Anthracite Region Mine Drainage Remediation Strategy

To contact me after my presentation, text 84H to INTRO (46876)

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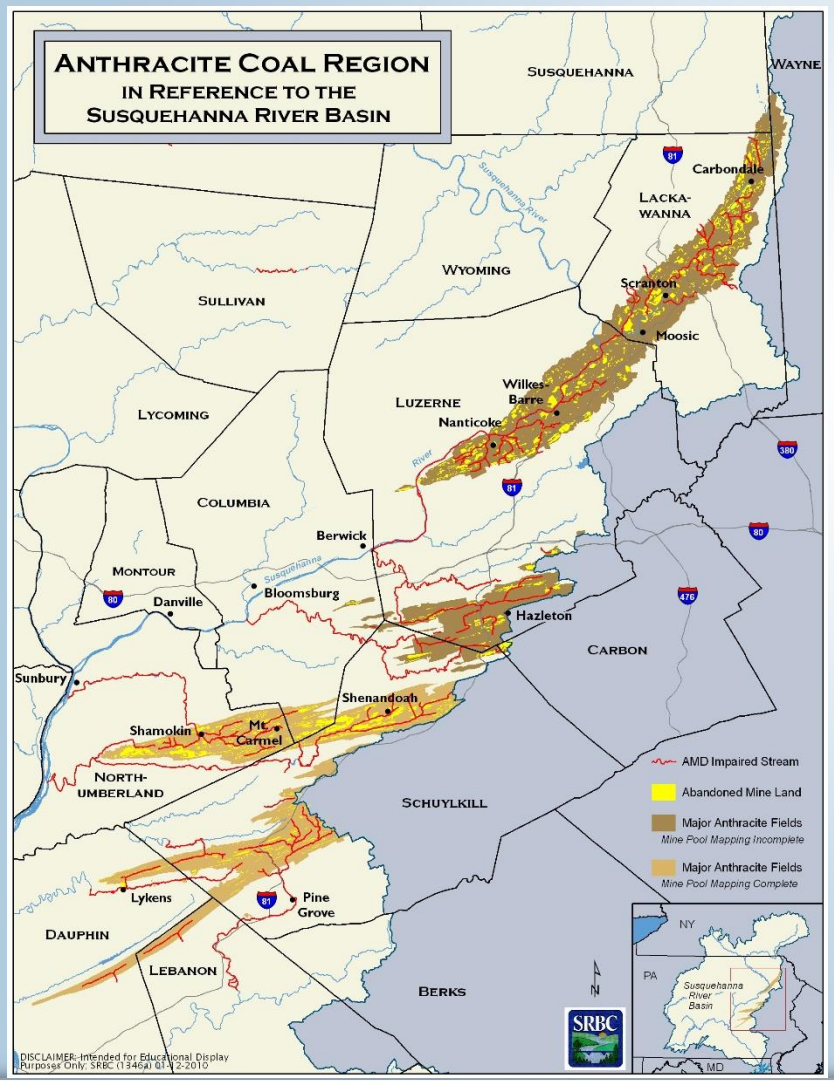
Susquehanna River Basin Commission

SRBC Past AMD Remediation Strategies

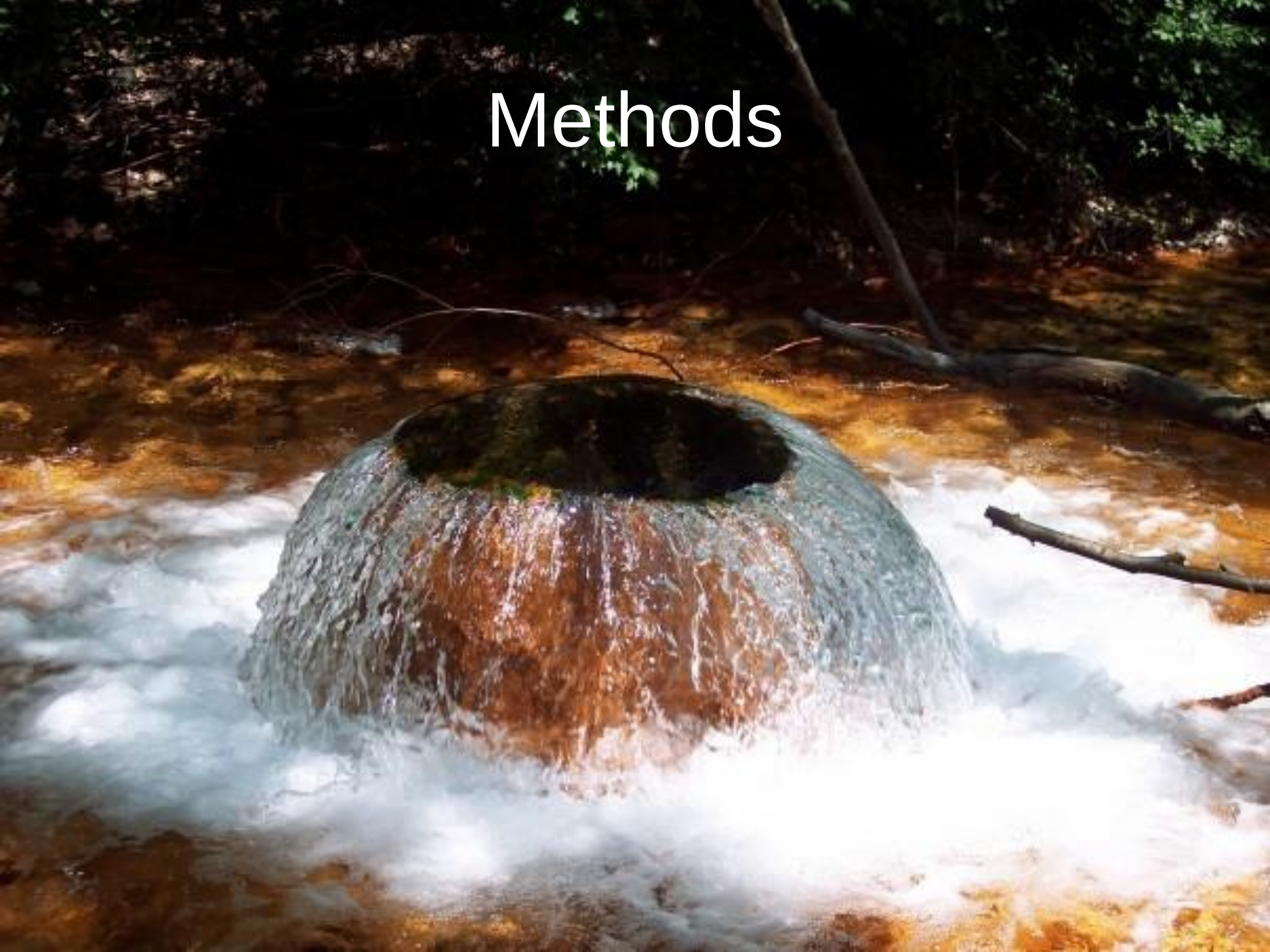
- Tioga River Watershed
  - Completed in 2003
  - Being utilized to plan remediation by a public/private partnership.
- West Branch Susquehanna River
  - Completed in 2008
  - Being utilized to plan remediation by the West Branch Task Force.
- Anthracite Coal Fields
  - Completed in 2011
  - Will be used to plan remediation and investigate sites that offer low-flow augmentation water.
- Broadtop Fields/Altoona Bituminous
  - Future Plan?

Susquehanna Basin Anthracite Fields



- **Northern Field**
  - 226.5 mi^2
  - Lackawanna River
  - Small Susquehanna River Tribs
- **Eastern Field**
  - 77.3 mi^2
  - Nescopeck Creek
  - Catawissa Creek
- **Western Field**
  - 114.2 mi^2
  - Shamokin Creek
  - Mahanoy Creek
- **Southern Field**
  - 98.6 mi^2
  - Mahantango Creek
  - Wiconisco Creek
  - Stony Creek
  - Swatara Creek

Methods



Anthracite Remediation Strategy

- Historical stream and discharge water quality and flow database. **No new water quality collected.**
- Incorporated into a Geo Database
- Geo Database Layers
  - AML Sites (PI, PII, PIII)
  - AMD Impaired Stream Reaches
  - Mining Permits
  - Mined Area Extent
  - Class A/Wild Trout
  - HQ/EV
  - Land Use

Sample Data Entered

- All TMDLs
- All known USGS studies
- All SRBC data
- Several known/found watershed assessments
- Select Scarlift data
- Select DEP SIS Database and NPDES permits

Data Collected

Description Data

Site Number – Primary Key (NFD001)
Type – Instream/Discharge
Field
Watershed
Stream
Site Name
Site Description
Mine Description
Latitude
Longitude
Begin Date
End Date
Data Source
Elevation

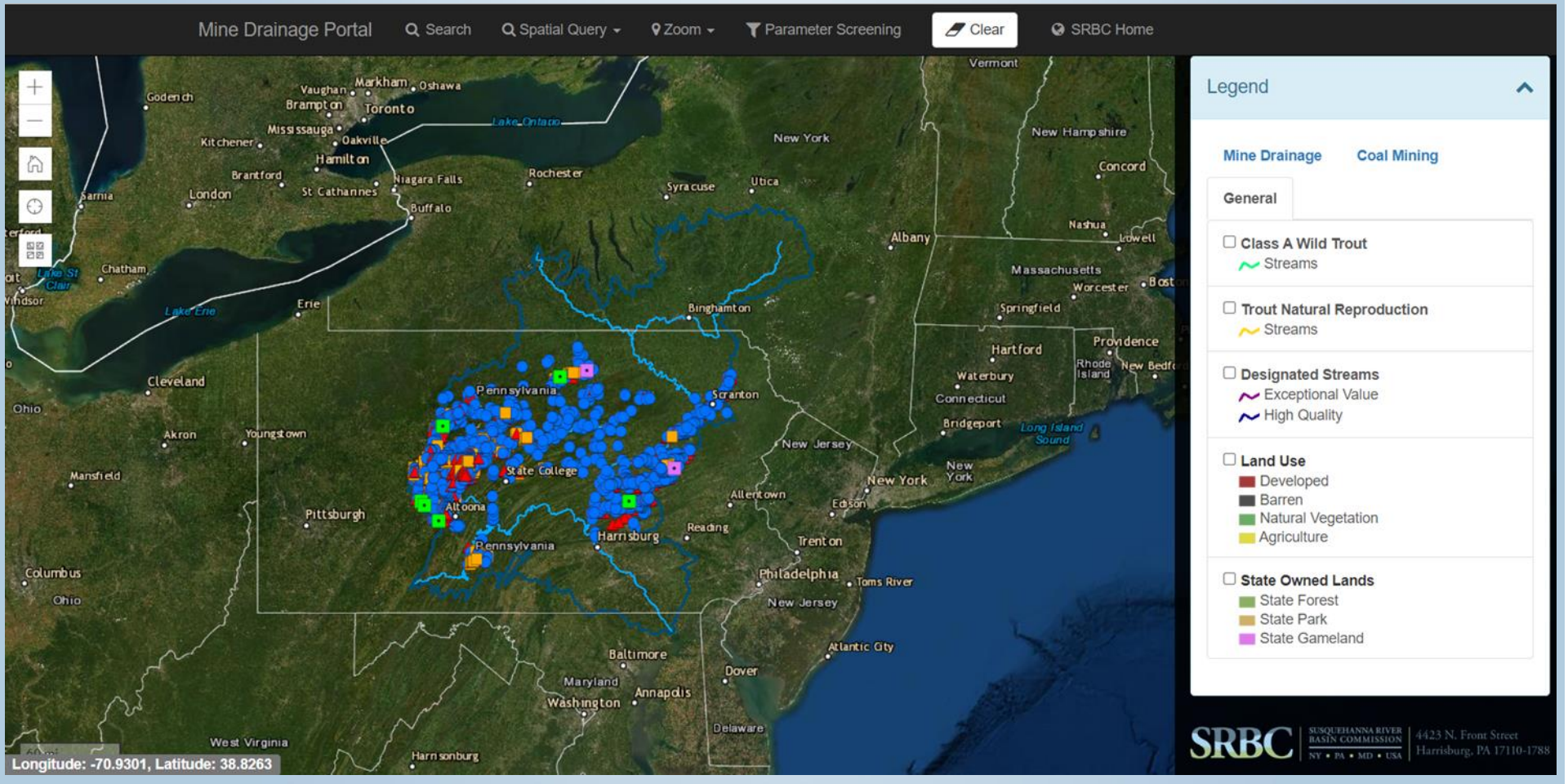
Min/Ave/Max

Discharge
Water Temp
Spec Cond
Field pH
Lab pH
DO
SO_4
Fe (Total, Fer., Dis.)
Mn (Total, Dis.)
Al (Total, Dis.)
Alkalinity
Acidity
TSS
TDS

Current Sample Station Coverage

	Stream Stations	Stream Samples	Discharge Stations	Discharge Samples	Total Stations	Total Samples
Northern	123	1,341	52	934	175	2,275
Eastern	59	820	20	912	79	1,732
Western	110	2,448	149	3,623	259	6,071
Southern	107	4,471	125	3,112	232	7,583
Total	**399**	**9,080**	**346**	**8,581**	**745**	**17,661**

SRBC Mine Drainage Data Portal



www.srbc.net/minedrainageportal/Map

Coal Field Comparisons

Coal Field Impairment Analysis

Field	Within Susquehanna	AMD Impairment	Total AMLs	PI AMLs	PII AMLs	PIII AMLs	Undetermined Priority	Undetermined Priority
	mi^2	miles	Mi^2	mi^2	mi^2	mi^2	mi^2	%
Northern	226.48	154.71	31.14	0.36	10.21	5.44	15.13	48.59
Eastern-Middle	77.34	120.74	6.15	0.21	1.52	1.52	2.90	47.15
Western-Middle	114.22	141.30	21.89	0.54	5.38	3.19	12.78	58.38
Southern	98.61	117.00	4.63	0.00	1.94	0.58	2.11	45.57
Total	516.65	533.75	63.81	1.11	19.05	10.73	32.92	51.59

- AMD impaired stream miles are comparable between the four fields. 22% in the Southern and 29% in the Northern.
- 83% of the AMLs are found in the Northern and Western-Middle.
- 32.92 mi^2 of AMLs currently unprioritized. This is 52% of all Susquehanna River Anthracite AMLs

Coal Field Impairment Analysis Cont.

Field	Discharges	Flow	Fe Loading	Mn Loading	Al Loading	Acid Loading
	#	CFS	Lbs/day	Lbs/day	Lbs/day	Lbs/day
Northern	51	251.97	41343.81	5002.66	622.75	53495.57
Eastern-Middle	20	127.49	3005.11	2500.66	6016.43	54664.67
Western-Middle	128	211.80	23995.90	4726.40	1741.92	61576.76
Southern	121	72.33	5501.94	698.49	583.60	19707.30
Total	320	663.59	73846.76	12928.21	8964.70	189444.30
Field	Discharge Yield	Flow Yield	Fe Loading Yield	Mn Loading Yield	Al Loading Yield	Acid Loading Yield
	#/mi^2	CFS/mi^2	Lbs/day/mi^2	Lbs/day/mi^2	Lbs/day/mi^2	Lbs/day/mi^2
Northern	0.23	1.11	182.55	22.09	2.75	236.20
Eastern-Middle	0.26	1.65	38.86	32.33	77.79	706.81
Western-Middle	1.12	1.85	210.08	41.38	15.25	539.11
Southern	1.23	0.73	55.79	7.08	5.92	199.85
Total	0.62	1.28	142.93	25.02	17.35	366.68

- The Northern and Western-Middle create a majority of the Fe, Mn, and acidity loading.
- The Eastern-Middle creates a majority of the Al loading and significant acidity loading.
- The Southern Field is the least pervasive of the four fields in terms of AMD loading.

Watershed Comparisons

Watershed Impairment Analysis

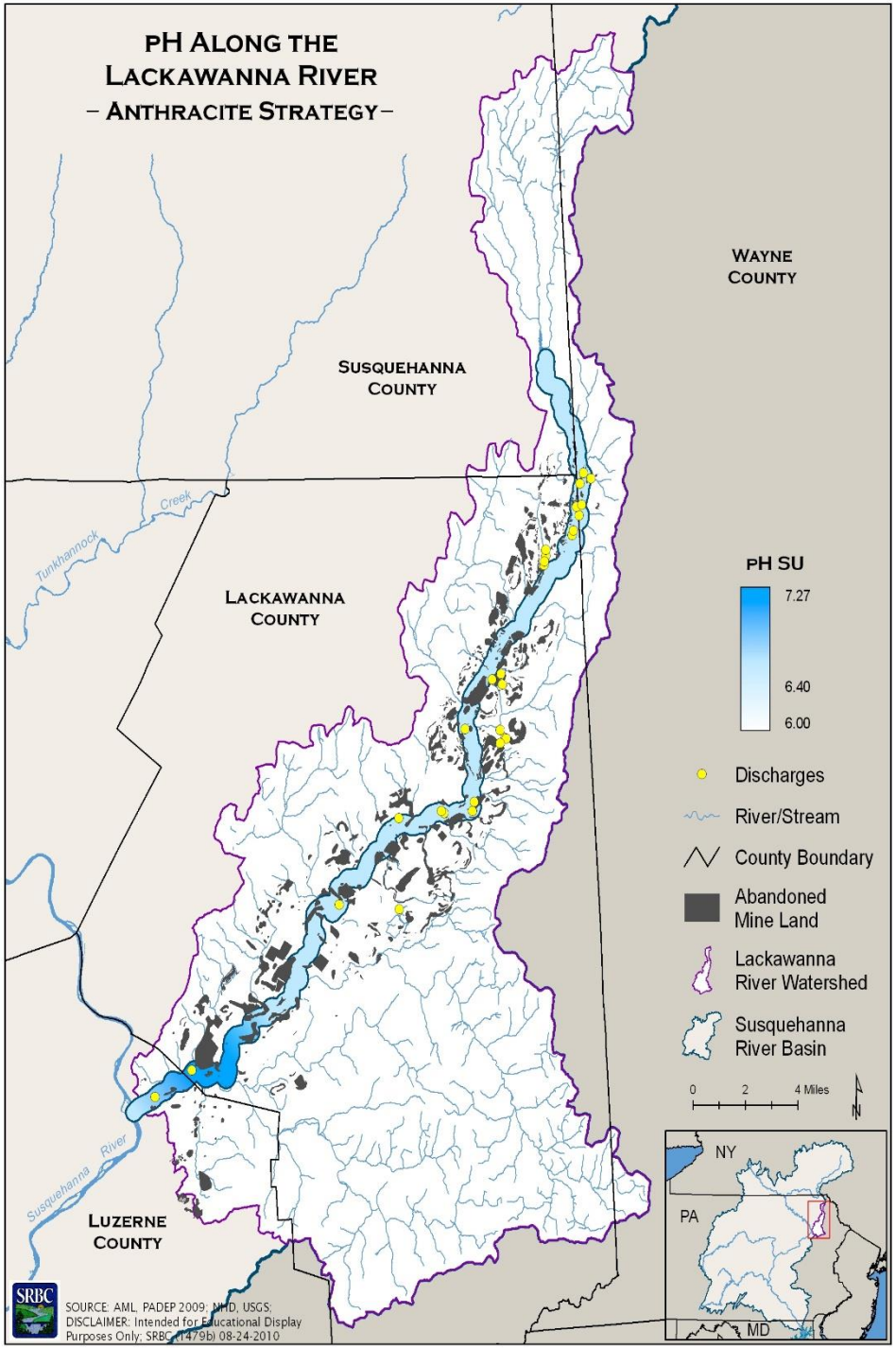
Watershed	Area in Field	AMD Impairment	Total AMLs	PI AMLs	PII AMLs	PIII AMLs	Undetermined Priority
	mi^2	miles	mi^2	mi^2	mi^2	mi^2	mi^2
Lackawanna River	126.64	73.93	17.46	0.12	6.01	3.66	7.67
Susquehanna River-Northern Field	99.84	80.78	13.68	0.24	4.20	1.78	7.46
Nescopeck Creek	51.57	64.43	3.90	0.05	1.04	1.39	1.42
Catawissa Creek	25.77	56.13	2.37	0.20	0.50	0.13	1.54
Shamokin Creek	49.66	60.95	8.29	0.14	1.88	1.23	5.04
Mahanoy Creek	57.09	80.18	13.28	0.37	3.44	1.91	7.56
Mahantango Creek	19.57	16.87	0.80	0.00	0.28	0.14	0.38
Wiconisco Creek	14.78	26.60	1.21	0.00	0.40	0.01	0.80
Stoney Creek	11.09	13.58	0.001	0.00	0.00	0.00	0.001
Swatara Creek	43.21	60.00	2.69	0.00	1.26	0.44	0.99

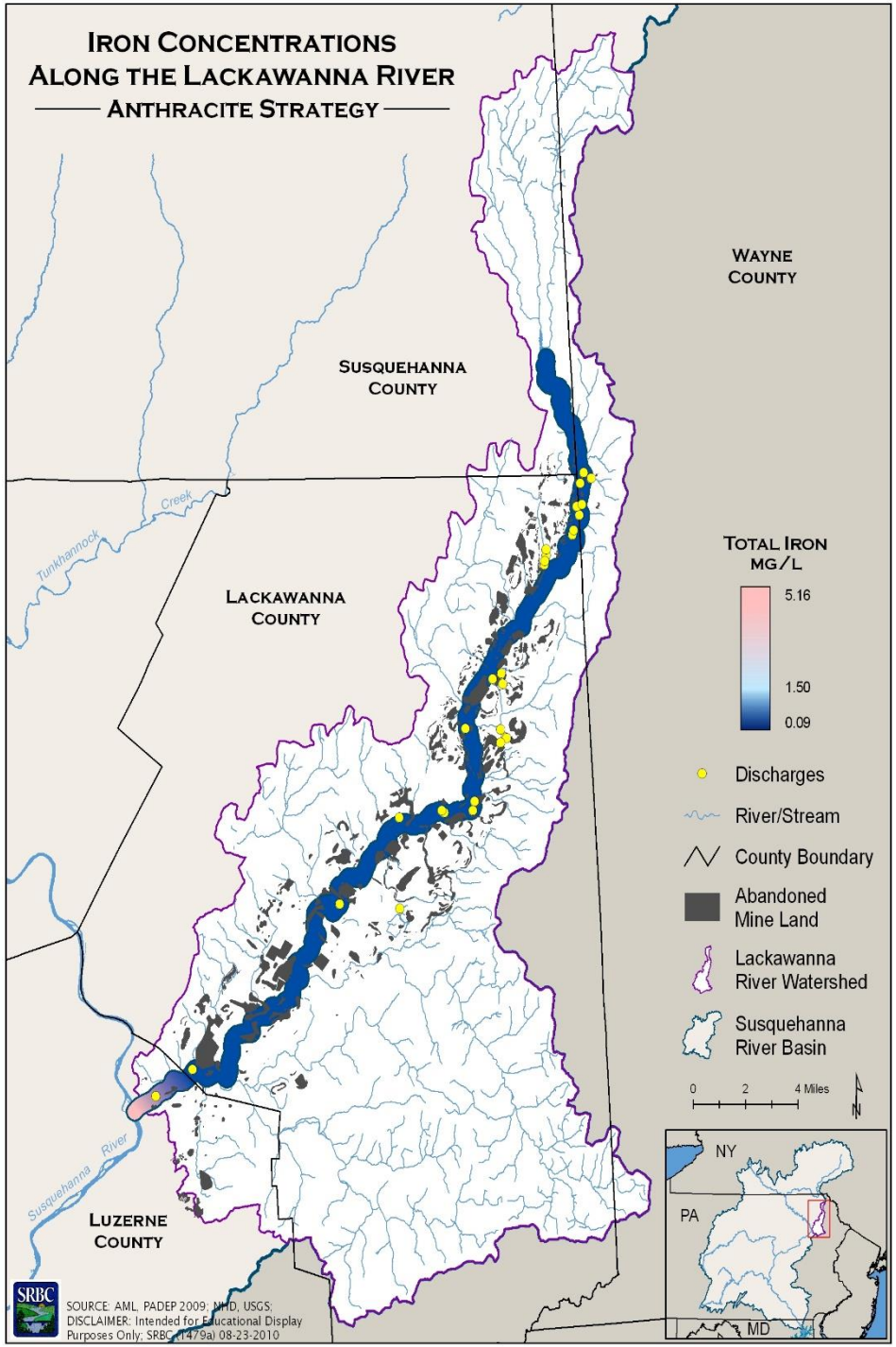
- AMD mileage fairly comparable between seven of the ten watersheds. Wiconisco Creek, Mahantango Creek, and Stoney Creek are the exceptions.
- 83% of AMLs are found in only four watersheds; Lackawanna River, Susquehanna River-Northern Field, Mahanoy Creek, and Shamokin Creek.
- Undetermined Prioirty AMLs are the highest in those same four watersheds.

Watershed Impairment Analysis Cont.

Watershed	Discharges	Flow	Fe Loading	Mn Loading	Al Loading	Acid Loading
	#	CFS	Lbs/day	Lbs/day	Lbs/day	Lbs/day
Lackawanna River	30	147.12	18285.08	2574.93	251.55	8334.24
Susquehanna River-Northern Field	21	104.85	23058.73	2427.74	371.19	45161.30
Nescopeck Creek	12	95.94	2781.84	2200.66	5051.74	35967.51
Catawissa Creek	8	31.55	223.27	300.00	964.70	18697.17
Shamokin Creek	67	79.63	10670.58	1396.27	657.17	26176.75
Mahanoy Creek	61	132.18	13325.32	3330.12	1084.76	35400.02
Mahantango Creek	23	16.75	1616.22	232.48	176.56	8690.85
Wiconisco Creek	12	11.09	1277.33	116.10	201.03	3847.48
Stoney Creek	3	5.68	1.16	8.48	0.00	326.45
Swatara Creek	83	38.80	2607.23	341.43	206.00	6842.53

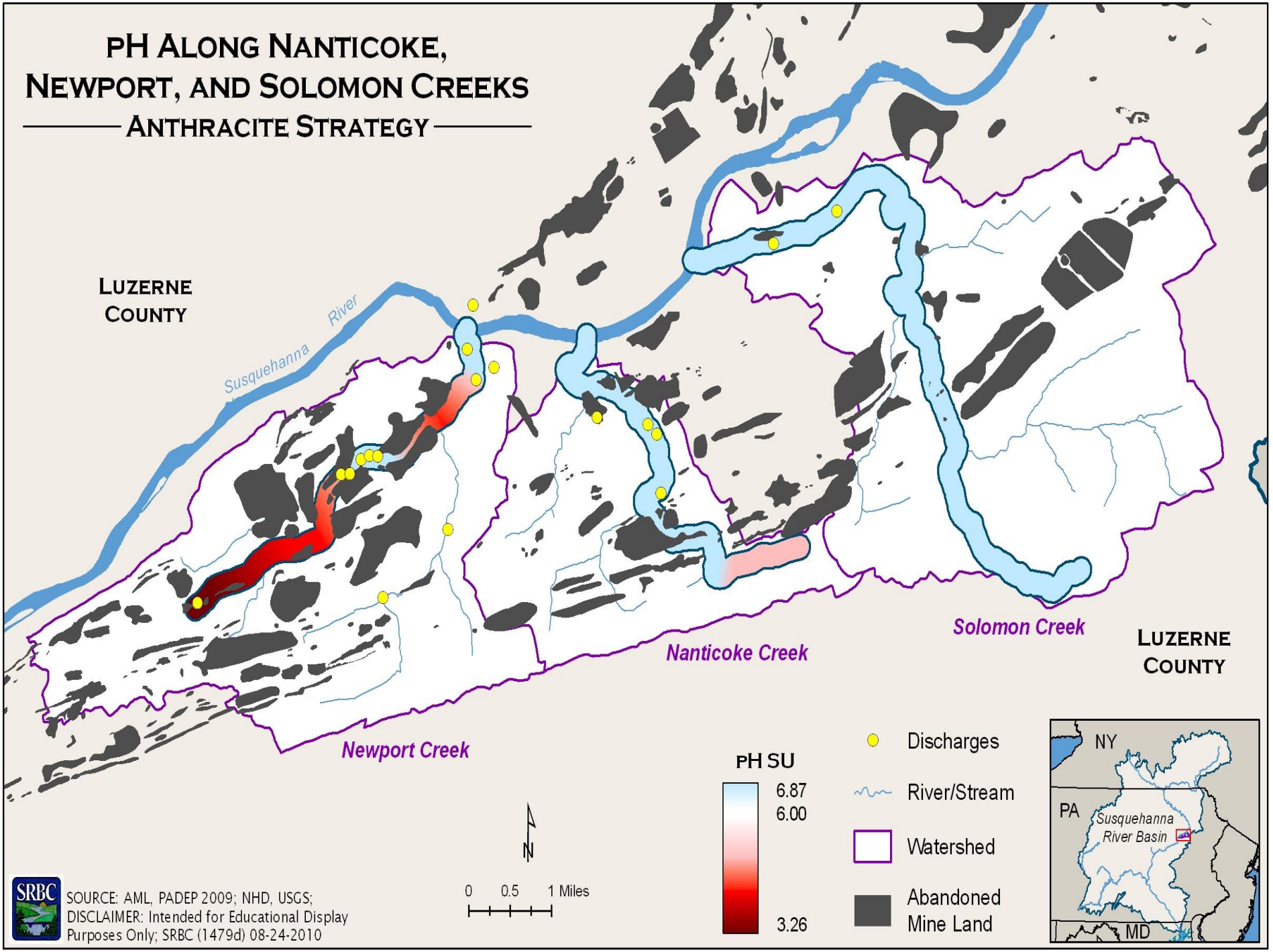
- 56.6% Discharge Flow – Lackawanna, Mahanoy, Nescopeck
- 74.1% Fe Loading – Lackawanna, Mahanoy, Solomon, Shamokin
- 83.5% Mn Loading – Mahanoy, Lackawanna, Nescopeck, Shamokin, Solomon
- 56.4% Al Loading – Nescopeck (79.3% if Mahanoy and Catawissa are included)
- 63.2% Acid Loading – Nescopeck, Mahanoy, Shamokin, Solomon


pH Along the
Lackawanna River
– Anthracite Strategy –
Wayne
County
Susquehanna
County
Lackawanna
County
Luzerne
County
Tunkhannock
Creek
Susquehanna
River
pH SU
7.27
6.40
6.00
Discharges
River/Stream
County Boundary
Abandoned
Mine Land
Lackawanna
River Watershed
Susquehanna
River Basin
0
2
4 Miles
N
NY
PA
MD
SRBC
SOURCE: AML, PADEP 2009; NHD, USGS;
DISCLAIMER: Intended for Educational Display
Purposes Only; SRBC (1479b) 08-24-2010


Iron Concentrations
Along the Lackawanna River
Anthracite Strategy
Wayne
County
Susquehanna
County
Lackawanna
County
Luzerne
County
Tunkhannock
Creek
Susquehanna
River
Total Iron
mg/L
5.16
1.50
0.09
Discharges
River/Stream
County Boundary
Abandoned
Mine Land
Lackawanna
River Watershed
Susquehanna
River Basin
0
2
4 Miles
N
NY
PA
MD
SRBC
SOURCE: AML, PADEP 2009; NHD, USGS;
DISCLAIMER: Intended for Educational Display
Purposes Only; SRBC (1479a) 08-23-2010

pH Along Nanticoke, Newport, and Solomon Creeks

Anthracite Strategy



SRBC

SOURCE: AML, PADEP 2009; NHD, USGS;
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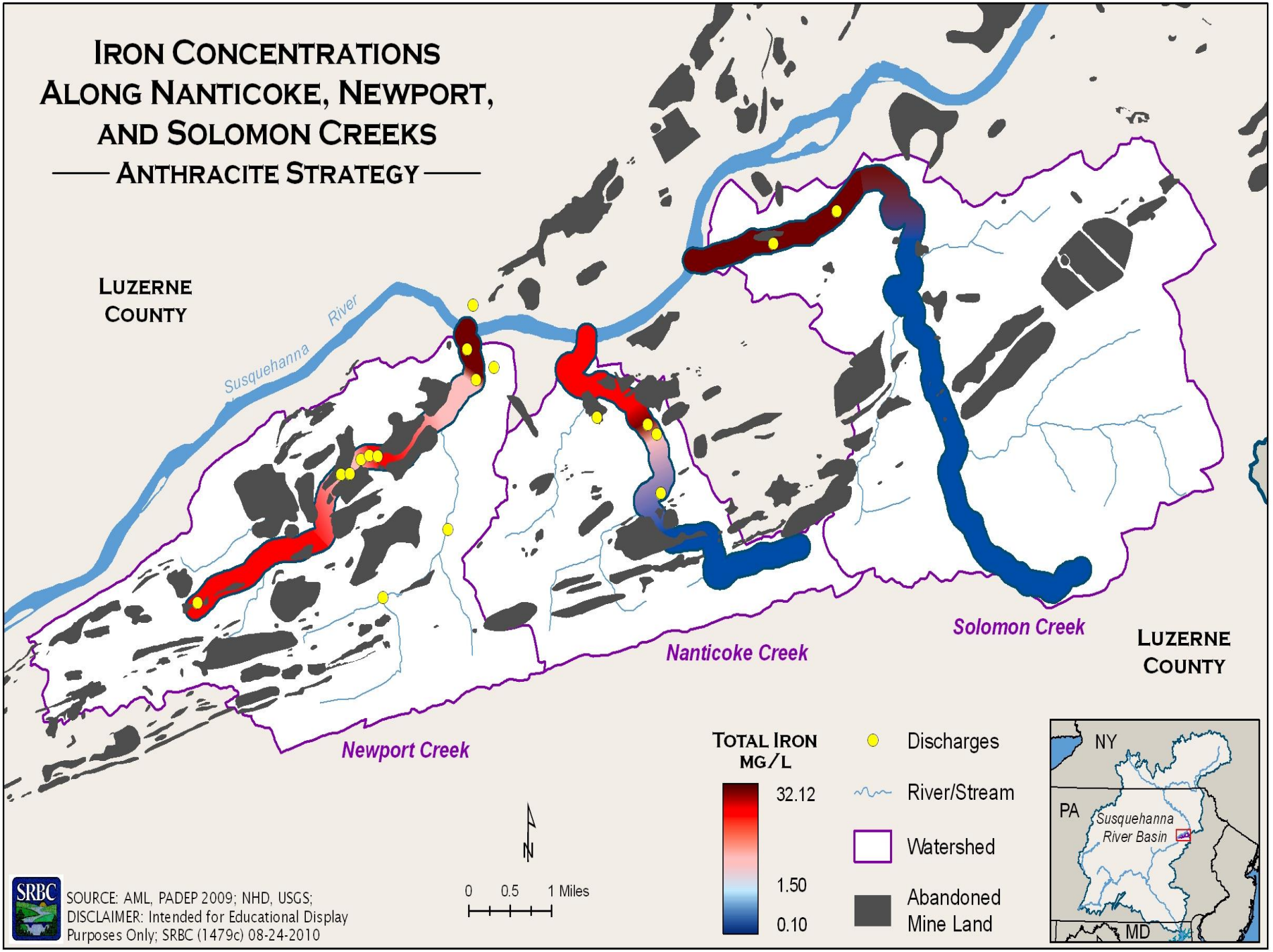
Iron Concentrations Along Nanticoke, Newport, and Solomon Creeks

— Anthracite Strategy —



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SOURCE: AML, PADEP 2009; NHD, USGS;
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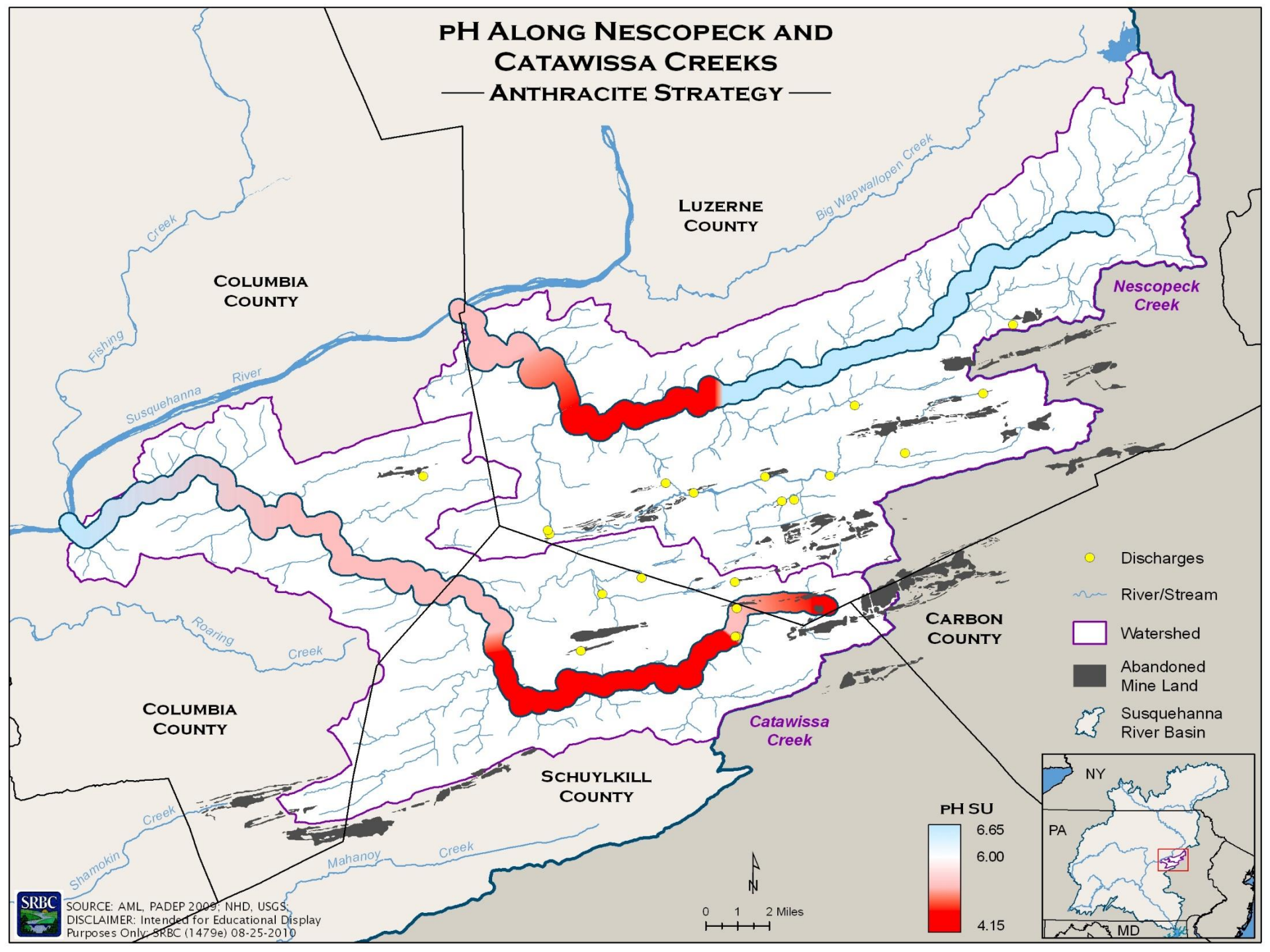
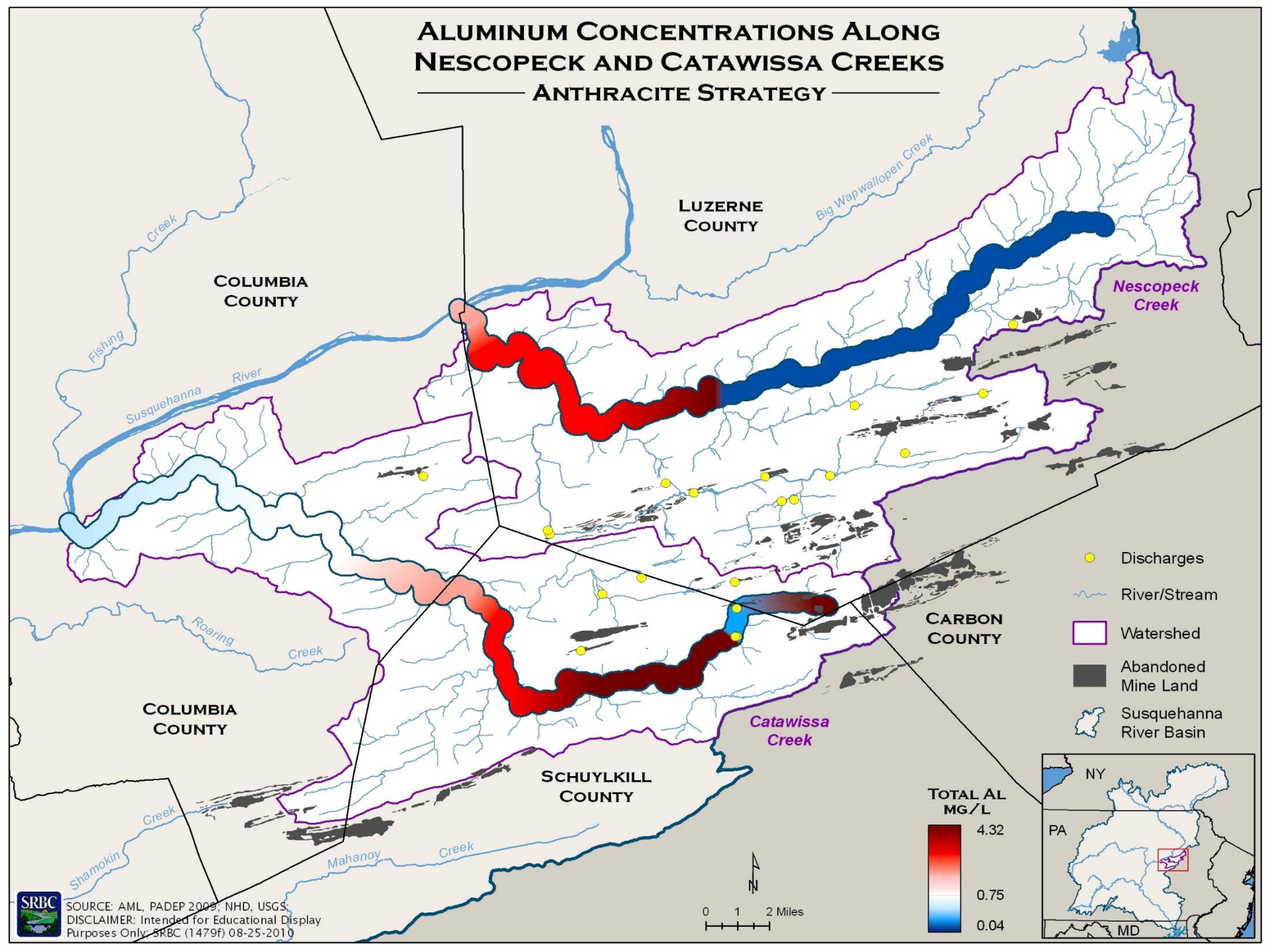
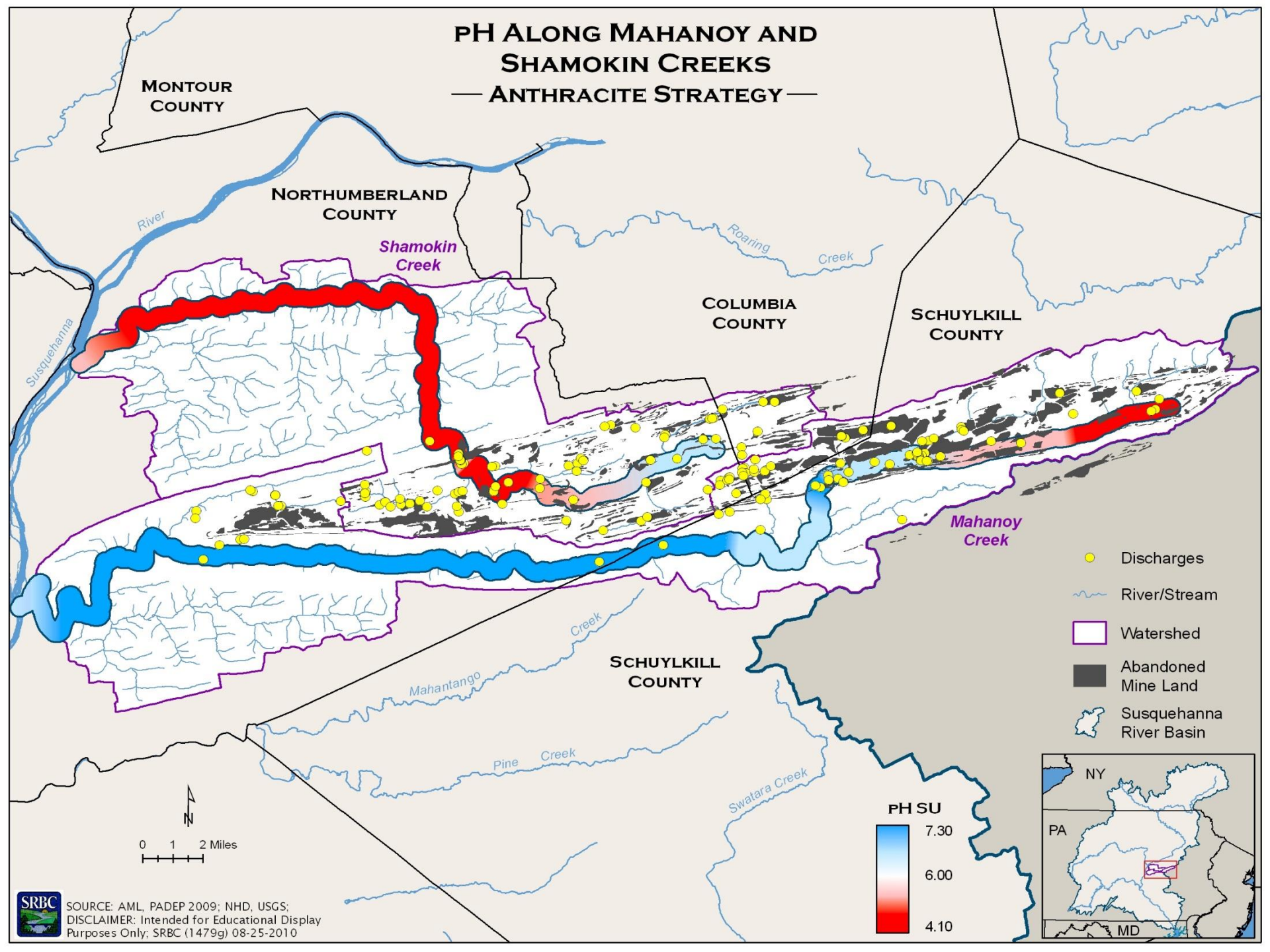
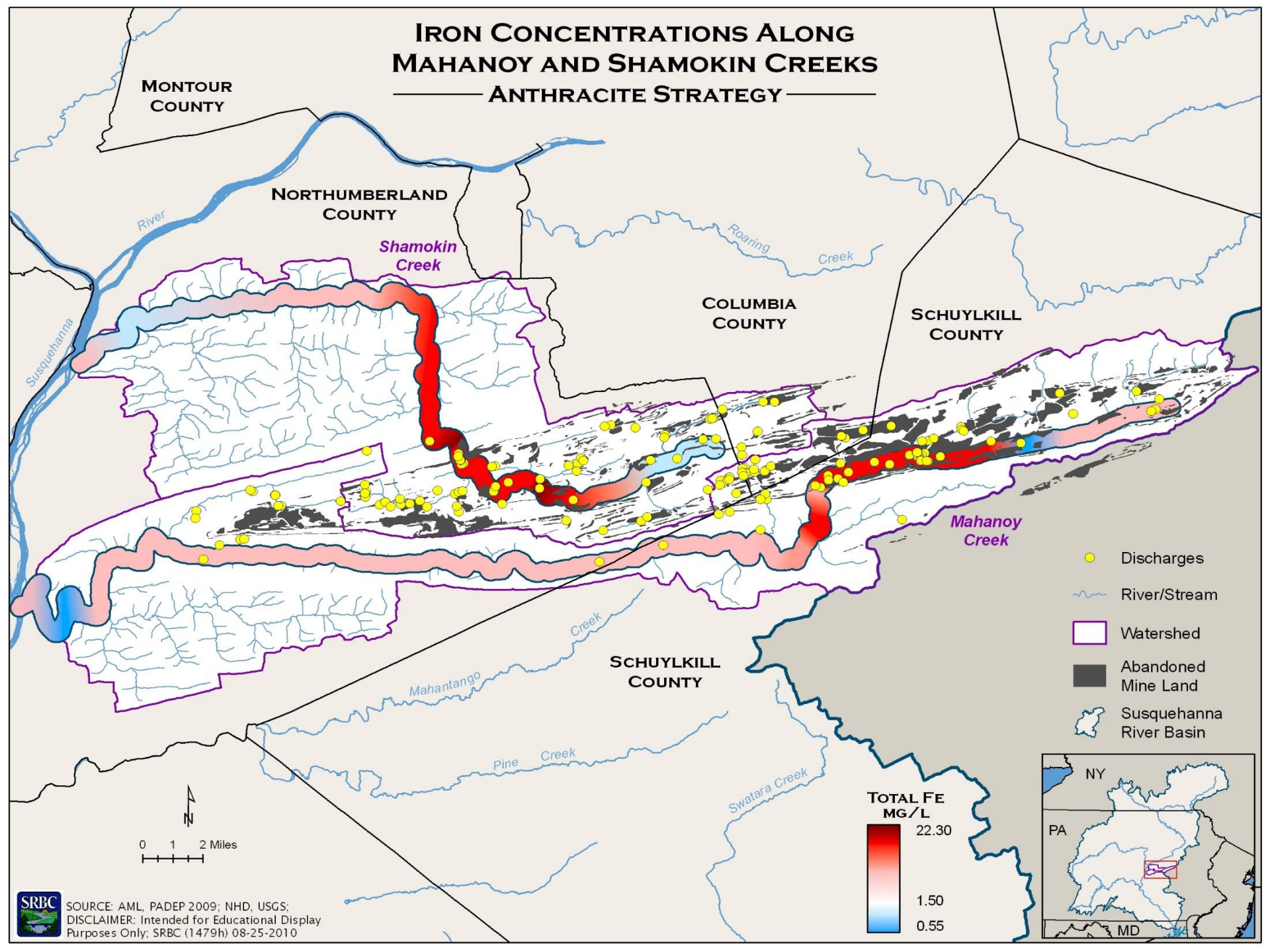

pH Along Nescopeck and Catawissa Creeks
Anthracite Strategy
Luzerne County
Columbia County
Carbon County
Schuylkill County
Columbia County
Big Wapwallopen Creek
Creek
Fishing
Susquehanna River
Roaring Creek
Shamokin Creek
Mahanoy Creek
Nescopeck Creek
Catawissa Creek
Discharges
River/Stream
Watershed
Abandoned Mine Land
Susquehanna River Basin
pH SU
6.65
6.00
4.15
N
0 1 2 Miles
NY
PA
MD
SRBC
SOURCE: AML, PADEP 2009; NHD, USGS;
DISCLAIMER: Intended for Educational Display Purposes Only; SRBC (1479e) 08-25-2010


Aluminum Concentrations Along
Nescopeck and Catawissa Creeks
Anthracite Strategy
Luzerne County
Columbia County
Columbia County
Schuylkill County
Carbon County
Big Wapwallopen Creek
Fishing Creek
Susquehanna River
Roaring Creek
Shamokin Creek
Mahanoy Creek
Nescopeck Creek
Catawissa Creek
Discharges
River/Stream
Watershed
Abandoned Mine Land
Susquehanna River Basin
Total Al mg/L
4.32
0.75
0.04
N
0 1 2 Miles
NY
PA
MD
SRBC
SOURCE: AML, PADEP 2009; NHD, USGS;
DISCLAIMER: Intended for Educational Display Purposes Only; SRBC (1479f) 08-25-2010


pH Along Mahanoy and Shamokin Creeks
— Anthracite Strategy —
Montour County
Northumberland County
Columbia County
Schuylkill County
Schuylkill County
Susquehanna River
Shamokin Creek
Roaring Creek
Mahanoy Creek
Mahantango Creek
Pine Creek
Swatara Creek
Discharges
River/Stream
Watershed
Abandoned Mine Land
Susquehanna River Basin
pH SU
7.30
6.00
4.10
N
0 1 2 Miles
NY
PA
MD
SRBC
SOURCE: AML, PADEP 2009; NHD, USGS;
DISCLAIMER: Intended for Educational Display Purposes Only; SRBC (1479g) 08-25-2010


Iron Concentrations Along
Mahanoy and Shamokin Creeks
Anthracite Strategy
Montour County
Northumberland County
Columbia County
Schuylkill County
Schuylkill County
Shamokin Creek
Mahanoy Creek
Susquehanna River
Roaring Creek
Mahantango Creek
Pine Creek
Swatara Creek
Discharges
River/Stream
Watershed
Abandoned Mine Land
Susquehanna River Basin
Total Fe mg/L
22.30
1.50
0.55
NY
PA
MD
N
0 1 2 Miles
SRBC
SOURCE: AML, PADEP 2009; NHD, USGS;
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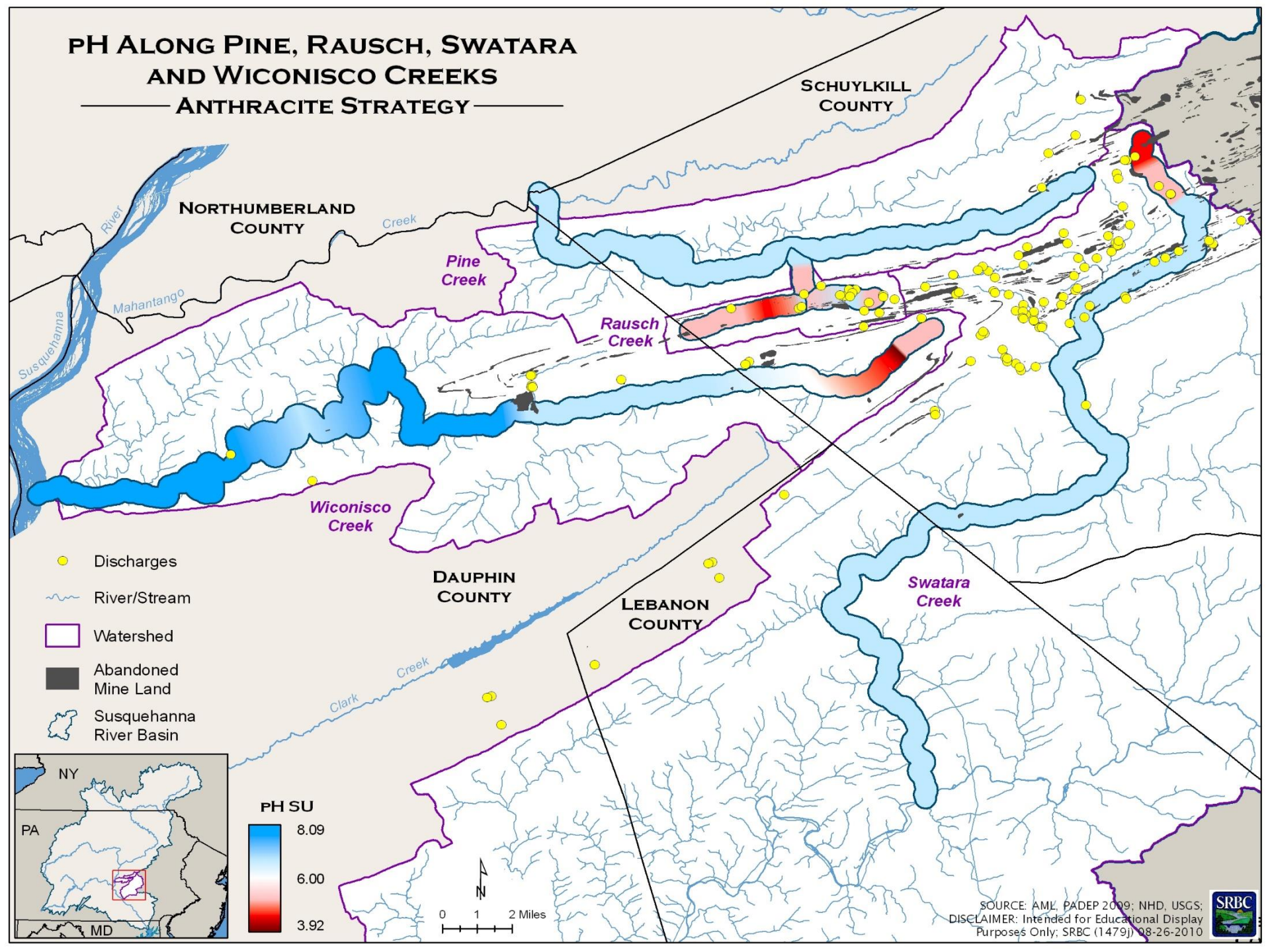
pH Along Pine, Rausch, Swatara and Wiconisco Creeks
Anthracite Strategy
Schuylkill County
Northumberland County
Dauphin County
Lebanon County
Susquehanna River
Mahantango Creek
Pine Creek
Rausch Creek
Wiconisco Creek
Swatara Creek
Clark Creek
Discharges
River/Stream
Watershed
Abandoned Mine Land
Susquehanna River Basin
NY
PA
MD
pH SU
8.09
6.00
3.92
N
0 1 2 Miles
SOURCE: AML, PADEP 2009; NHD, USGS;
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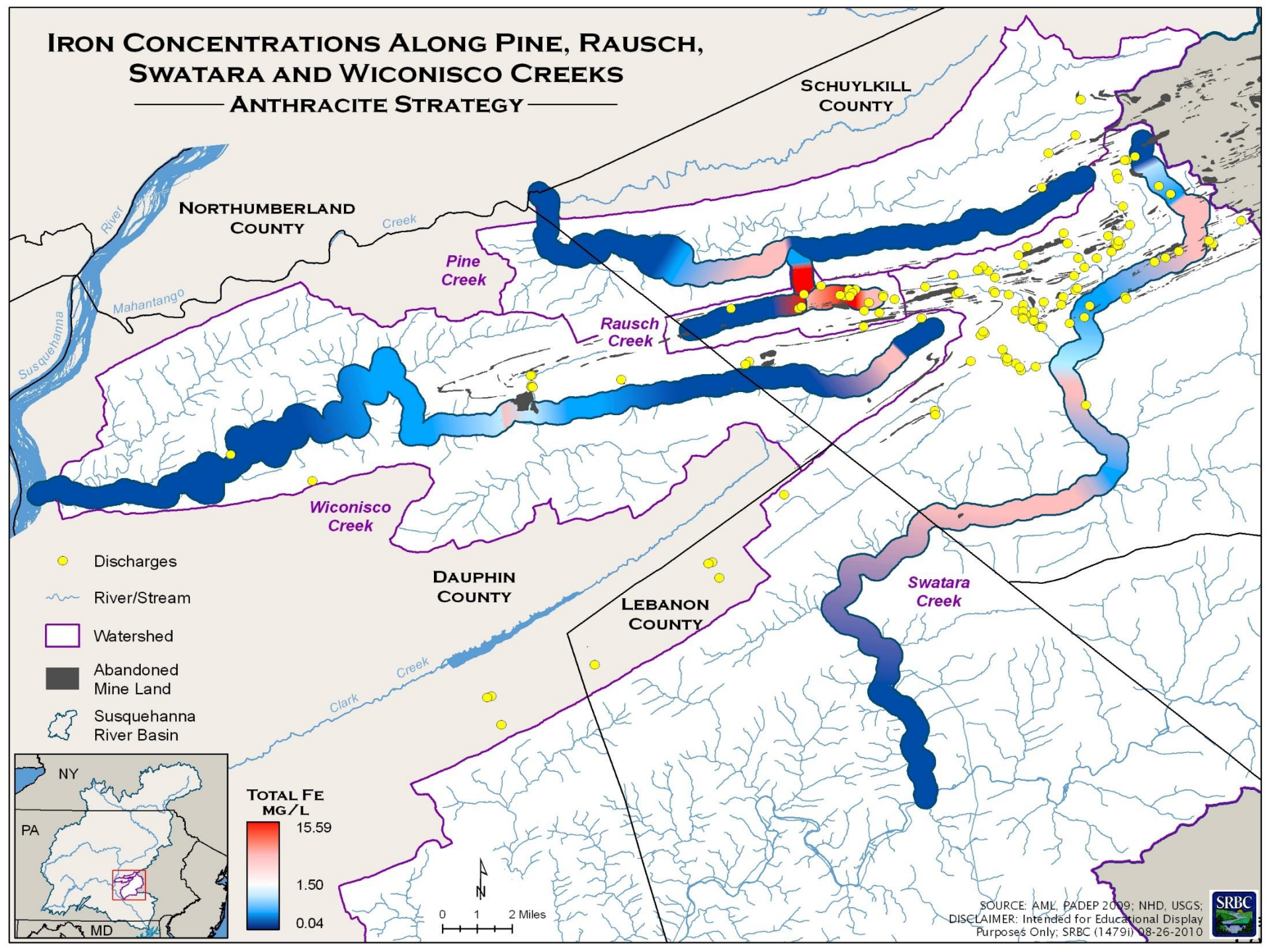
SRBC


Iron Concentrations Along Pine, Rausch, Swatara and Wiconisco Creeks
Anthracite Strategy
Schuylkill County
Northumberland County
Dauphin County
Lebanon County
Susquehanna River
Mahantango Creek
Pine Creek
Rausch Creek
Wiconisco Creek
Swatara Creek
Clark Creek
Discharges
River/Stream
Watershed
Abandoned Mine Land
Susquehanna River Basin
NY
PA
MD
Total Fe mg/L
15.59
1.50
0.04
N
0 1 2 Miles
SOURCE: AML, PADEP 2009; NHD, USGS;
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SRBC

Restoration Effort Focus?

"By concentrating restoration efforts on only two watersheds, Lackawanna River and Nescopeck Creek, 42.1 percent of the iron loading, 43.8 percent of the manganese loading, 52.2 percent of the aluminum loading, and 58.3 percent of the acidity loading currently entering the Susquehanna River proper from the Anthracite Region would be eliminated."

Top 10 Discharge Analysis

Top-10 Flow (CFS) Discharges

Ranking	Discharge - CFS	% Discharge Total	Watershed	Mine Discharge
1	75.95	11.45	Lackawanna River	Old Forge Borehole
2	64.89	9.78	Nescopeck Creek	Jeddo Tunnel
3	31.21	4.70	Solomon Creek	Solomon Creek Boreholes
4	30.51	4.60	Solomon Creek	Nottingham-Buttonwood Airshaft
5	27.66	4.17	Lackawanna River	Duryea Breach
6	20.19	3.04	Mahanoy Creek	Packer #5 Breach and Borehole
7	19.94	3.00	Nescopeck Creek	Gowen Tunnel
8	19.93	3.00	Catawissa Creek	Audenreid Tunnel
9	18.06	2.72	Lackawanna River	Jermyn Slope
10	14.47	2.18	Mahanoy Creek	Gilberton Pump
Top Ten Total	322.81			
All Discharges	663.59			
% Discharge Total	48.65			

Top-10 Fe Loading (lbs/day) Discharges

Ranking	Fe Loading	% Loading Total	Watershed	Mine Discharge
1	12393.02	16.78	Lackawanna River	Old Forge Borehole
2	6700.92	9.07	Solomon Creek	Solomon Creek Boreholes
3	5798.45	7.85	Solomon Creek	Nottingham-Buttonwood Airshaft
4	5464.45	7.40	Lackawanna River	Duryea Breach
5	3435.41	4.65	Mahanoy Creek	Gilberton Pump
6	3319.93	4.50	Nanticoke Creek	Dundee Outfall
7	2746.11	3.72	Mahanoy Creek	Packer #5 Breach and Borehole
8	2544.26	3.45	Nescopeck Creek	Jeddo Tunnel
9	2434.14	3.30	Newport Creek	Susquehanna #7 Shaft
10	1778.10	2.41	Susquehanna River	Plainsville Outlet
Top Ten Total	46614.79			
All Discharges	73846.76			
% Loading Total	63.12			

Top-10 Mn Loading (lbs/day) Discharges

Ranking	Mn Loading	% Loading Total	Watershed	Mine Discharge
1	1726.76	13.36	Lackawanna River	Old Forge Borehole
2	1461.01	11.30	Nescopeck Creek	Jeddo Tunnel
3	785.01	6.07	Mahanoy Creek	Packer #5 Breach and Borehole
4	739.48	5.72	Lackawanna River	Duryea Breach
5	674.81	5.22	Solomon Creek	Nottingham-Buttonwood Airshaft
6	660.77	5.11	Mahanoy Creek	Gilberton Pump
7	616.21	4.77	Solomon Creek	Solomon Creek Boreholes
8	582.27	4.50	Nescopeck Creek	Gowen Tunnel
9	388.23	3.00	Mahanoy Creek	Continental Plant
10	320.77	2.48	Mahanoy Creek	Centralia Tunnel
Top Ten Total	7955.32			
All Discharges	12928.21			
% Loading Total	61.53			

Top-10 Al Loading (lbs/day) Discharges

Ranking	Al Loading	% Loading Total	Watershed	Mine Discharge
1	3847.62	42.92	Nescopeck Creek	Jeddo Tunnel
2	937.87	10.46	Nescopeck Creek	Gowen Tunnel
3	856.61	9.56	Catawissa Creek	Audenreid Tunnel
4	337.01	3.76	Mahanoy Creek	Centralia Tunnel
5	253.13	2.82	Nescopeck Creek	Derringer Tunnel
6	182.23	2.03	Wiconisco Creek	Porter Tunnel
7	167.77	1.87	Lackawanna River	Old Forge Borehole
8	153.68	1.71	Mahanoy Creek	West Penn Discharge
9	138.41	1.54	Mahanoy Creek	Doutyville Tunnel
10	132.53	1.48	Susquehanna River	Mocanaqua Tunnel
Top Ten Total	7006.84			
All Discharges	8964.70			
% Loading Total	78.16			

Top-10 Acid Loading (lbs/day) Discharges

Ranking	Acid Loading	% Loading Total	Watershed	Mine Discharge
1	25410.56	13.41	Nescopeck Creek	Jeddo Tunnel
2	16570.82	8.75	Catawissa Creek	Audenreid Tunnel
3	14024.59	7.40	Solomon Creek	Nottingham-Buttonwood Airshaft
4	8147.17	4.30	Solomon Creek	Solomon Creek Boreholes
5	7130.31	3.76	Nescopeck Creek	Gowen Tunnel
6	6902.56	3.64	Susquehanna River	Mocanaqua Tunnel
7	5480.49	2.89	Nanticoke Creek	Dundee Outfall
8	4804.65	2.54	Mahanoy Creek	Packer #5 Breach and Borehole
9	4804.59	2.54	Mahanoy Creek	Centralia Tunnel
10	4726.07	2.49	Lackawanna River	Old Forge Borehole
Top Ten Total	98001.81			
All Discharges	189444.30			
% Loading Total	51.73			

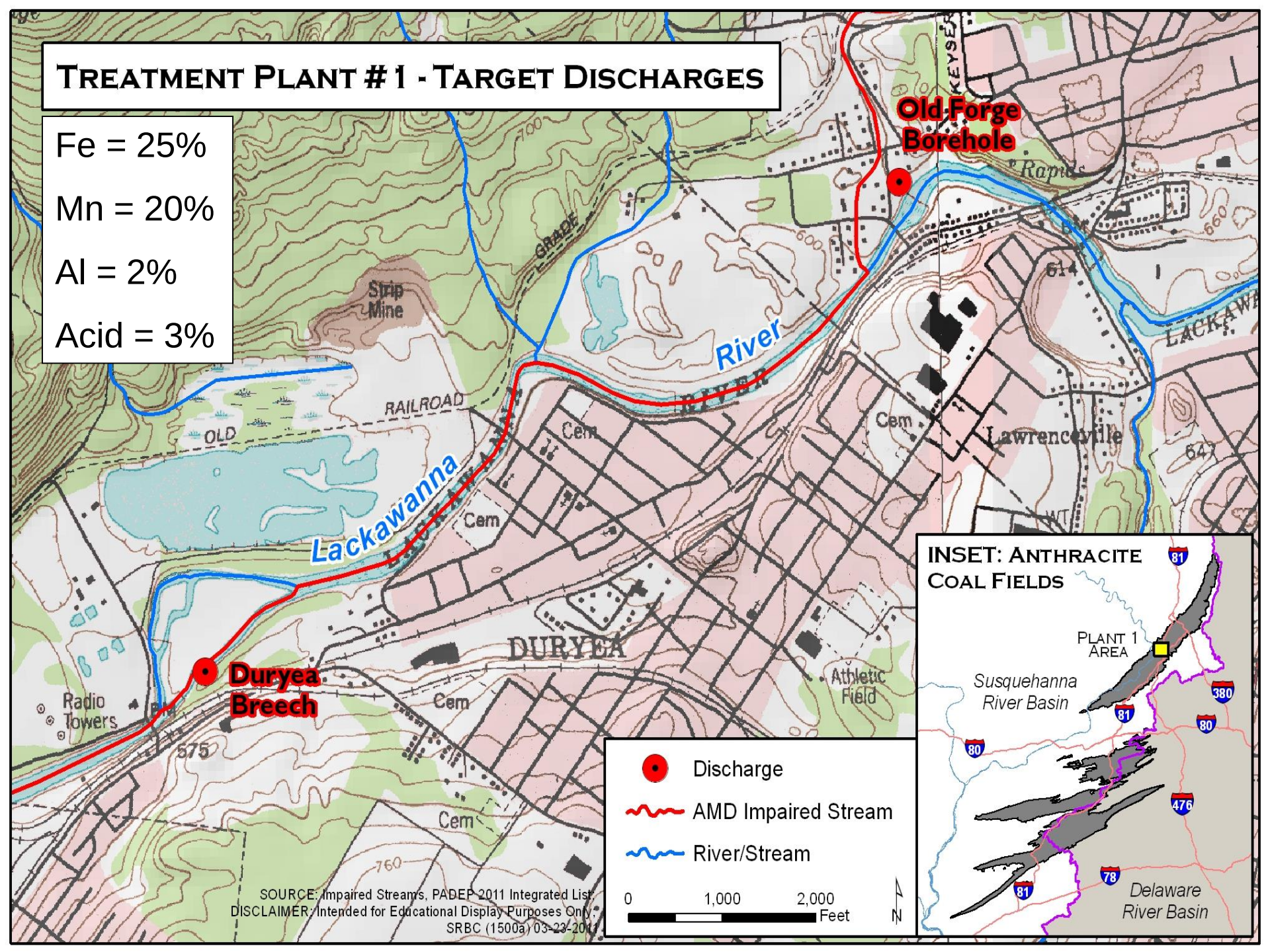
Top-20 Prioritized Discharges within the Anthracite Region of the Susquehanna River Basin and Their Separated Pollution Contribution Percentages

Discharge	Field	Watershed	Flow %	Fe Load %	Mn Load %	Al Load %	Acid Load %	Loading Average %
Jeddo Tunnel	Eastern-Middle	Nescopeck Creek	9.78	3.45	11.30	42.92	13.41	17.8
Old Forge Borehole	Northern	Lackawanna River	11.45	16.78	13.36	1.87	2.49	8.6
Nottingham-Buttonwood Airshaft	Northern	Solomon Creek	4.60	7.85	5.22	0.53	7.40	5.3
Solomon Creek Boreholes	Northern	Solomon Creek	4.70	9.07	4.77	0.34	4.30	4.6
Gowen Tunnel	Eastern-Middle	Nescopeck Creek	3.00	0.19	4.50	10.46	3.76	4.7
Duryea Breach	Northern	Lackawanna River	4.17	7.40	5.72	0.42	0.88	3.6
Audenreid Tunnel	Eastern-Middle	Catawissa Creek	3.00	0.26	2.05	9.56	8.75	5.2
Packer #5 Breach and Boreholes	Western-Middle	Mahanoy Creek	3.04	3.72	6.07	0.08	2.54	3.1
Gilberton Pump	Western-Middle	Mahanoy Creek	2.18	4.65	5.11	0.63	1.72	3.0
Centralia Tunnel	Western-Middle	Mahanoy Creek	1.27	0.49	2.48	3.76	2.54	2.3
Dundee Outfall	Northern	Nanticoke Creek	0.72	4.50	0.92	0.00	2.89	2.1
Derringer Tunnel	Eastern-Middle	Nescopeck Creek	0.78	0.04	1.09	2.82	1.16	1.3
Mocanaqua Tunnel	Northern	Susquehanna River	0.62	2.02	1.85	1.48	3.64	2.2
Porter Tunnel	Southern	Wiconisco Creek	0.17	0.82	0.34	2.03	1.40	1.1
West Penn Breaker Plant Discharge	Western-Middle	Mahanoy Creek	0.27	0.96	0.75	1.71	0.40	1.0
Jermyn Slope	Northern	Lackawanna River	2.72	0.25	0.31	0.12	0.27	0.2
Doutyville Tunnel	Western-Middle	Mahanoy Creek	1.49	0.47	0.88	1.54	1.07	1.0
Continental Plant Bypass	Western-Middle	Mahanoy Creek	1.48	1.36	3.00	0.18	1.80	1.6
Susquehanna #7 Shaft	Northern	Newport Creek	1.43	3.30	1.70	0.23	0.49	1.4
Plainsville Outlet	Northern	Susquehanna River	0.69	2.41	0.62	0.14	2.08	1.3
		Total %	57.6	70.0	72.0	80.8	63.0	

Restoration Effort Focus?

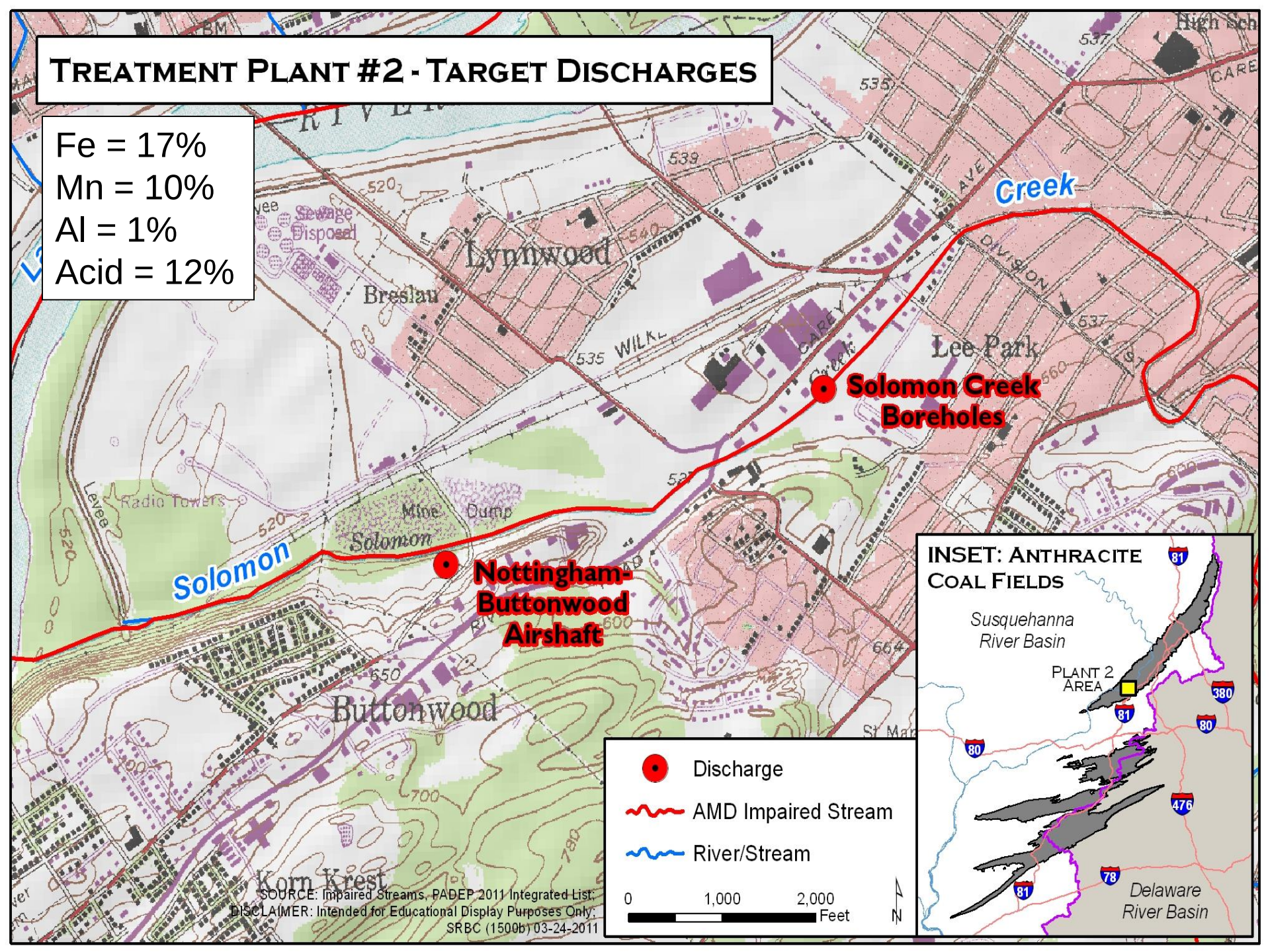
"Strategic treatment plant site selections would allow, in some cases, several Top-20 discharges to be treated at the same plant, thus reducing capital, operation, and maintenance costs. Strategic treatment plant site selections would also allow, in some cases, incorporation of adjacent non-Top-20 discharges into the treatment plant, increasing the percentage of total Anthracite loading being treated."

Top 20 Plan Suggested Plants


TREATMENT PLANT #1 - TARGET DISCHARGES
Fe = 25%
Mn = 20%
Al = 2%
Acid = 3%
Old Forge Borehole
Rapids
Strip Mine
GRADE
River
RAILROAD
OLD
Cem
Lackawanna
Lawrenceville
614
647
DURYEA
Duryea Breech
Radio Towers
575
760
Athletic Field
Discharge
AMD Impaired Stream
River/Stream
0
1,000
2,000
Feet
N
SOURCE: Impaired Streams, PADEP 2011 Integrated List
DISCLAIMER: Intended for Educational Display Purposes Only
SRBC (1500a) 03-23-2011
INSET: ANTHRACITE COAL FIELDS
PLANT 1 AREA
Susquehanna River Basin
Delaware River Basin
81
380
80
476
78

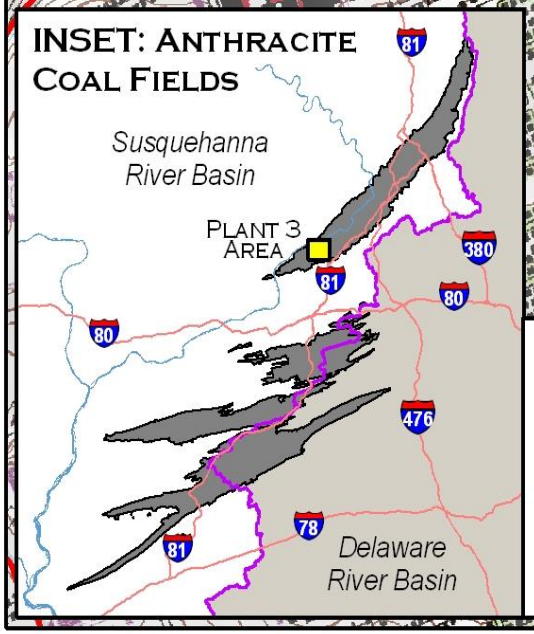
Treatment Plant #2 - Target Discharges

Fe = 17%
Mn = 10%
Al = 1%
Acid = 12%



Treatment Plant #3 - Target Discharges

Fe = 8%
Mn = 3%
Al = 0%
Acid = 3%



Discharge
AMD Impaired Stream
River/Stream

0 1,000 2,000 Feet

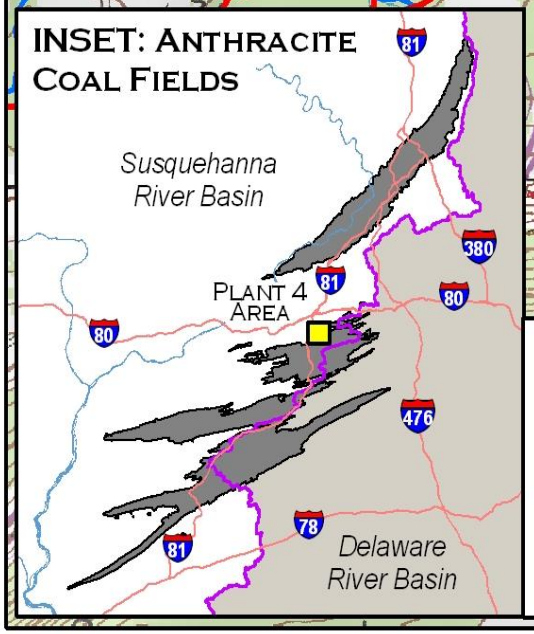
N

SOURCE: Impaired Streams, PADEP 2011 Integrated List;
DISCLAIMER: Intended for Educational Display Purposes Only;
SRBC (1500c) 03-24-2011

Susquehanna River
Susquehanna #7 Shaft
Nanticoke Creek
Truesdale/ Dundee Outfall
Loomis Park
Warrior Road
Mine Dump

Treatment Plant #4 - Target Discharges

Fe = 4%
Mn = 11%
Al = 43%
Acid = 13%



Jeddo Tunnel

Discharge
AMD Impaired Stream
River/Stream

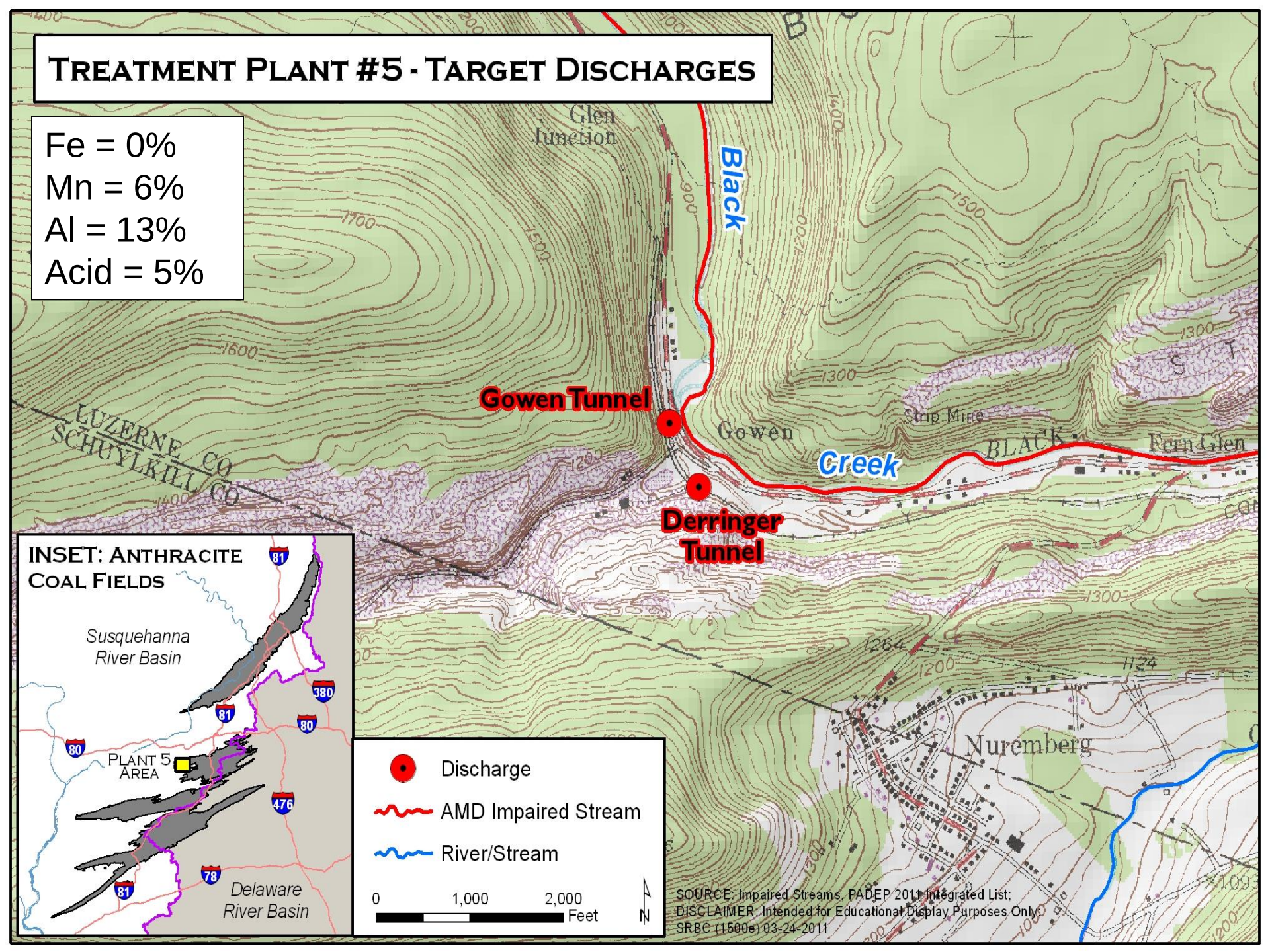
0 1,000 2,000 Feet

N

SOURCE: Impaired Streams, PADEP 2011 Integrated List;
DISCLAIMER: Intended for Educational Display Purposes Only;
SRBC (1500d) 03-24-2011

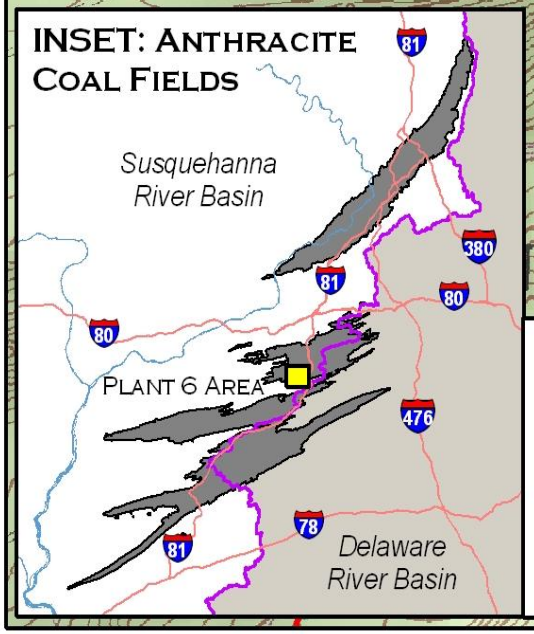
Treatment Plant #5 - Target Discharges

Fe = 0%
Mn = 6%
Al = 13%
Acid = 5%



Treatment Plant #6 - Target Discharges

Fe = 0%
Mn = 2%
Al = 10%
Acid = 9%



Discharge
AMD Impaired Stream
River/Stream

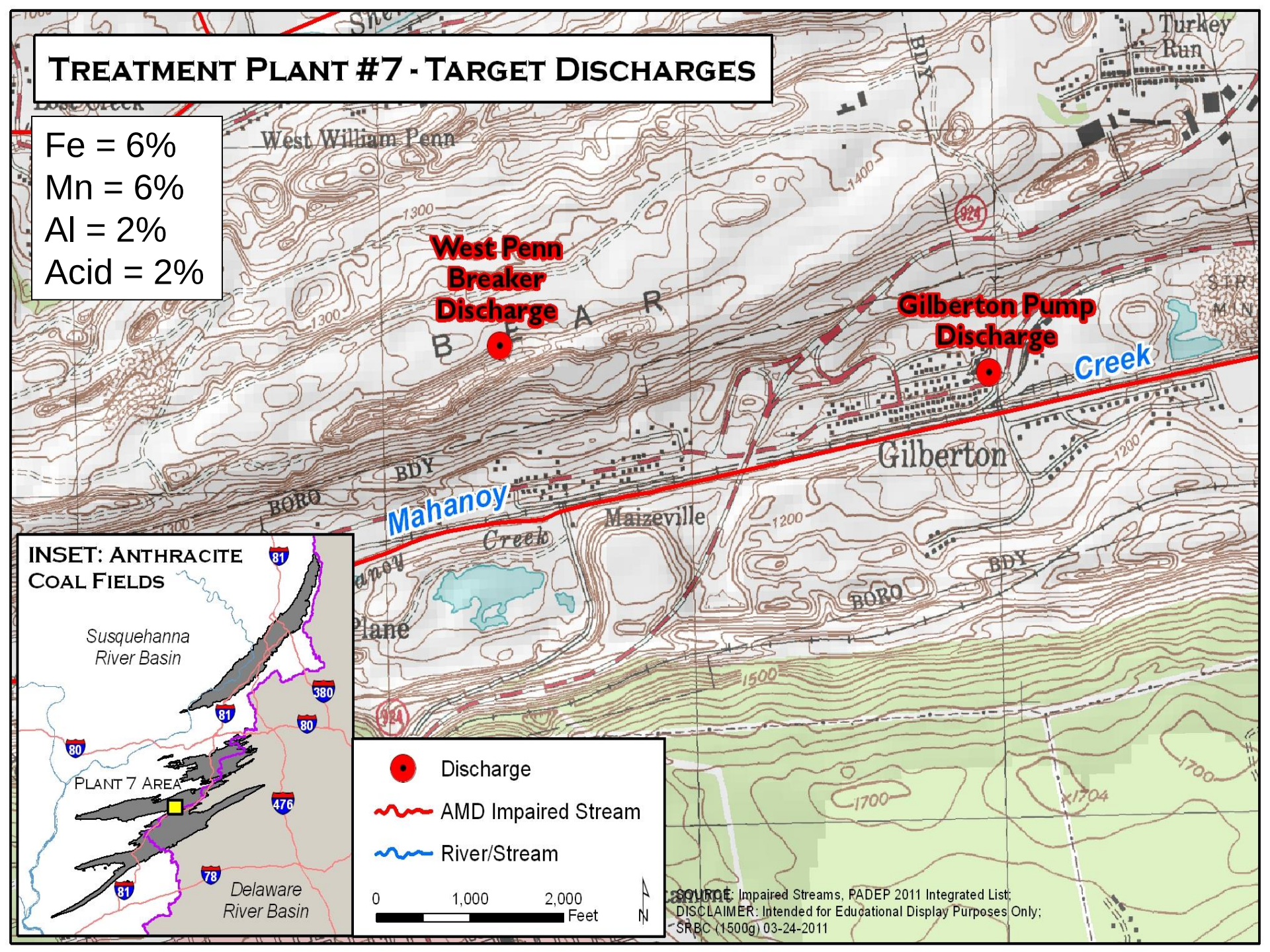
0 1,000 2,000 Feet

N

SOURCE: Impaired Streams, PADEP 2011 Integrated List;
DISCLAIMER: Intended for Educational Display Purposes Only;
SRBC (1500f) 03-24-2011

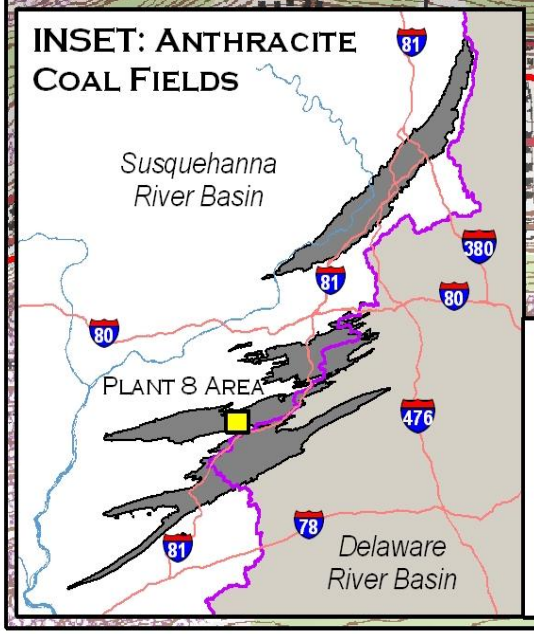
Treatment Plant #7 - Target Discharges

Fe = 6%
Mn = 6%
Al = 2%
Acid = 2%



Treatment Plant #8 - Target Discharges

Fe = 6%
Mn = 7%
Al = 0%
Acid = 5%



Hammond Mine Pool Seep

Connerton Village Boreholes

Packer #5 Breach & Borehole

Girard Overflow 1

Girard Overflow 2

Girard Mine Pool Discharge

McTurks Borehole

Shenandoah Creek

Mahanoy Creek

Discharge

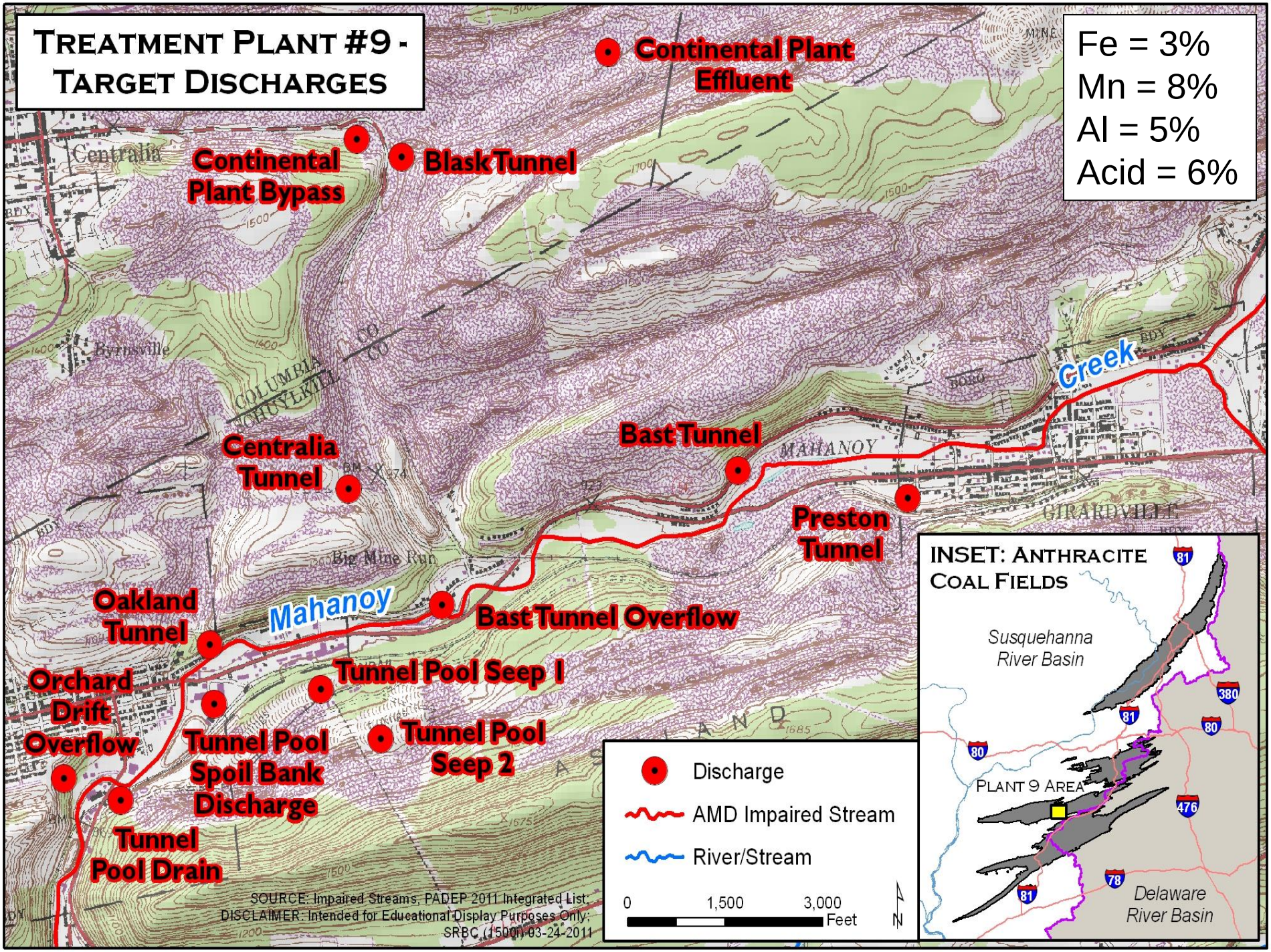
AMD Impaired Stream

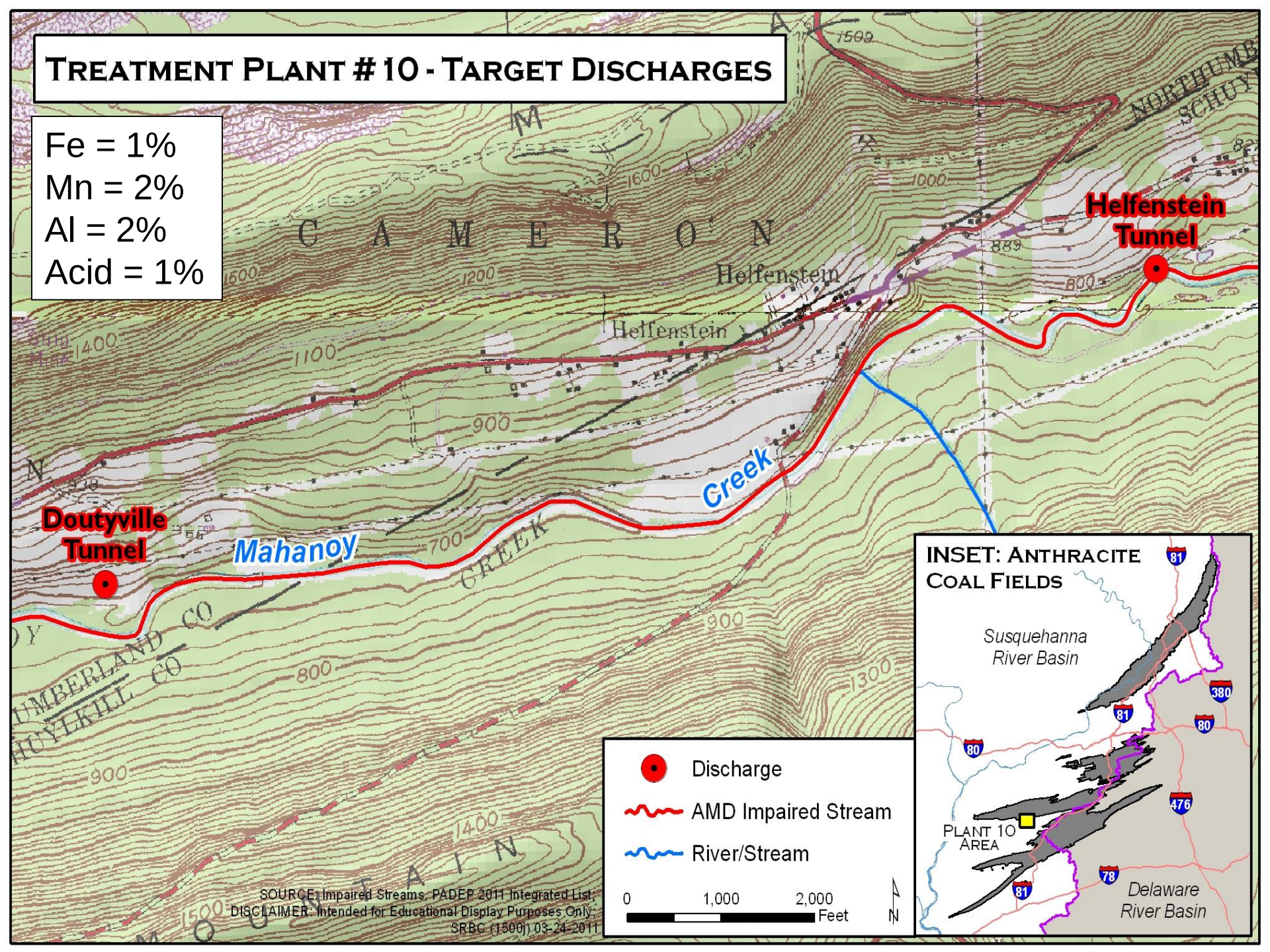
River/Stream

0 1,000 2,000 Feet

N

SOURCE: Impaired Streams, PADEP 2011 Integrated List;
DISCLAIMER: Intended for Educational Display Purposes Only;
SRBC (1500h) 03-24-2011


Treatment Plant #9 - Target Discharges
Fe = 3%
Mn = 8%
Al = 5%
Acid = 6%
Continental Plant Effluent
Continental Plant Bypass
Blask Tunnel
Centralia
Byrnsville
Centralia Tunnel
Bast Tunnel
Preston Tunnel
Mahanoy Creek
Big Mine Run
Oakland Tunnel
Mahanoy
Bast Tunnel Overflow
Orchard Drift Overflow
Tunnel Pool Seep 1
Tunnel Pool Spoil Bank Discharge
Tunnel Pool Seep 2
Tunnel Pool Drain
Discharge
AMD Impaired Stream
River/Stream
0
1,500
3,000
Feet
N
SOURCE: Impaired Streams, PADEP 2011 Integrated List;
DISCLAIMER: Intended for Educational Display Purposes Only;
SRBC (1500) 03-24-2011
INSET: Anthracite Coal Fields
Susquehanna River Basin
Plant 9 Area
Delaware River Basin


Treatment Plant # 10 - Target Discharges
Fe = 1%
Mn = 2%
Al = 2%
Acid = 1%
Helfenstein Tunnel
Doutyville Tunnel
Mahanoy Creek
Helfenstein
CAMERON
MOUNTAIN
Discharge
AMD Impaired Stream
River/Stream
0 1,000 2,000 Feet
N
SOURCE: Impaired Streams, PADEP 2011 Integrated List;
DISCLAIMER: Intended for Educational Display Purposes Only;
SRBC (1500j) 03-24-2011
INSET: Anthracite Coal Fields
Susquehanna River Basin
Plant 10 Area
Delaware River Basin
81
380
80
476
78

Summary

- These 10 possible treatment plants would treat 16 of the Top-20 Discharges and 20 non-Top-20 Discharges.
- The treatment of the four final Top-20 Discharges are significantly less important than the combination of discharges suggested for treatment within the ten plants.
- The 10 plants would treat 68% of the Fe loading, 73% of the Mn loading, 79% of the Al loading, and 60% of the acidity loading that enters the Susquehanna Basin via the Anthracite Coal Fields.

Questions or Comments?

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