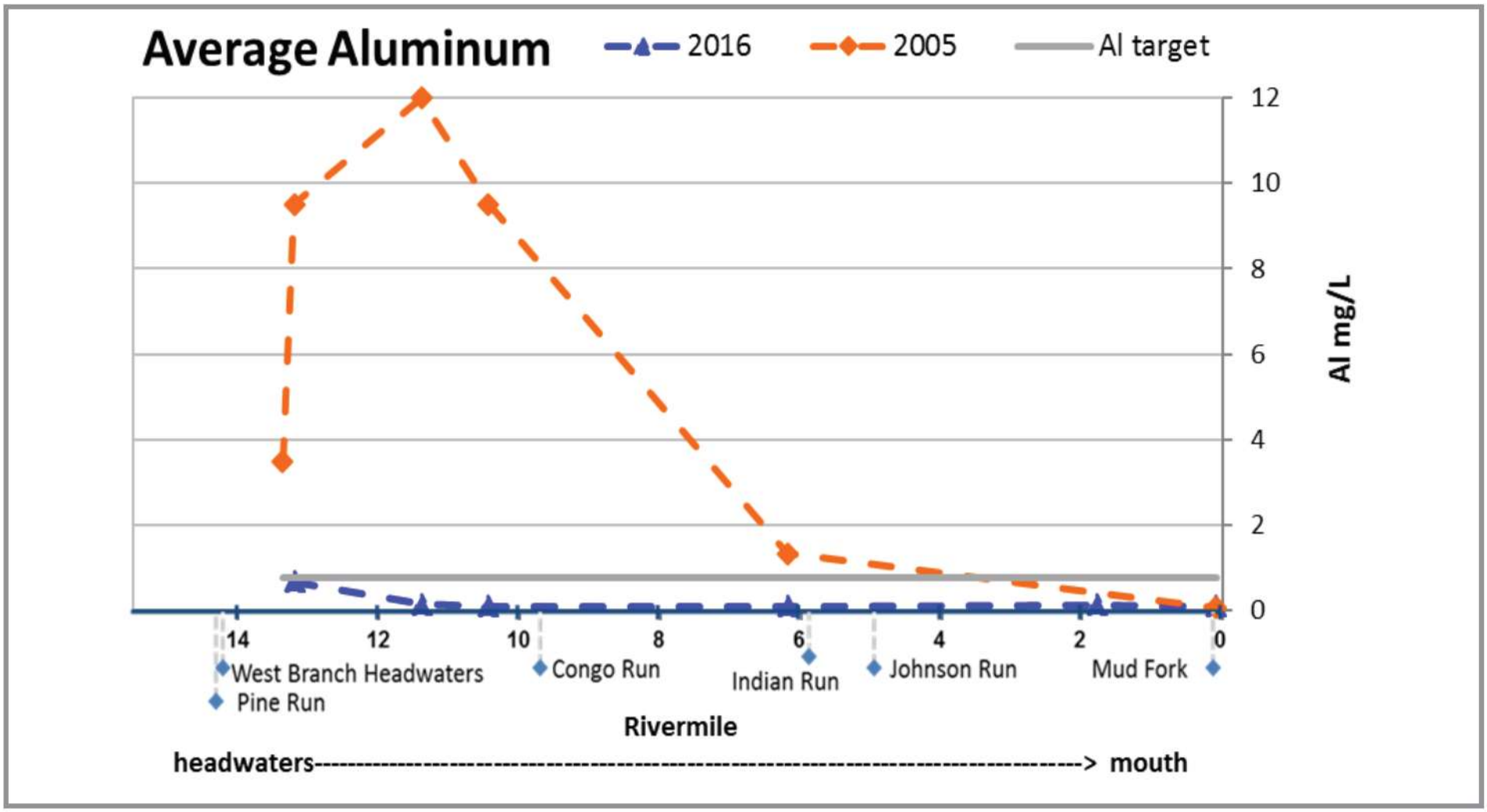
Huff Run Mainstem pH



RACCOON CREEK HEADWATERS



WEST BRANCH SUNDAY CREEK




WRESTLING TOURNAMENT

Figure 1: Biological health improvements in Raccoon Creek from baseline (1997) to 2015.

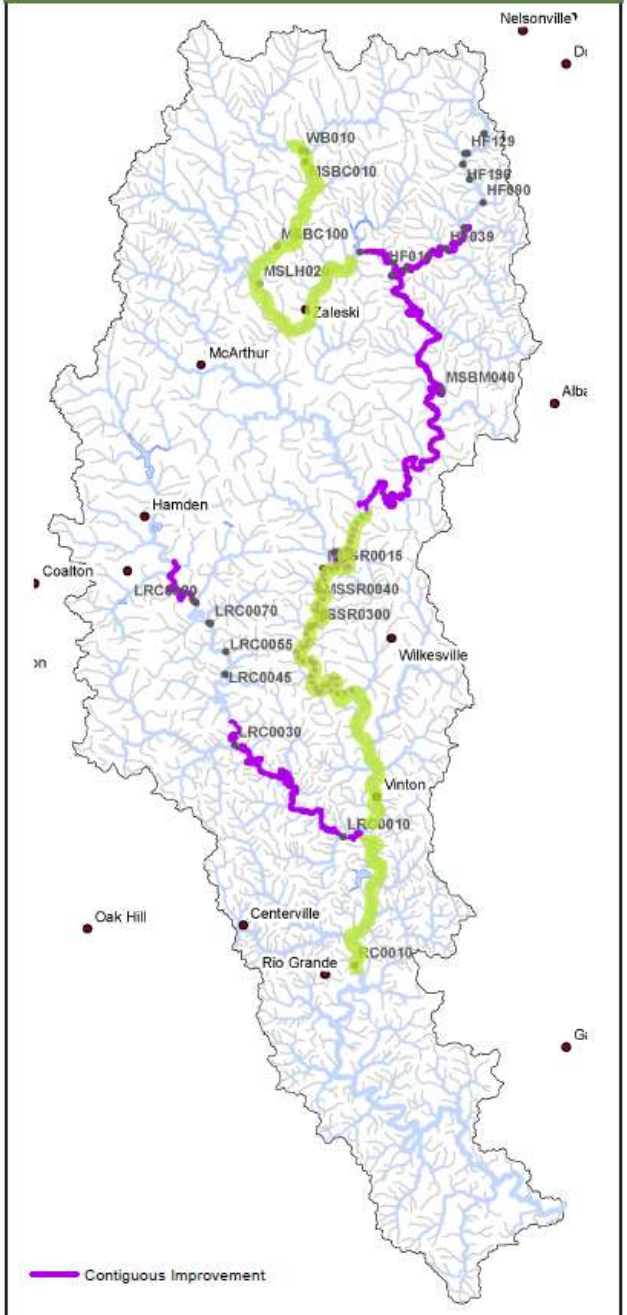
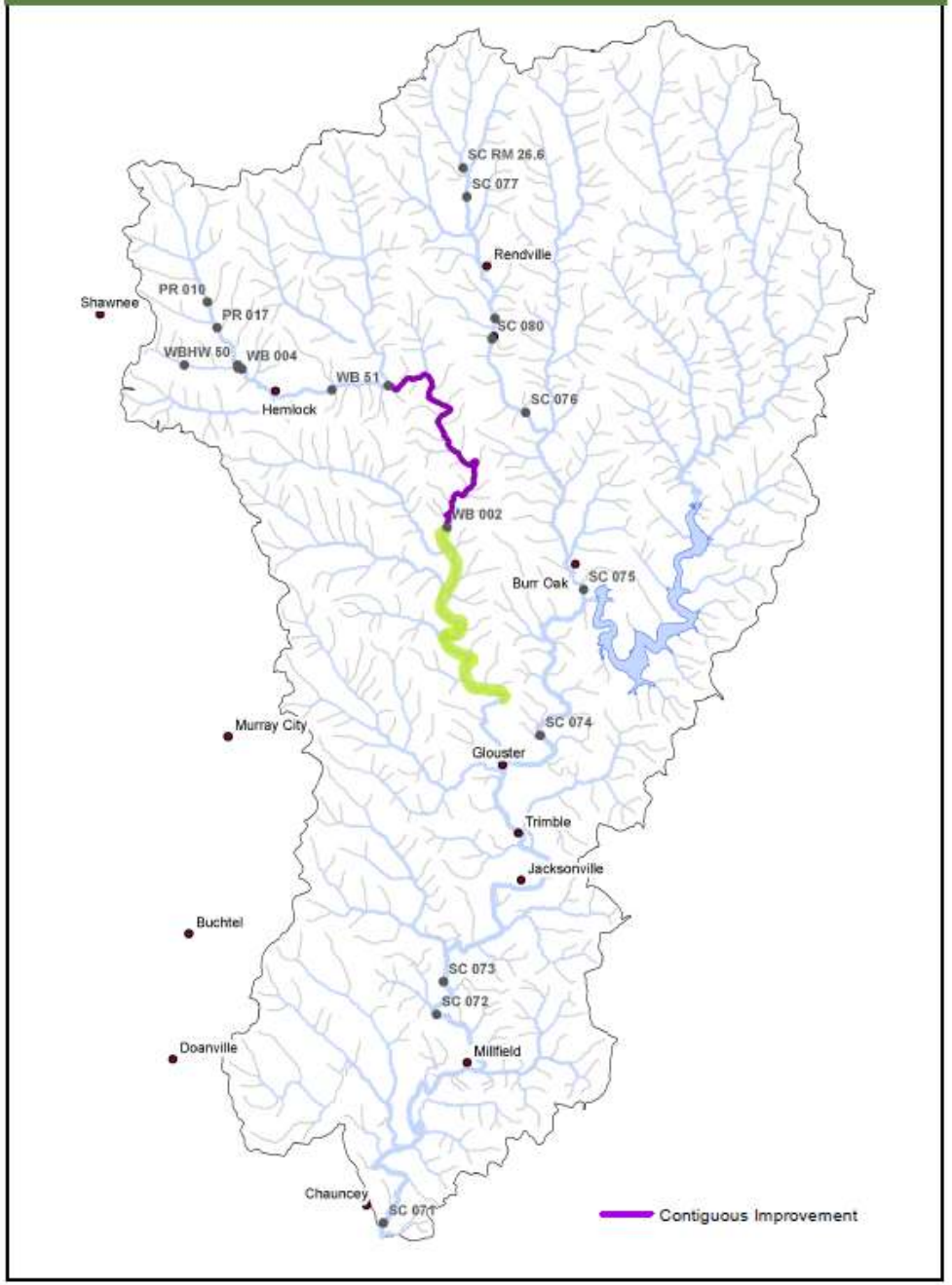
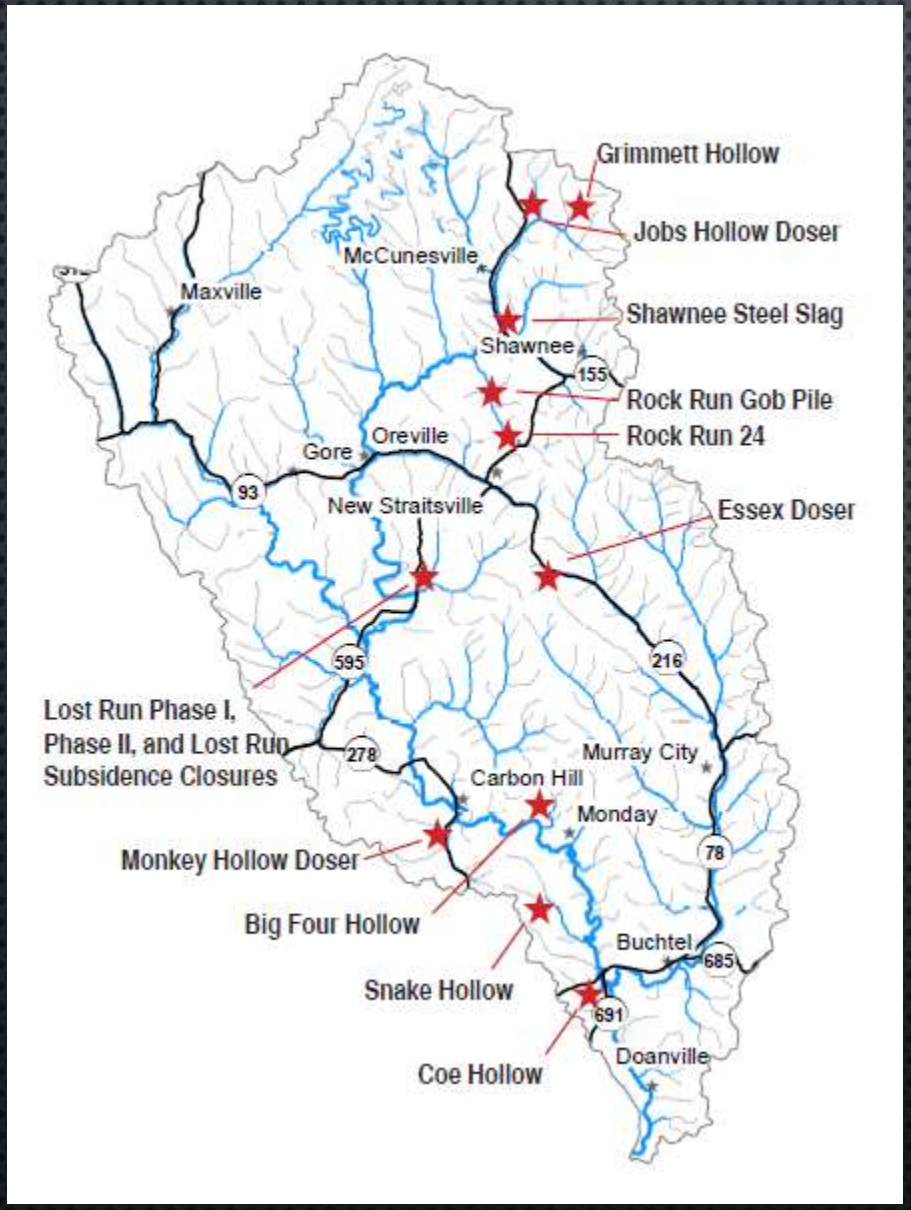
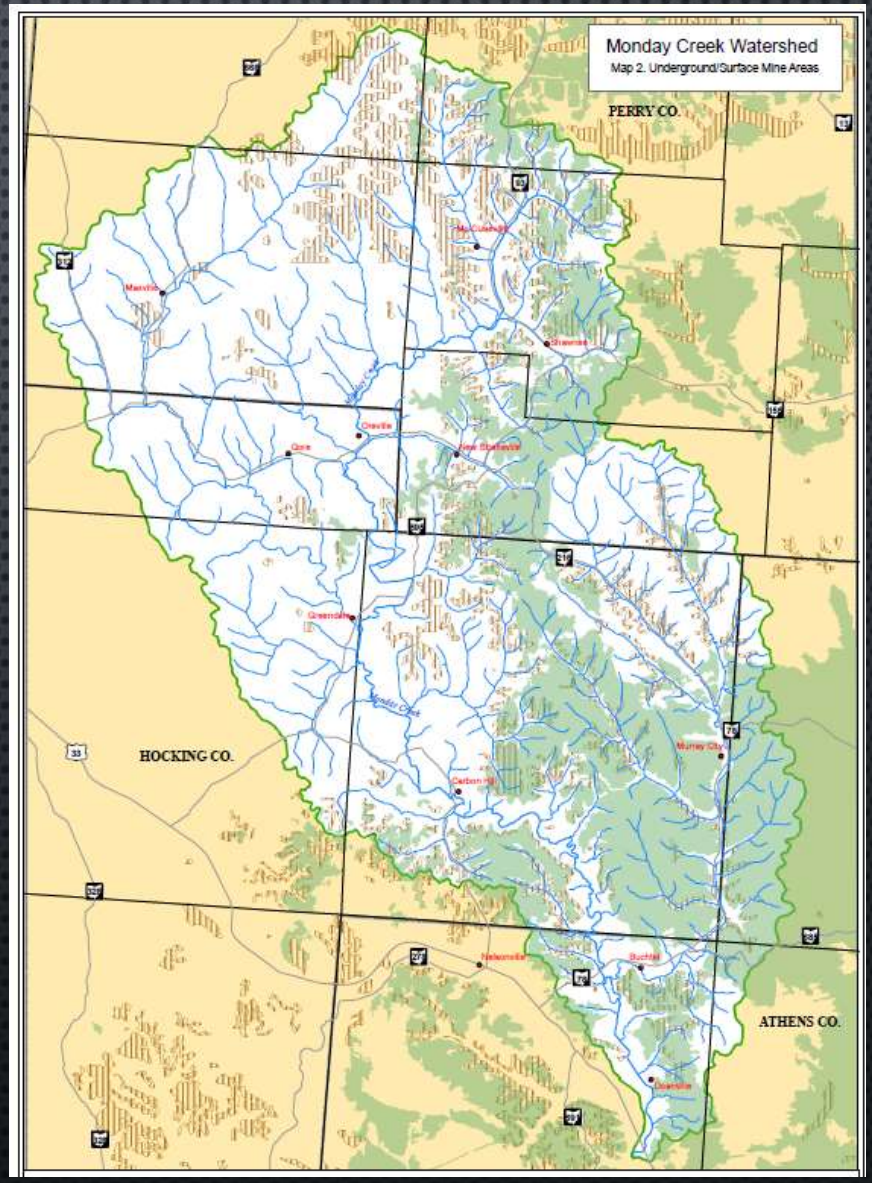


Figure 2: Biological health improvement in Sunday Creek West Branch from 2005 to 2015.

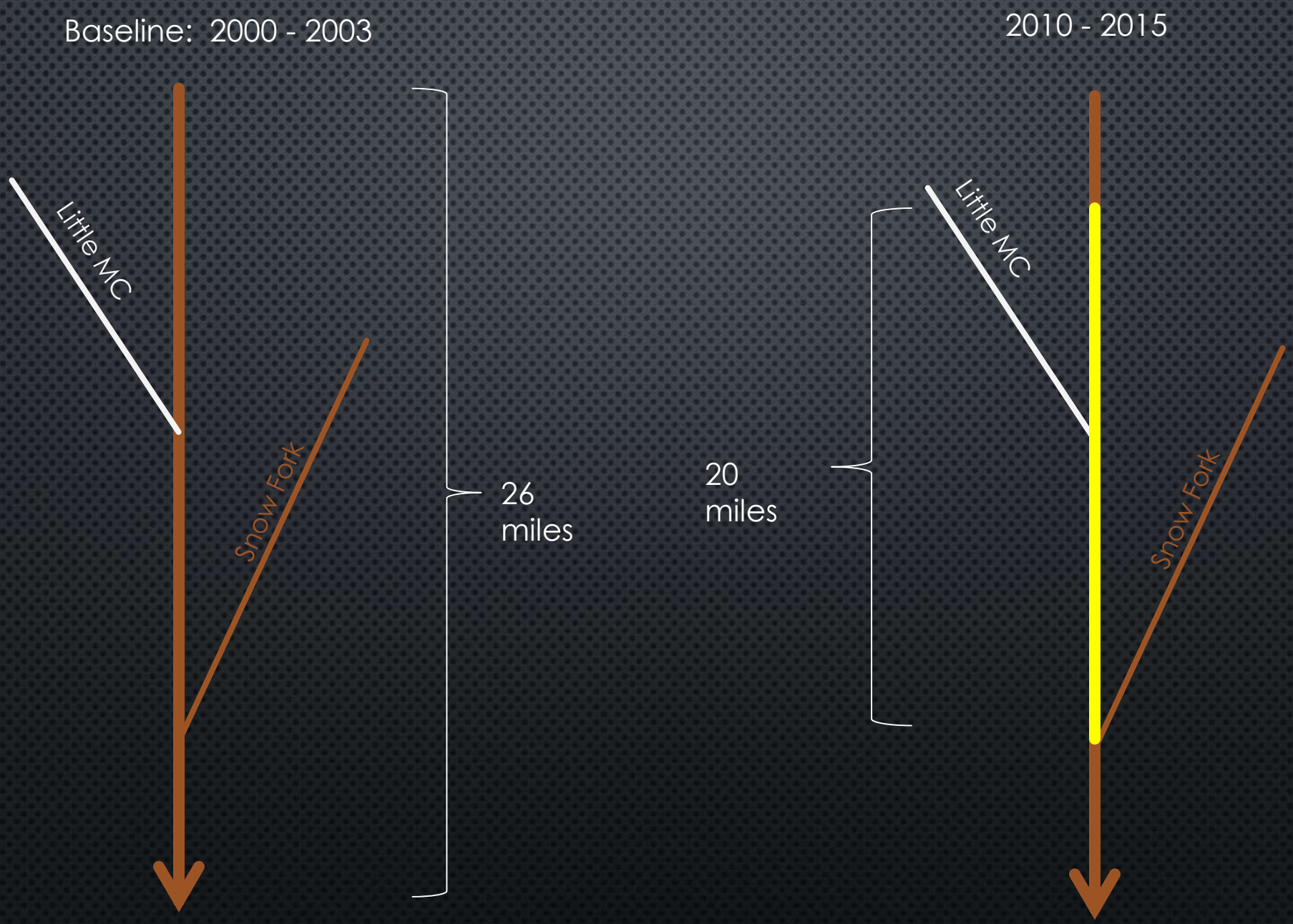


Monday Creek

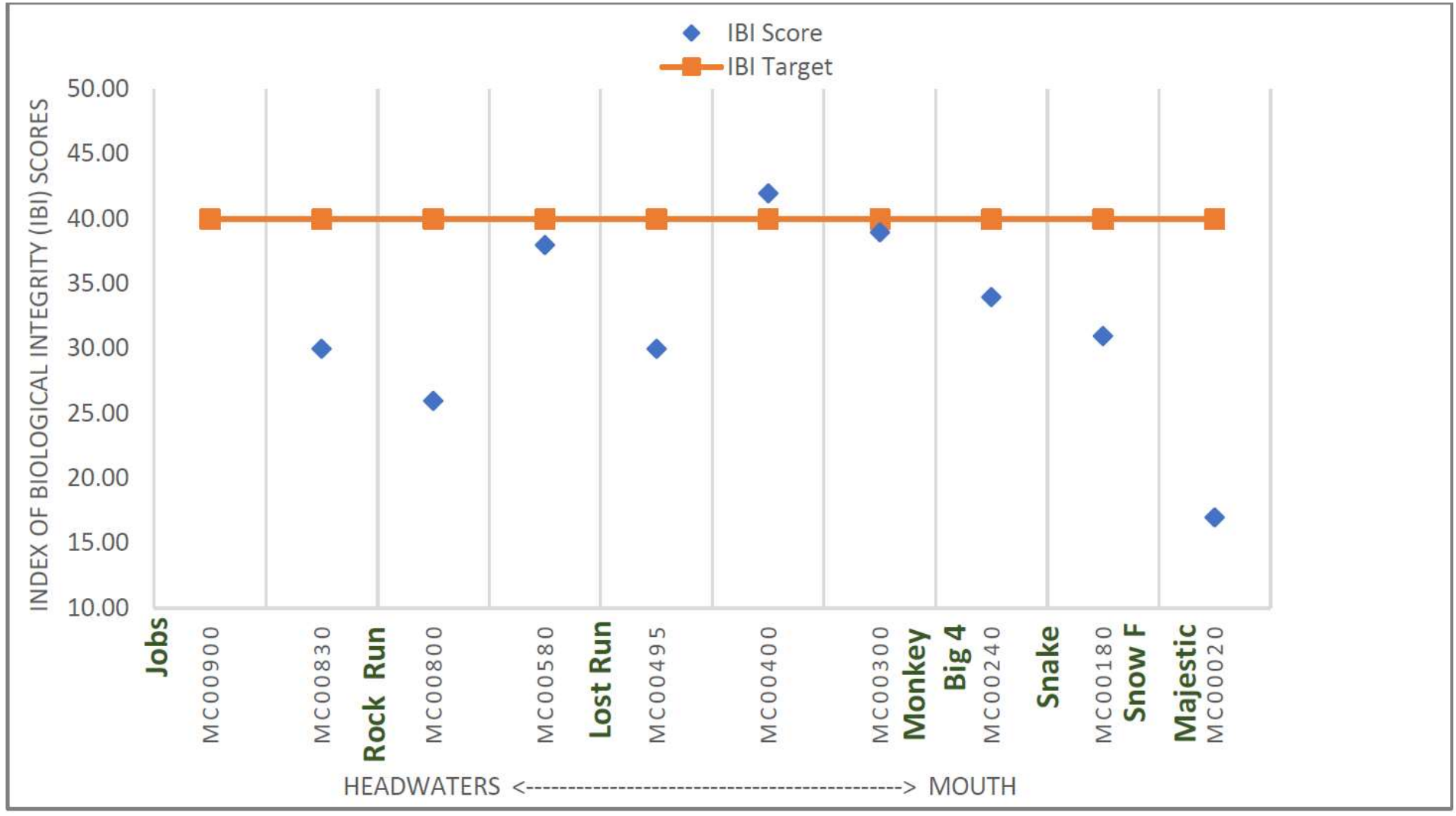




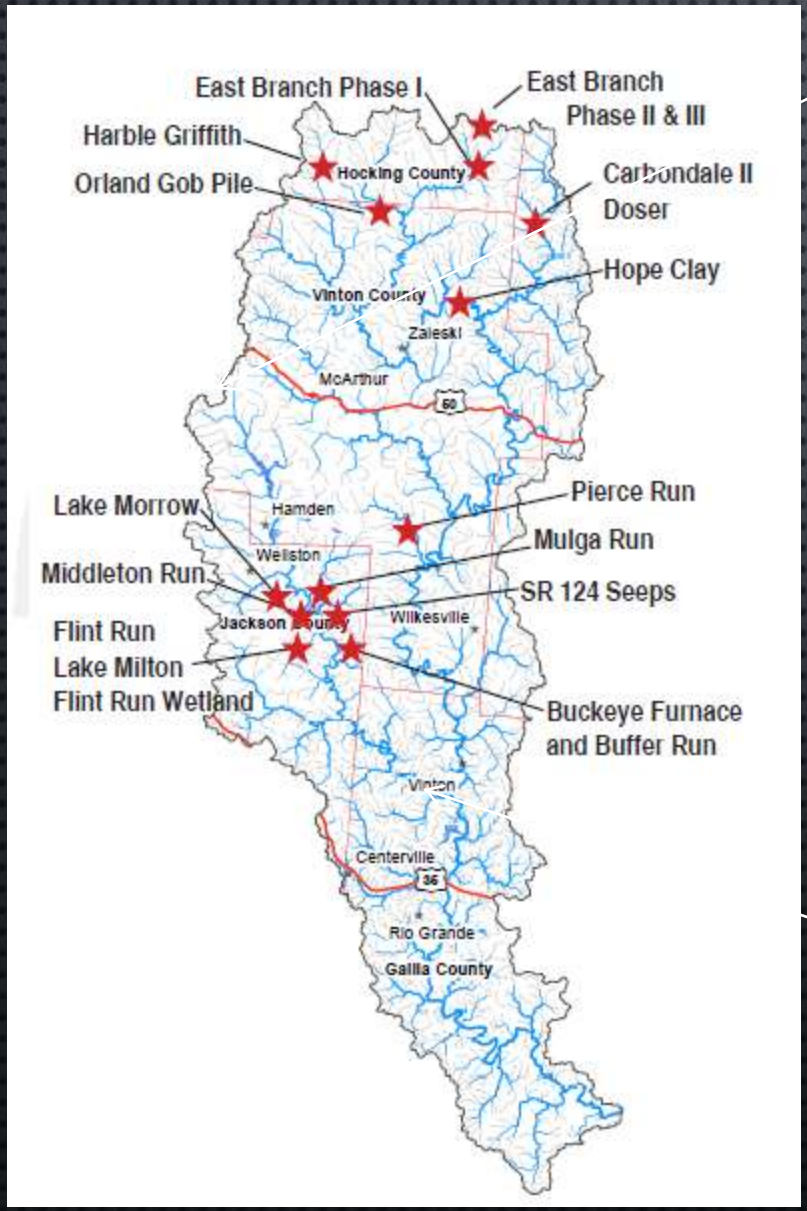
Monday Creek



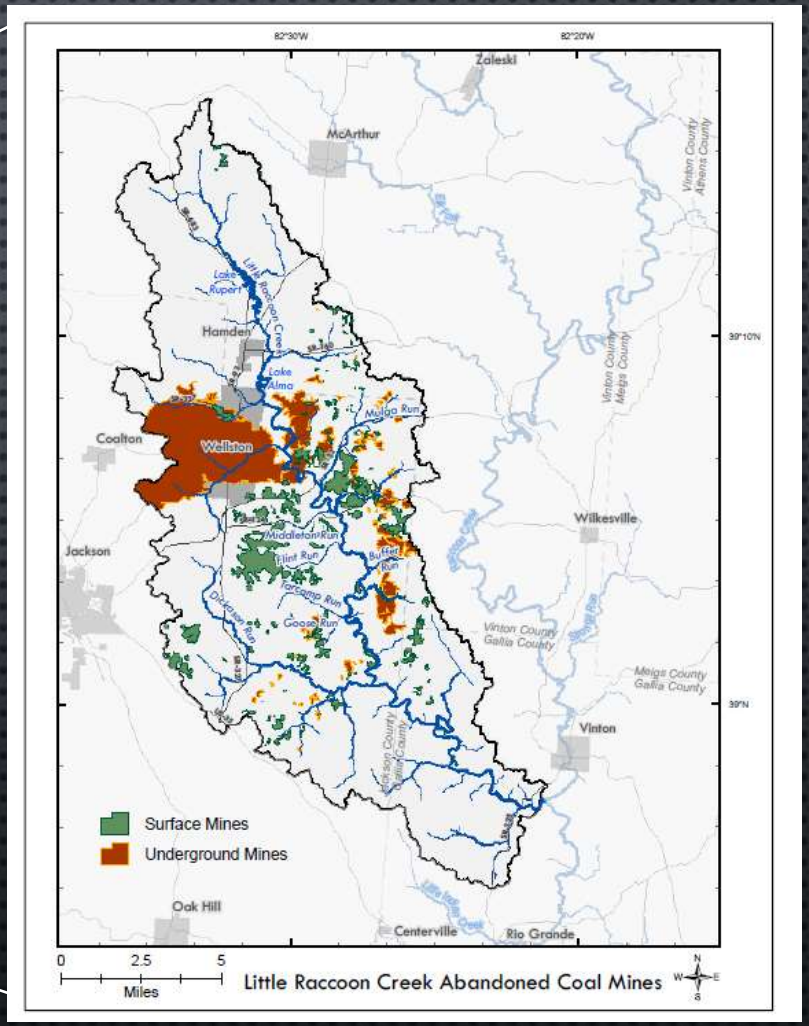
MONDAY CREEK FISH DATA



Raccoon Creek



Little Raccoon Creek



LITTLE RACCOON CREEK

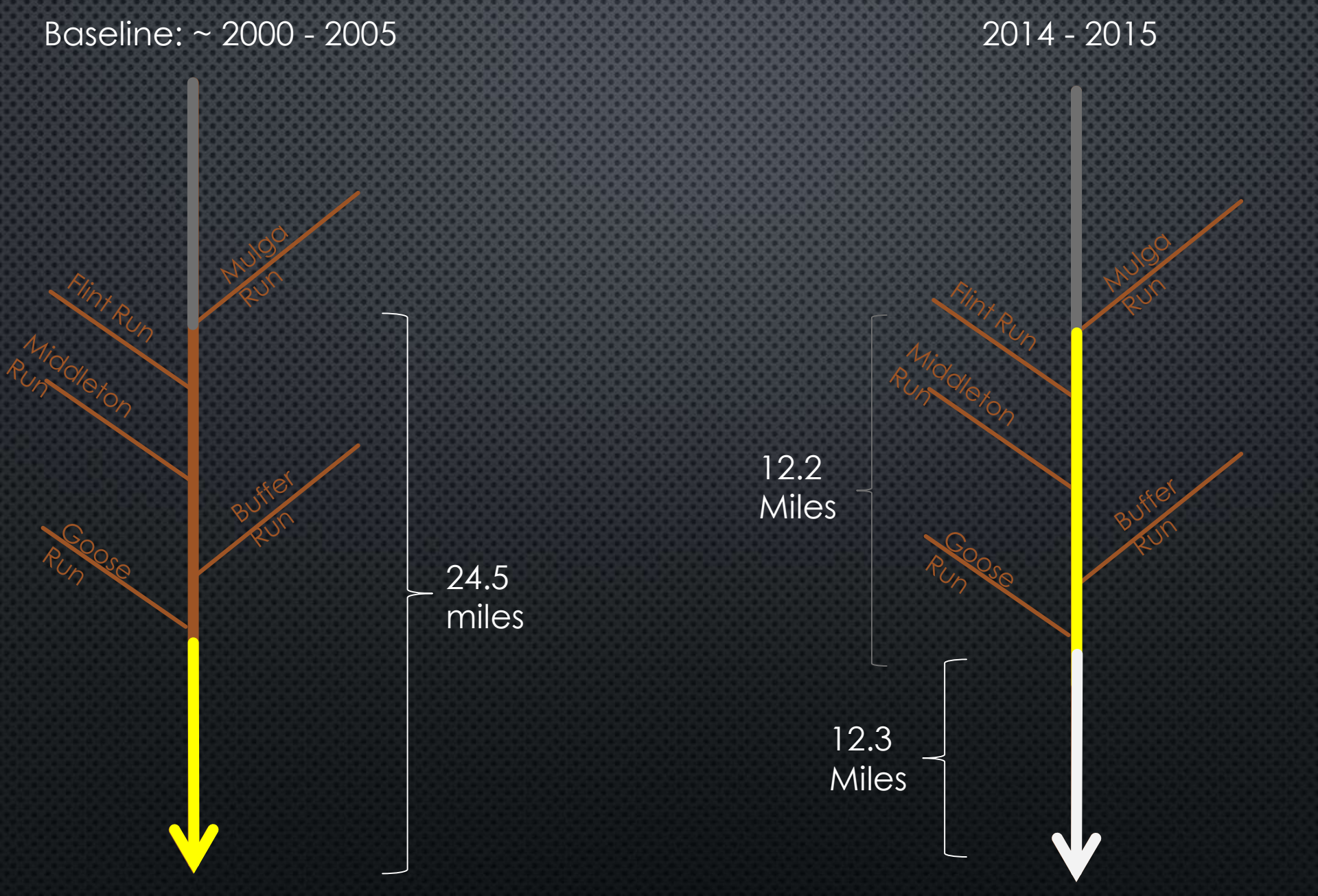
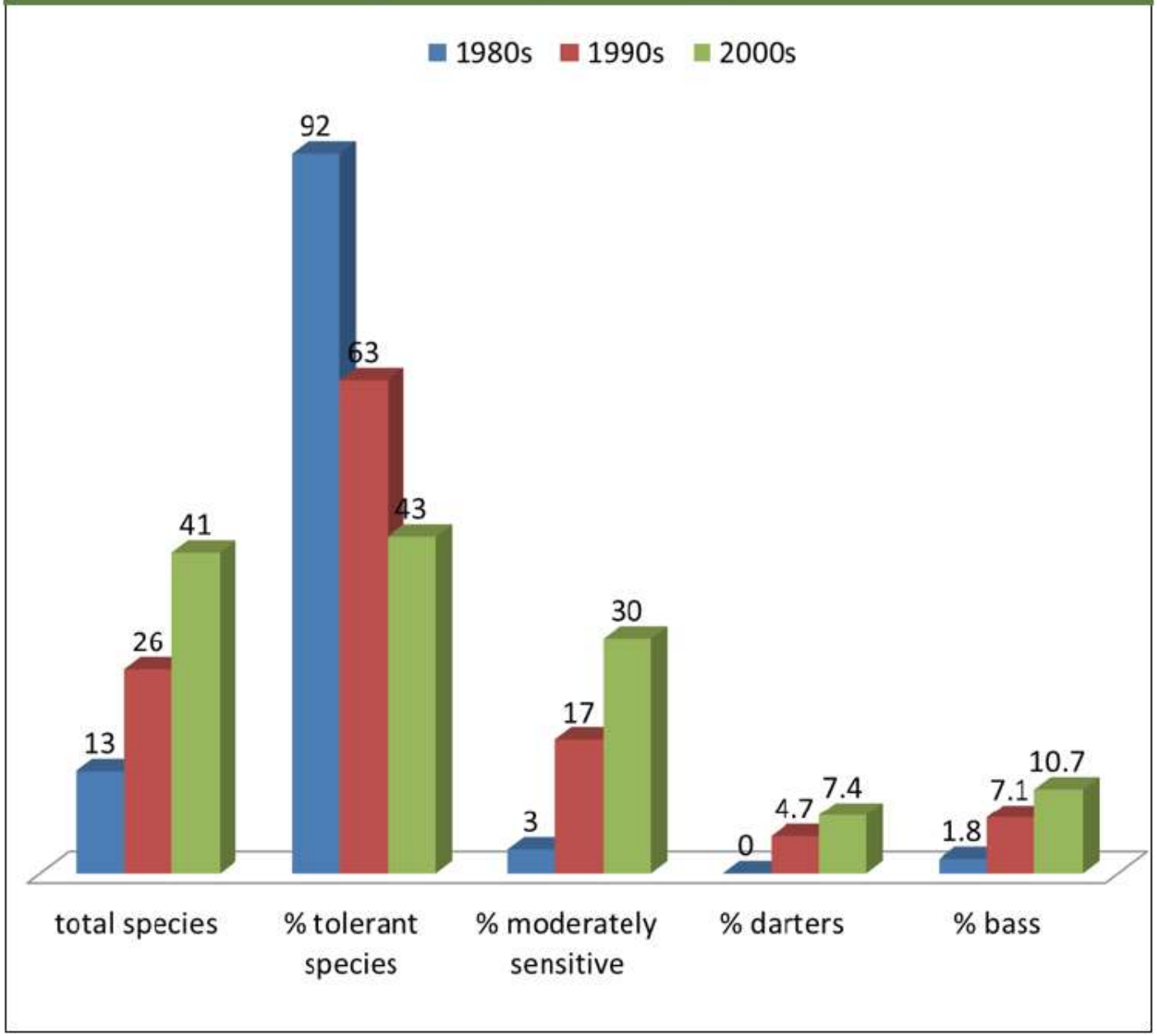


Figure 6: Little Raccoon Creek fish Community Recovery 1980s, 1990s, and 2000s.



AMD PROJECT COST & RECOVERY ANALYSIS

Categories	Leading Creek	Sunday Creek	Raccoon Creek	Huff Run	Monday Creek	Total	Average
No. of Projects	2	12	20	14	18	66	
Project Costs	$728,481	$2,618,273	$14,521,361	$5,308,353	$7,197,808	$30,374,276	
Acid Load Reduction (lbs/day)	661.00	352.00	4,267.00	1,129.00	4,360.00		2,153.80
Cost per lb of acid removed	$1,102	$7,438	$3,403	$4,702	$1,651		$3,659
Miles Improved*	7			6	21	34	
Miles Recovered	0	11.5	82	0	0	93.5	
Cost per mile improved	$104,069	NA	NA	$884,726	$342,753	NA	$443,849
Cost per mile recovered	NA	$227,676	$177,090	NA	NA	NA	$202,383
Cost per foot improved	$20	NA	NA	$144	$195	NA	$119
Cost per foot recovered	NA	$43	$34	NA	NA	NA	$38

** miles improved is estimated*

CHALLENGES

- Determining success and when stream has reached potential short term recovery
- Takes years or decades to see results in some cases. Pressure for immediate results.
- Long term O&M funding
- Difficult to leverage "other" sources of funding for O&M projects
- Other NPS issues may need to be addressed to achieve full potential recovery. Need multi-agency funding & support.
- Using AMD funds to assist with watershed management for "holistic" restoration work

Long Term Operation and Maintenance of Acid Mine Drainage Treatment Projects

March 29, 2017

Table 1. Results of AMD Project Operation and Maintenance Prioritization

Priority 1	Priority 2	Priority 3	Scheduled to be Abandoned at end of life cycle	Total # of Projects Prioritized
23	9	6	8	46

Table 2. Results of 30-Year O&M Cost Estimate Analysis for Priority AMD Projects

Total Cost Priority 1	Total Cost Priority 2	Total Cost Priority 3	Total Cost All priority projects	Average annual cost all priority projects	Average annual cost priority 1 projects only
$15,810,749	$2,553,033	$1,160,373	$19,524,155	$650,805	$527,025

Questions?

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