

**Upper Schuylkill River TMDL Watershed
Implementation Plan
Schuylkill County, PA
Revision October 2019**

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UPPER SCHUYLKILL RIVER

The Upper Schuylkill River watershed is in central Schuylkill County, Pa. and encompasses many communities that include Pottsville, Schuylkill Haven, and Port Clinton. The Upper Schuylkill River flows east-southeast from its headwaters near the small community of Tuscarora to its confluence with the Little Schuylkill River in Port Clinton.

CAUSES OF IMPAIRMENT

Abandoned Mine Drainage (AMD)

The major pollution source in the watershed is abandoned mine drainage (AMD), which causes high levels of metals and low pH in the Upper Schuylkill River and several its tributaries. The combined drainage area for the entire Upper Schuylkill River Watershed totals +/-264 square miles. The PA Department of Environmental Protection (PA-DEP) has listed the Upper Schuylkill River, many tributaries to the river, and West Branch Schuylkill River in 1996 and 2002 on the 303(d) List of Impaired Streams due primarily to abandoned mine drainage. Within the drainage area, a total of 11.17 miles of Mill Creek Watershed, 5.62 miles of Muddy Branch Watershed, 9.02 miles of West Branch Schuylkill River Watershed, 9.43 miles of Panther Creek Watershed, 2.03 miles of Wabash Creek Watershed, and 34.32 miles of Schuylkill River Watershed are listed as impaired by metals, and 31.47 miles of the Little Schuylkill River Watershed are listed as impaired by low pH and metals on the 303(d) listing.

The Upper Schuylkill River Watershed is a very large watershed with a very diverse cultural, historic, economic, and environmental history. Historical land uses throughout the watershed were centered primarily on agricultural activities and transportation, and then adjusted over time to include industrial development, recreational opportunities, and included resource extraction.

Anthracite coal mining was the primary source of resource extraction that took place in the Upper Schuylkill River Watershed. Portions of the Eastern Middle, Western Middle, and Southern Anthracite Coal Fields are found within Schuylkill County. These coal fields lie within the Ridge and Valley Physiographic Province, and generally coal is found in the valleys, but can also be found in the ridges as well. The largest of the three coalfields is the Southern Anthracite Coal Field that stretches across the entire length of Schuylkill County from east to west. The headwaters of the Schuylkill River and its many tributaries are found directly within the Southern Anthracite Coal Field.

Anthracite mining within Schuylkill County and the headwaters of the Schuylkill River was very extensive and prolific. Coal was discovered around 1750, but it wasn't until the early 1800's that anthracite coal became very marketable. Mining began within the headwaters of the Schuylkill River during this time and spread exponentially across the area. By 1913, 80 million tons of coal was being extracted from the anthracite fields annually, and in 1917 mining activity reached its peak with over 100 million tons being extracted. Large amounts of this coal extraction occurred within the Schuylkill River's headwaters because that is where the coal was found, but also because the river supplied an excellent source of transportation for the coal to markets such as Philadelphia.

Anthracite coal was the fuel for the Industrial Revolution, but there were environmental challenges or problems due to the coal mining. Mining was relatively unregulated until the late 1970's. In 1972, the enactment of Federal Water Pollution Control Act Amendments of 1972 started leading the way to protecting or addressing pollution control measures. It wasn't until 1977, when the Federal Surface Mining Control and Reclamation Act (SMCRA) passed, that mining activities required numerous environmental controls or regulations. Up until 1977 any mining that occurred was basically unregulated and exempt from this law. Most of the mining activities that occurred in the Schuylkill River's headwaters occurred before 1977, and therefore the mining industry was not responsible for any reclamation activities or treating abandoned mine drainage discharges to meet water quality standards.

The impacts of mining activities and abandoned mine drainage have been extensively documented by numerous reports, studies, and watershed assessments. The SHA in cooperation with the SCD completed an extensive watershed assessment on the Upper Schuylkill River and Little Schuylkill River (Kimball, 2000 & 2001). The Upper Schuylkill River assessment targeted only AMD issues and resulted in the identification of 108 AMD discharge/recharge sites. The Little Schuylkill River assessment documented 35 different AMD discharges. The Natural Lands Trust completed a PA Department of Conservation and Natural Resources (DCNR) Rivers Conservation Plan in 2001 on the Schuylkill River. The plan addressed AMD issues in the Schuylkill River's headwaters. The Conservation Fund prepared a "State of the Schuylkill River Watershed" report in 2002, which also commented on the AMD issues and discharges within Schuylkill County. Most recently the USGS in cooperation with the Schuylkill Headwaters Association and Schuylkill Conservation District compiled data to develop a prototype Qualified Hydrologic Unit Plan (QHUP). This is covered in more detail later in this WIP revision.

Due to the size of the watershed and the numerous sources of AMD, resources have been focused primarily on AMD remediation projects. Pollution sources such as sediment runoff, abandoned mine drainage from refuse piles, uncontrolled stormwater runoff, raw sewage discharges, and U. S. Environmental Protection Agency (EPA) Superfund sites also have been identified in the Upper Schuylkill River Watershed. However, the Upper Schuylkill River Watershed has not been assessed to determine impairment from sources other than abandoned mine drainage refuse piles.

Sediment Runoff and Abandoned Mine Drainage from Refuse Piles

In areas of historic mining, vegetation, soil, and rock layers (known as overburden) were stripped away to expose the coal vein. In many cases, this overburden was stockpiled adjacent to the mining operation and remains there still today. These spoil piles are a source of coal fines or culm that, if not properly contained, can runoff into nearby streams covering stream bottoms which serve as habitat for macroinvertebrates. This culm often contains iron pyrite, which negatively impacts not only the stream bottom but also the water column by producing abandoned mine drainage. Several refuse piles within the study area are currently being reprocessed for energy at nearby cogeneration plants. Reprocessing involves mining existing culm piles and mixing the mined material with fluidized bed ash to increase the effectiveness of the material for burning. The final product can then be used in cogeneration plants as fuel. Culm varies in grade for fuel and some piles are more efficient to reprocess than others. Reclamation should decrease the loading to the receiving stream if a site is chosen as being an economically feasible source of fuel for cogeneration. Implementing Best Management Practices (BMPs) on site will also

decrease runoff.

REASON FOR AMENDMENT

Ten plus years have passed since the original Watershed Implementation Plan (WIP) was prepared. As will be demonstrated throughout this revision, many of the priority projects have been completed and streams are improving. Unfortunately, many more AMD sources still exist, and water quality is not meeting standards in the entire watershed. Therefore, it is time to look at current water quality, the AMD sources that still exist and prioritize the sites to continue working towards restoration.

Since the reauthorization of SMCRA in 2006, states were permitted to put 30% of its annual AML grant into a Set-Aside fund. These funds can be used for the abatement of AMD in the state but only if the watershed is in a qualified hydrologic unit plan (QHUP).

In 2011, the Upper Schuylkill River was chosen to develop a prototype QHUP that could be used as a template for other AMD affected watersheds to use. Project partners Schuylkill Conservation District (SCD), Schuylkill Headwaters Association (SHA) and with technical help from the U.S. Geological Survey (USGS) and PADEP began to supplement old water quality from the original TMDL restoration plan (WIP) with newer information. The hope was to revise the plan to meet the requirements of a QHUP.

Water quality data from 1999-2011 was used for this update (unless otherwise noted). The mean flow and mean water quality were used to establish priorities. Discharges were ranked overall in the Upper Schuylkill River based on load ranks for acidity and metals. For this WIP, updated load ranks for metals is used to prioritize the discharges and is shown in Table 1. Data from this report along with AMD treat is also used to derive approximate costs for construction of treatment systems.

WATERSHEDS IN THE UPPER SCHUYLKILL RIVER

For ease of prioritization the headwaters of the Schuylkill River were broken into smaller watersheds. These watersheds and their priority discharges are addressed using a top down approach much of the time. Various factors can change this such as property owner permission, opportunities to work with other partners, etc. Therefore, if there is an opportunity to work on a project that might be “out of order” but still a priority and beneficial to the overall watershed restoration the association with project partners will do that. These are the following subwatersheds:

- Main Stem Schuylkill River
- Mill Creek
- West Branch Schuylkill River
- Muddy Branch (West Branch Schuylkill River)
- Little Schuylkill River
- Wabash Creek (Little Schuylkill River)
- Panther Creek (Little Schuylkill River)

For this updated WIP, Panther Creek will not be addressed at this time. The biggest discharge in the area, the Route 309 Discharge, is currently being treated actively by a mining company.

The project partners are looking to concentrate on the Main Stem Schuylkill River and then tackle other subwatersheds in order that they enter the river. Therefore, Mill Creek will be the next priority subwatershed along with the main stem. It should be noted though, that the Schuylkill Action Network (SAN), has the West Branch as a priority and Pennsylvania Bureau of Abandoned Mine Reclamation (PABAMR) is currently reviewing a qualified hydrologic plan for the subwatershed. There is always a possibility that funding from Section 319 may be needed for design work as a basis to get construction funding from PABAMR even though the West Branch is not the top priority subwatershed in this revision.

OVERALL PRIORITIES IN THE HEADWATERS OF THE SCHUYLKILL RIVER

The table below shows the priorities of the top discharges in the entire watershed. These are determined by using ranking based on the metal loadings of the discharges. These will be further broken down into sub-watersheds in the sections that follow.

Table 1. Priorities Ranked Based on Metal Loadings			
Metals Rank	AMD Site name	Subwatershed	Comments
1	Route 309 Discharge (AMD108A)	Panther Creek/Little Schuylkill	Active Treatment
2	Pine Knot Mine (AMD187)	West Branch	
3	Morea Mine Discharge (AMD162)	Mill Creek	
4	Otto Mine Primary Airshaft (AMD190)	Muddy Branch	Passive Treatment
5	Oak Hill Boreholes (AMD188)	West Branch	
6	Silver Creek Mine Pool (AMD149)	Schuylkill River	Passive Treatment
7	Silverbrook Mine (AMD110)	Little Schuylkill	
8	Replier Mine (AMD166)	Mill Creek	
9	Pine Forest (AMD167)	Mill Creek	Passive Treatment
10	Eagle Hill Mine (AMD157)	Schuylkill	
11	Brockton Mine (AMD129)	Schuylkill	
12	Caparrel/Brockton Mine Strip Pool Overflow (AMD131)	Schuylkill	
13	Kaska Mine (AMD136)	Schuylkill	
14	Newkirk Mine Tunnel North Dip (AMD114)	Wabash	Passive treatment
15	Lucianna Tunnel (AMD160)	Schuylkill	
16	Mary D East Overflow (AMD125)	Schuylkill	Passive Treatment
17	Randolph Tunnel Mine (AMD161)	Schuylkill	
18	Mary D Borehole (AMD122)	Schuylkill	Passive treatment
19	Bell Colliery Mine (AMD121)	Schuylkill	Passive Treatment
20	Otto Mine Secondary (AMD189)	Muddy Branch	
21	Primrose Slope Discharge (AMD317)	Muddy Branch	
22	Neumeister Mine/Buck Mtn Drift (AMD314)	West Branch (West West Branch)	

23	Newkirk Mine Tunnel South Dip (AMD116)	Wabash	
24	Reevesdale Mine South Dip (AMD118)	Wabash	Passive Treatment
25	Middleport Mine Tunnel (AMD144)	Schuylkill	
26	Reevesdale Mine North Dip Tunnel (AMD117)	Wabash	
27	Whitepipe Discharge (AMD318)	Muddy Branch	

HEADWATERS OF
SCHUYLKILL
RIVER

Pollution Sources (AMD Discharges) in Main Stem Headwaters of the Schuylkill River

The headwaters of the Schuylkill River are affected by pollution from AMD. For this revised WIP there are eleven (11) priority abandoned deep mine discharges (See Map 2, Appendix A) ranked using amount of metals present in water. The table below shows the ranking two different ways. First is based on the rank looking at the metal combination of iron, aluminum and manganese. The second ranking is location in watershed, number 1 being the most upstream discharge. In most cases priorities have been addressed by project partners in a sequence starting upstream and working down. It should be noted this order is not all inconclusive and that much of this also depends on landowner cooperation and other opportunities that may make it more beneficial to address a priority out of order.

Overall Metals Rank in the Schuylkill River	Location Starting at headwaters	AMD Site Name	Status
6	8	Silver Creek Mine Pool (AMD149)	Completed
10	9	Eagle Hill Mine (AMD157)	Not built
11	5	Brockton Mine (AMD129)	Not built
12	4	Caparrel/Brockton Mine Strip Pool Overflow (AMD131)	Not built
13	6	Kaska Mine (AMD136)	Not built
15	10	Lucianna Tunnel (AMD160)	Not built
16	2	Mary D East Overflow (AMD122)	Completed
17	11	Randolph Tunnel Mine (AMD161)	Not built
18	3	Mary D Borehole (AMD125)	Completed
19	1	Bell Colliery Mine (AMD121)	Completed
25	7	Middleport Mine Tunnel (AMD144)	Not built

Discharges that have been addressed:

The following is a list of the discharges that now have a passive treatment system treating the water. Operation and maintenance continue on all of these systems. It should be mentioned that even though a system is in place, it does not mean there will never be a need for more funding in the future for upgrades as the systems age.

- ***Silver Creek Mine (AMD149):*** This mine includes a seepage/tunnel discharge that forms a turquoise-colored ponded upwelling that overflows into Silver Creek. It contributes iron, aluminum, manganese and acidity into the stream. The passive treatment consists of a scour pool, aeration pond, settling pond, a wetland cell and a variable level pond. The system was designed to treat 1,500 gallons per minute of water and was built in 2010.

- **Mary D East (Overflow)(AMD125):** This project enlarged an existing wetland and created a 2.5-acre wetland to passively treat the Mary D Overflow Mine Discharge. The project involved piping the mine discharge under Swift Creek to a constructed settling pond and then to the enlarged wetland. The pipe network was designed to enhance the aeration of the mine discharge and associated treatment. Excess material from the wetland enlargement was used to reclaim 150 feet of dangerous highwall, 10 to 20 feet deep, located near the mine discharge. The project area which was once part of the Mary D Colliery was revegetated with grass, legumes and wetland plants. This was completed by PA Bureau of Abandoned Mine Reclamation (PABAMR).
- **Mary D Mine Borehole (AMD122):** This AMD discharge contributes iron, manganese and acidity to the headwaters of the Schuylkill River. This project involved many partners to finish. The biggest hurdle was that the only space to build the system was the community ball field. A parcel of land was donated elsewhere near Mary D and a new recreation complex was built which included a ball field, multi-purpose field, walking trail and skating pond. Then the parcel that had the old ball field was donated to the watershed organization to build the passive treatment system. The treatment system consists of intake piping from the borehole, a settling pond for metal particles can settle out, an aerobic wetland and a vertical flow limestone bed. The system was designed to treat 1,140 gallons per minute. The system was finished in 2013.
- **Bell Colliery (AMD121):** Abandoned mine drainage (AMD) from the Bell Colliery Drift in Schuylkill Township, Schuylkill County, adds metals and acidity to the main branch of the Schuylkill River near its headwaters. Above its confluence with the Bell Discharge, the Schuylkill River runs clear and has a near-neutral pH. In 2004 the original system was constructed which consisted of two parallel flushable downflow limestone cells followed by an aerobic wetland cell. The aerobic cell ended up being too small and could not contain the metals during times when the system was flushed and thus allowing them to go directly into the river. In 2006 a flush pond was built on other side river to help settle out metals.

The system started to show a decrease in treatment volume due to plugged limestone and a clogged flushing system. In 2013 it was modified to an upflow system. This allows the metal precipitates to be close to the flush zone thus allowing the flush to be more effective.

Other finished projects of interest

- **Sharp Mountain Mine Subsidence Reclamation:** A portion of Sharp Mountain located in the City of Pottsville has very dangerous mine subsidences called cropfalls extended along the contour of the mountain for 2 miles. These subsidences capture all runoff from the mountain ridge on the north side and contribute AMD to the Sherman discharge into the main stem Schuylkill River and to the RS&W drift mine discharge into the West Branch Schuylkill River. The City of Pottsville completed 8 phases of a reclamation project to backfill the cropfalls through funding under Growing Greener and OSM also completed an emergency project. The completion of this project is important not only for the prevention of AMD, but also for the severe health and safety hazards. The final phase of the project was completed in the spring 2016.

Water Quality Improvements

To demonstrate improvements in the watershed after the installation of these projects various points from the TMDL are used (See Map 1, Appendix A). These points serve as a background water quality data that can be used to compare quality after construction of the above passive treatment systems. As seen by the table below improvements have been occurring and the stream is showing net alkaline conditions at New Philadelphia.

Table 3. Water Quality at Selected Sites in Main Stem Headwaters of the Schuylkill River							
Site	Timeframe	pH	Acidity (mg/L)	Alkalinity (mg/L)	Iron (mg/L)	Aluminum (mg/L)	Manganese (mg/L)
S1 - Headwaters	2002-2003	5.94	47.68	9.75	0.65	1.1	1.01
	2017	6.75	-4.3	11.6	0.37	0.42	0.5
S2A – Near Mary D	2002-2003	4.8	ND	1.69	1.79	1.07	1.24
	2017	6.74	-6.0	15.3	0.56	0.26	0.55
SRM – at Middleport	2002-2003	6.58	17.28	17.16	0.64	ND	0.94
	2017	7.13	-2.2	10.5	0.4	0.45	0.8
SRNP* – New Philadelphia	2002-2003	6.48	21.0	16.85	1.85	ND	1.05
	2017	7.34	-5.5	11.1	0.67	0.28	0.89
SR2 – Port carbon	2002-2003	6.56	18.2	24.92	2.02	0.15	1.14

*Actual Sampling point ½ mile downstream of original TMDL point but nothing of any significance flows into river

TMDL

The TMDL goal for this particular stretch of stream came from the SR2 TMDL point located on the Schuylkill River in Port Carbon upstream of Mill Creek. Goals were set using the Upper Schuylkill River Metals TMDL approved in 2007. Reduction at the SR2 point was calculated taking existing load and subtracting both the load tracked from upstream points and the allowable load at the point. Unfortunately, aluminum could not be determined so no goal exists and is shown as ND. Loadings from completed projects on Silver Creek, Bell Colliery, Mary D Borehole and Mary D East (Overflow) are shown in Table 4.

Table 4. Project and TMDL information for Main Stem Headwaters of the Schuylkill River.						
	Project Name/ID	Project Cost	Load Reduction-Acidity (lbs/day)	Load Reduction-Aluminum (lbs/day)	Load Reduction-Iron (lbs/day)	Load Reduction-Manganese (lbs/day)
	Silver Creek (AMD149)/2730	\$853,402	300.8	8.1	301.4	59.1
	Mary D Outflow (AMD125)/1014	\$805,500		10.4	101.8	19.4
	Mary D Overflow (AMD122)/PA BAMR	\$268,253		7.4	66.0	18.0
	Bell Colliery (AMD121)/1114	617,485	268.3	13.5	44.7	16.4
Total for Subwatershed			569.1	39.4	513.9	112.9
TMDL Load Reduction Required			1,054	ND	76.47	0

Priorities and BMP's needed

Table 5 below shows the BMP's needed for the priorities for this newly revised WIP. Ideally these would be addressed in this order, but this could change depend on metal rank, the status of landowner, ability to work with other partners, etc.

It must be stressed that these are probable project cost opinions and are based solely upon information from AMDTreat, experience with construction, and knowledge of the proposed sites. This requires a number of assumptions as to actual conditions which will be encountered on the site; the specific decisions of other design professionals engaged; the means and methods of construction the contractor will employ; the cost and extent of labor, equipment, and materials that the contractor will employ; the contractor's techniques in determining prices and market conditions at the time; and other factors over which there is no control. Given these assumptions, which must be made, it is believed that the below probable project cost opinion to be a fair and reasonable estimate for project costs for each priority discharge.

Table 5. AMD Treatment Systems Needed in the Main Stem Headwaters of the Schuylkill River.				
Priority Discharge	Active or Passive	BMP Main component	Estimated Construction Costs	Operation and Maintenance Costs/year
Caparrel Strip Mine Pit (AMD131)	Passive	Limestone Sanding	NA	\$30,000
Kaska Mine Outfall (AMD136)	Passive	Aerobic Pond	\$457,754	\$16,646
Randolph Discharge (AMD161)	Passive	Aerobic Pond	\$236,607	\$8,604
Port Carbon Mine/Lucianna water level tunnel (AMD160)	Passive	Oxic limestone drain (OLD)	\$281,727	\$10,245
Brockton Discharge (AMD129)	Passive	Vertical Flow Wetland and Land reclamation	\$1,702,869	\$61,923
Middleport Mine Discharge (AMD144)	Passive	Oxic limestone drain (OLD)	\$69,554	\$2,529
Eagle Hill Mine (AMD157)	Passive	Aerobic Pond	\$679,978	\$24,726
TOTAL			\$3,428,489	\$154,673

New Priorities

1) *Caparrel Strip Mine Pit (AMD131)* - Big Creek's headwaters begin with overflow from the Chaparral Strip Mine Pit Discharge which is low in metals with low pH and high acidity. Two other smaller discharges that flow into Big Creek are located lower in the watershed, but their main impact is low-pH and acidity as they flow through natural wetlands that remove virtually all metals before entering Big Creek. This low-pH water is witnessed through the three-mile stream length to its confluence with the Schuylkill River near the village of Brockton. The low-pH water and acidity from the Chaparral Discharge degrades not only the entire length of Big Creek but also the Schuylkill River below their confluence. Big Creek its self has the potential to be a productive wild trout stream given that it is over 95% forested (USGS Stream Stats). Fish and macroinvertebrate collection were conducted as nine sampling locations for the development of a Coldwater Conservation plan. Macroinvertebrate sampling resulted in an impaired rating at all nine sampling locations and fish sampling resulted in the collection of only one brook trout over the nine sampling points. These findings were consistent with the PA Fish & Boat Commission findings in 2003 which concluded that the lack of a viable fish population was due to low-pH acidic water as low-pH stream water was found again through water sampling conducted during the Coldwater Conservation Plan development. Currently the SHA has been addressing this discharge

by limestone sanding the stream and PA BAMR has been monitoring to test the effectiveness. Future funding may be needed to continue this sanding or some other type of remediation if sanding is not enough.

Table 6. Predicted Load Reductions for Chaparrel Strip Mine Pit						
Big Creek/Caparrel Strip Overflow (AMD131)	pH	Alkalinity (lbs/day)	Acidity (lbs/day)	Iron (lbs/day)	Aluminum (lbs/day)	Manganese (lbs/day)
Average water quality	4.9	0.1 mg/L	9.0 mg/L	0.03 mg/L	0.43 mg/L	0.28 mg/L
Loadings using 630 gpm			68	0.23	3.3	2.1
Assumed % removal after treatment			100	90	90	90
Loadings removed after treatment			68	0.21	3.0	1.9

*Data is from sampling completed from 2016-2017

- 2) ***Kaska Mine Discharges (AMD136):*** These discharges can be found north of New Philadelphia. They enter a small stream that flows through an area called the Kaska Silt Dam. The affected area is comprised of the remains of an old coal silt dam that washed out during Tropical Storm Agnes in 1972. Coal refuse piles surround the silt dam. The site is unstable and washes out silt during heavy rains. The silt and refuse pile may be able to be removed for use at a cogeneration plant; however, previous testing indicated the silt and refuse was not of good quality to be used without blending. If the refuse cannot be removed off site, it would have to be stabilized, covered and seeded. The unnamed tributary (with iron precipitate) originates one mile upstream of the silt dam and may need to be stabilized. There is an opportunity for room for passive wetland treatment if the remains of the silt dam can be removed. The removal of the silt dam is covered more later in this section.

Kaska Mine Outfall (AMD136)	pH	Alkalinity (lbs/day)	Acidity (lbs/day)	Iron (lbs/day)	Aluminum (lbs/day)	Manganese (lbs/day)
Average water quality	6.1	44.8 mg/L	-5.2 mg/L	15.88 mg/L	0.65 mg/L	4.13 mg/L
Loadings using 940 gpm				179.9	7.4	46.8
Assumed % removal after treatment				90	90	90
Loadings removed after treatment				161.9	6.7	42.1

3) **Randolph Discharge (AMD161):** This deep mine discharge flows out from a hillside located along Route 209 just east of the Port Carbon/Palo Alto area and drains into the Schuylkill River on its south bank. The average flow volume is 602 gpm and the discharge has a high iron concentration. Aeration and oxidation of the flow from a series of vertical drops causes a high iron precipitate to form and armor its defined channel located along the floodplain of the Schuylkill River. Space along the river's floodplain appears to be available for the installation of a settling pond and an aerobic wetland treatment system providing landowner's consent is obtained. Due to the high iron accumulation at this site, possible partnerships with facilities/entities seeking iron oxide material may exist.

Randolph Tunnel Discharge (AMD161)	pH	Alkalinity (lbs/day)	Acidity (lbs/day)	Iron (lbs/day)	Aluminum (lbs/day)	Manganese (lbs/day)
Average water quality	6.41	76.05 mg/L	-44.8 mg/L	11.47mg/L	0.84 mg/L	3.34 mg/L
Loadings using 543 gpm				75.1	5.5	21.9
Assumed % removal after treatment				90	90	90
Loadings removed after treatment				67.6	5.0	19.7

- 4) **Port Carbon Mine/Lucianna water level tunnel (AMD160):** This discharge is located near Port Carbon and is net alkaline with high concentrations of iron and manganese. The best treatment strategy would be an aerobic pond.

Table 11. Predicted Load Reductions for the Lucianna Discharge

Lucianna Discharge (AMD160)	pH	Alkalinity (lbs/day)	Acidity (lbs/day)	Iron (lbs/day)	Aluminum (lbs/day)	Manganese (lbs/day)
Average water quality	6.31	31.14 mg/L	-4.3 mg/L	10.22 mg/L	0.53 mg/L	2.96 mg/L
Loadings using 604 gpm				74.4	3.9	21.6
Assumed % removal after treatment				90	90	90
Loadings removed after treatment				67.0	3.5	19.4

- 5) **Brockton Discharge (AMD129):** This is a small discharge located on the south side of Route 209 near Brockton. Originally, this discharge had a very large flow (shown in table below), especially during the time that the TMDL was developed. Since then a stripping pit located upslope of this discharge was reclaimed and has greatly decreased the flow. However, the load reductions were calculated using the higher flow with the assumption that after reclamation, some of the pollutant loadings are being removed. Currently, the smaller flow of water from the discharge, moves through some natural wetlands which appears to help remove some of the pollutants. More monitoring should be completed to determine the best type of treatment. Also, at the time of this revision, PPL electric is looking into this area as a wetland mitigation site. If this occurs, more wetlands will be installed helping remove more of the metals present in the water.

Brockton Discharge (AMD129)	pH	Alkalinity (lbs/day)	Acidity (lbs/day)	Iron (lbs/day)	Aluminum (lbs/day)	Manganese (lbs/day)
Average water quality	6.4	3.09 mg/L	63.18 mg/L	8.45 mg/L	6.11 mg/L	3.2 mg/L
Loadings using 796 gpm			606.3	81.1	58.6	30.7
Assumed % removal after treatment			100	90	90	90
Loadings removed after treatment			606.3	73.0	52.7	27.6

6) **Middleport Mine Discharge (AMD144):** Located south of Middleport along Mountain Road, this discharge originates from an abandoned deep mine opening approx. 1,800 feet south of Middleport, PA, which drains an unmapped mine pool complex. The flow range is 150 - 400 gpm with a pH around 5.5 with low aluminum, elevated iron and some alkalinity. The discharge currently flows into two existing small ponds allowing some of the iron to fall out. A potential passive treatment project could consist of an oxic limestone drain and then enhancing a wetland area.

Middleport Mine Discharge (AMD144)	pH	Alkalinity (lbs/day)	Acidity (lbs/day)	Iron (lbs/day)	Aluminum (lbs/day)	Manganese (lbs/day)
Average water quality	5.54	9.43 mg/L	2.78 mg/L	5.24 mg/L	0.15 mg/L	0.96 mg/L
Loadings using 241 gpm			8.1	15.2	0.4	2.8
Assumed % removal after treatment			100	90	90	90
Loadings removed after treatment			8.1	13.7	0.4	2.5

7) **Eagle Hill Mine** (AMD157) This use to be a pool discharge from a drift located northeast of Port Carbon which has a high flow (up to 2,250 gpm) with high iron and manganese concentrations. There is a restricted connection between some mine workings in the area including this mine and what is known as the Feeder Dam mine workings (Mill Creek). Recently, a private property owner drilled a potable water well into the Feeder Dam workings draining that mine pool down. Due to this connection, this activity also drained down the Eagle Hill mine pool. The Eagle Hill Mine discharge has been dry since October 2015 and it is likely that it will only flow intermittently depending on rainfall conditions. Since loadings from this discharge was part of the TMDL determination, reductions were still calculated to show that they have been removed.

Table 12. Predicted Load Reductions for Eagle Hill Mine						
Eagle Hill Mine (AMD157)	pH	Alkalinity (lbs/day)	Acidity (lbs/day)	Iron (lbs/day)	Aluminum (lbs/day)	Manganese (lbs/day)
Average water quality	6.36	160 mg/L	-116 mg/L	18.48 mg/L	0.48 mg/L	4.3 mg/L
Loadings using 1321 gpm				294.3	7.6	68.5
Assumed % removal after treatment				90	90	90
Loadings removed after treatment				264.9	6.8	61.6

Total Load Reductions

Using the load reductions from completed and future systems the TMDL table below can be examined again to see what results could be expected. Each system provides a measurable milestone of loadings removed. When all priorities are addressed the load reductions called for in the TMDL for acidity and the metals should be met.

Table 13. Project and TMDL information for Main Stem Headwaters of the Schuylkill River with Projected Load Reductions					
	Project Name/ID	Load Reduction-Acidity (lbs/day)	Load Reduction-Aluminum (lbs/day)	Load Reduction-Iron (lbs/day)	Load Reduction-Manganese (lbs/day)
Loadings of finished systems		624.0	41.5	219.2	59.6
Construction milestones	Caparrel Strip Mine Pit	68	3.0	0.21	1.9
	Brockton	606.3	52.7	73.0	27.6
	Kaska	-	7.0	161.9	42.1
	Middleport Mine	8.1	0.4	13.7	2.5
	Randolph discharge	-	5.0	67.6	19.7
	Port Carbon/Lucianna	-	3.5	67.0	19.4
	Eagle Hill Mine*	-	6.8	264.9	61.6
Total for Subwatershed		1,306.4	119.9	867.51	234.4
TMDL Load Reduction Required		1,054	ND	76.47	0

* At the time of this update, Eagle Hill Mine is dry. Loadings will be counted as if a system was constructed for the discharge since it was part of the original TMDL.

Refuse Piles

Many sections of the Schuylkill River are also impaired for siltation. Much of this sediment comes from the many spoil or culm piles leftover from past mining. Coal fines from these piles will wash into the streams coating the bottom. Also, these piles also contain pyrite, which can form AMD. Lastly, the majority of these are in the floodplain of the river. Their removal not only removes a source of sediment in the watershed, floodplains can be restored which will help prevent flooding in the communities downstream. Therefore, the removal of these sources of AMD pollution are also part of this revision.

The top 5 priorities are listed below, and their locations can be seen on Map 6, located in the appendix. These costs are approximate. Exact costs can be determined only after the designs for removal can be completed. Once designs are completed, the Pilot Program funding from PA-BAMR can be used to fund removal and floodplain restoration.

Site	Subwatershed Impacted	Approximate Costs
Firth Lock	Main Stem Schuylkill River	\$2,500,000
Mar Lin	West Branch of Schuylkill River	\$5,000,000
Site 5	Main Stem Schuylkill River	\$750,000
Site 4	Main Stem Schuylkill River	\$7,000,000
Kaska Slush Dam	Main Stem Schuylkill River	\$4,000,000
TOTAL		\$19,250,000

Schedule for Implementation

The main milestone for this section of the stream is the restoration of the Upper Schuylkill River. The table below shows steps in reaching this milestone.

Timeline and Milestones	Dates	Responsible Parties
Continue OM&R on Bell Colliery, Mary D Mine Borehole, Mary East and Silver Creek Mine Passive treatment systems	Ongoing	SHA/SCD/PADEP
Interim Milestone: Provide OM&R on 4 constructed systems so they continue to function and remove acidity and metal loadings from the watershed. Water quality should be meeting water quality standards at S1, S2A, SRM and SRNP (Table 3) monitoring point		
Acquire funding to address priority discharges and Firth Lock refuse pile design.	2018-2023	SHA/SCD
Interim milestone: Three of the 7 priorities have been addressed and are removing acidity and metal loadings from the watershed. OM&R is occurring on all constructed systems. Water quality should be improved by 50% at SR2 TMDL point (Table 3).		
Continue acquiring funding for rest of priorities including refuse pile removal depending on water quality at SR2 TMDL point.	2023-2027	PADEP/SHA/SCD
Interim milestone: All 7 priorities have been addressed (if needed) and water quality at SR2 has a pH 6.0-9.0, iron < 1.5 mg/L and aluminum < 0.75 mg/L and is net alkaline.		
Stream from Port Carbon upstream to headwaters reassessed	By 2029	PADEP

Specific Monitoring for Upper Schuylkill River

Monitoring of the passive treatment systems have been ongoing and will continue. The goal is to ensure that the systems are working at removing metals and acidity and adding alkalinity. Below is a table showing what parameters are being monitored on each of the built passive treatment systems and who is responsible. As systems are built they will be added on the schedule for monitoring.

Table 16. Monitoring of AMD Treatment Systems for Main Stem Headwaters of the Schuylkill River			
Systems monitored	Frequency	Responsible Party	Comments
Bell Colliery	pH, DO, specific conductance (~1x/ two weeks) Hach Kit total iron (~1x/month)	SCD & SHA	Grab sample as possible
Mary D Outflow	pH, DO, specific conductance (~1x/ two weeks) Hach Kit total iron (~1x/month)	SCD SHA	Grab sample as possible
Silver Creek Mine	pH, DO, specific conductance (~1x/ two weeks) Hach Kit total iron (~1x/month)	SCD SHA	Grab sample as possible
Mary D East	Monthly lab sample	PADEP	Grab sample and flow
Any new systems		SCD, SHA or PADEP	

Abbreviations:

Schuylkill Conservation District (SCD)

Pennsylvania Department of Environmental Protection (PADEP)

Schuylkill Headwaters Association (SHA)

Monitoring of the stream has been ongoing and will continue. TMDL points (Map 1, Appendix A) were chosen as monitoring points for several reasons. Background data from the TMDL shows what the stream was like before passive treatment systems were installed. Changes in the stream can be tracked and improvements can be seen with good background data. Also sampling at these points, the data can be used to see if TMDL's are being met.

Table 17. Monitoring of Stream at TMDL points for Main Stem Headwaters of the Schuylkill River			
In-stream Point Being Monitored	Type	Frequency	Responsible Party
Schuylkill Headwaters above Bell Colliery (S1)	TMDL	3 times/year	PADEP
Schuylkill Headwaters above Mary D overflow (S2A)	TMDL	3 times/year	PADEP
Schuylkill River at Middleport (SRM)	TMDL	3 times/year	PADEP
At New Philadelphia (SRNP)*	TMDL	3 times/year	PADEP
In Port Carbon Above Mill Creek Influence (SR2)	TMDL	Will be added in future	To be determined

*Actual Sampling point ½ mile downstream of original TMDL point but nothing of any significance flows into river

MILL CREEK

Pollution Sources (AMD Discharges) in Mill Creek Subwatershed

Mill Creek is in central Schuylkill County and flows 11.2 miles south/southwest from its headwaters near Interstate 81 and Mahanoy City to its confluence with the Schuylkill River in Port Carbon. Mill Creek is affected by pollution from AMD that has caused high levels of metals in Mill Creek. Major sources of AMD occur at five (5) abandoned deep mine discharges named the Morea Overflow, Repplier/Buck Mountain, Pine Forest and a newly formed discharge, Feeder Dam Colliery Discharge (See Map 3, Appendix A).

Table 18. Ranking of Priority AMD Discharges in Mill Creek Subwatershed

Overall Metals Rank in the Schuylkill River	Location in watershed starting at upstream point in Mill Creek	AMD Site Name	Status
3	1	Morea Mine Discharge (AMD162)	Not built
8	2	Repplier Mine (AMD166)	Not built
9	4	Pine Forest (AMD167)	Completed
*	3	Pine Forest Mine – Upper Discharge	New discharge – not built
*	5	Feeder Dam Colliery Discharge	New discharge – Not built

*Discharges that were not sampled during the original ranking

Discharge that has been addressed

The following is the discharge that now has a passive treatment system treating the water. Operation and maintenance continue for this system. It should be mentioned that even though a system is in place, it does not mean there will never be a need for more funding in the future for upgrades as the systems age.

- ***Pine Forest Mine:*** AMD comes from an old pump shaft in the Pine Forest Mine and contributes aluminum, iron, manganese and acidity into Mill Creek. A system consisting of an anoxic limestone drain, an aerobic settling pond and wetland cell treats the discharge that averages about 1,360 gal/min. The system was finished in 2007. Unfortunately, there is still a discharge named Pine Forest Mine-Upper Discharge that will be a priority to address and will be explained in more detail below.

Water Quality Improvements

To demonstrate improvements in the watershed after installation of projects a TMDL point is the best choice (See Map 1, Appendix A). This point serves as a background water quality data that can be used to compare quality after construction of the above treatment systems. In the case the TMDL point used is at the mouth of Mill Creek before it enters the Schuylkill River. Sampling completed in 2014/2015 is compared to the data collected in 2002-2003 for the TMDL. As

shown in the table below, there has been some improvements in acidity and aluminum, but more work needs done to improve water quality at the mouth.

Site	Timeframe	pH	Acidity	Alkalinity	Iron	Aluminum	Manganese
TMDL	2002-2003	6.28	28.67	14.71	3.091	1.126	1.793
Point M6	2014-2015	6.90	14.48	11.44	5.028	0.718	1.206

TMDL

The TMDL goal for this particular stretch of stream came from the M6 TMDL point located at the mouth Mill Creek before it enters the Schuylkill River. Goals were set using the Mill Creek TMDL approved in 2005. Reduction at the M6 point was calculated taking existing load and subtracting both the load tracked from upstream points and the allowable load at the point. Loadings from the only completed project, Pine Forest Mine Treatment system, are shown in the table.

	Project Name/ID	Project Cost	Load Reduction-Acidity (lbs/day)	Load Reduction-Aluminum (lbs/day)	Load Reduction-Iron (lbs/day)	Load Reduction-Manganese (lbs/day)
	Pine Forest (AMD167)	\$492,226	185.6	35.1	210.7	77.9
Total for Subwatershed			185.6	35.1	210.7	77.9
TMDL Load Reduction Required			7,084.94	167.93	583.51	272.67

Priorities and BMP's needed

The table below shows the BMP's needed for the priorities for this newly revised WIP. It should be noted that these are ranked based on their location in the watershed with the first priority being the furthest up in the stream. Ideally these would be addressed in this order, but this could change depend on metal rank, the status of landowner, ability to work with other partners, etc.

It must be stressed that these are probable project cost opinions and are based solely upon information from AMDTreat, experience with construction, and knowledge of the proposed sites. This requires a number of assumptions as to actual conditions which will be encountered on the site; the specific decisions of other design professionals engaged; the means and methods of construction the contractor will employ; the cost and extent of labor, equipment, and materials that the contractor will employ; the contractor's techniques in determining prices and market

conditions at the time; and other factors over which there is no control. Given these assumptions, which must be made, it is believed that the below probable project cost opinion to be a fair and reasonable estimate for project costs for each priority discharge.

Priority Discharge	Active or Passive	BMP Main component	Estimated Construction Costs	Estimated Operation and Maintenance Costs/year
Pine Forest Mine-Upper Discharge	Passive	Ponds and wetlands	\$700,000	\$25,000
Feeder Dam Colliery Discharge	Passive	Oxic Limestone drain	\$400,000	\$25,000
Morea Mine Discharge (AMD162)	Active	Some type of active with land reclamation	\$1,072,711	\$249,716
Replier Mine (AMD166)	Passive	Oxic Limestone Drain	745,371	\$27,104
TOTAL			\$2,918,082	\$326,820

New Priorities

- 1) *Pine Forest Mine - Upper Discharge:* This second discharge from the Pine Forest Mine is not being treated with the current Pine Forest Mine treatment system (See discharges addressed above). Treatment has not been constructed for this discharge yet though it is thought the type of system needed would consist of ponds and aerobic wetlands.

Pine Forest Mine	pH	Alkalinity (lbs/day)	Acidity (lbs/day)	Iron (lbs/day)	Aluminum (lbs/day)	Manganese (lbs/day)
Average water quality	5.85	32.57 mg/L	10.23 mg/L	13.6 mg/L	0.4 mg/L	5.3 mg/L
Loadings using 931 gpm			114.8	152.6	4.5	59.5
Assumed % removal after treatment			100	90	90	90
Loadings removed after treatment			114.8	137.4	4.0	53.5

*Data used was from data collected 2014-2015

2) **Feeder Dam Colliery Discharge:** A moderate flow, alkaline, high iron metal concentration discharge of isolated underground mine workings on Little Wolf Creek, a tributary of Mill Creek. A private landowner drilled a well for potable water and encountered the minepool in April 2015. This is the minepool that is connected to the Eagle Hill Mine mentioned in the Upper Schuylkill priorities which is now dry since the landowner lowered the level of the water in the mine. Additional monitoring is required to observe changes to the local hydrology and to evaluate treatment options.

Table 23. Predicted Load Reductions for the Feeder Dam Colliery Discharge

Feeder Dam Colliery	pH	Alkalinity (lbs/day)	Acidity (lbs/day)	Iron (lbs/day)	Aluminum (lbs/day)	Manganese (lbs/day)
Average water quality	6.82	195.2 mg/L	-150 mg/L	10.4 mg/L	<0.2 mg/L	2.2 mg/L
Loadings using 222 gpm				27.8		5.9
Assumed % removal after treatment				90		90
Loadings removed after treatment				25.0		5.3

*Data used was from data collected 2014-2015

3) **Morea Mine (AMD162):** This site is comprised of a strip mine pool overflow in the Mill Creek watershed in West Mahanoy Township. Upstream of the point water disappears and reappears at this overflow site. The site is still being investigated as a partnering venture for stream reclamation and likely treatment would need to be some form of an active system due to severe water quality.

Morea Mine (AMD162)	pH	Alkalinity (lbs/day)	Acidity (lbs/day)	Iron (lbs/day)	Aluminum (lbs/day)	Manganese (lbs/day)
Average water quality	3.68	0 mg/L	42.93 mg/L	5.49 mg/L	3.88 mg/L	1.49 mg/L
Loadings using 9,631 gpm			4,984	637.4	450.5	173.0
Assumed % removal after treatment			100	90	90	90
Loadings removed after treatment			4,984	573.7	405.5	155.7

*Data used was from data collected 2014-2015

- 4) **Replier Mine Tunnel (AMD166):** This discharge is a big contributor of iron to Mill Creek. More flow and chemical data is needed to determine potential treatment possibilities. One option may be to breach barrier pillar and send flow to Pine Knot Mine workings if suitable space for treatment system (active or passive) isn't found.

Repplier Mine Tunnel (AMD166)	pH	Alkalinity (lbs/day)	Acidity (lbs/day)	Iron (lbs/day)	Aluminum (lbs/day)	Manganese (lbs/day)
Average water quality	6.14	39.77 mg/L	4.74 mg/L	15.6 mg/L	0.25 mg/L	4.3 mg/L
Loadings using 1985 gpm			133.4	373.3	6.0	102.9
Assumed % removal after treatment			100	90	90	90
Loadings removed after treatment			133.4	336.0	5.4	92.6

Total Load Reductions

Using the load reductions from completed and future systems the TMDL table can be examined again to see what results could be expected. Each system provides a measurable milestone of loadings removed. When all priorities are addressed the load reductions called for in the TMDL for the metals should be met. The table still shows the need to reduce acidity.

One item that is not shown in the loadings tables is the amount of alkalinity that is produced in treatment systems. This alkalinity will buffer the leftover acidity in the stream. Therefore, acidity will be reduced more than is shown below in Table 26, the stream will be net alkaline and hopefully water quality should be improved enough to restore the subwatershed.

Table 26. Project and TMDL information for Mill Creek Subwatershed with Projected Load Reductions					
	Project Name/ID	Load Reduction-Acidity (lbs/day)	Load Reduction-Aluminum (lbs/day)	Load Reduction-Iron (lbs/day)	Load Reduction-Manganese (lbs/day)
Loadings of finished systems		185.6	35.1	210.7	77.9
Construction milestones	Pine Forest Mine – Upper Discharge	114.8	4.0	137.4	53.5
	Feeder Dam Colliery Discharge	0	0	25	5.3
	Morea Mine Discharge (AMD162)	4,984	405.5	873.7	155.7
	Repplier Mine (AMD166)	133.4	5.4	336.0	92.6
Total for Subwatershed		5,417.8*	450.0	1,282.8	385.0
TMDL Load Reduction Required		7,084.94	167.93	583.51	272.67

*Even though it appears that acidity still needs decreased, excess alkalinity from treatment systems will help neutralized remaining acidity.

Schedule for Implementation

The main milestone for this section of the stream is the restoration of Mill Creek. The table below shows steps in reaching this milestone. One item to mention at this point is that there has been some interest in working with PA Bureau of Abandoned Mine Reclamation and developing a Qualified Hydrologic Unit Plan for the watershed. This would create an opportunity for funding from the PA AMD Set-aside Program. This is included as a milestone for Mill Creek.

Table 27. Timeline and Milestones for Mill Creek Subwatershed		
Timeline and Milestones	Dates	Responsible Parties
Continue OM&R on Pine Forest Mine Passive treatment system	Ongoing	SHA/SCD/PADEP
Interim Milestone: Provide OM&R on 1 constructed system so it continues to function and remove acidity and metal loadings from the watershed.		
Acquire funding to address priority discharges. Develop a QHUP for Set-Aside funding.	2018-2023	SHA/SCD
Interim milestone: Two of the 4 priorities have been addressed and are removing acidity and metal loadings from the watershed. OM&R is occurring on all constructed systems. Water quality should be improved by 50% at M6 TMDL point (Table 19).		
Continue acquiring funding for rest of priorities depending on water quality M6 TMDL point.	2023-2027	PADEP/SHA/SCD
Interim milestone: All 4 priorities have been addressed (if needed) and water quality at M6 has a pH 6.0-9.0, iron < 1.5 mg/L and aluminum < 0.75 mg/L and is net alkaline.		
Stream from mouth to headwaters reassessed	By 2029	PADEP

Specific Monitoring for Mill Creek

Treatment Systems

Monitoring of the passive treatment systems have been ongoing and will continue. The goal is to ensure that the systems are working at removing metals and acidity and adding alkalinity. Below is a table showing what parameters are being monitored on each of the built passive treatment systems and who is responsible. As systems are built they will be added on the schedule for monitoring.

Table 28. Monitoring of AMD Treatment Systems for Mill Creek Subwatershed			
Systems monitored	Frequency	Responsible Party	Comments
Pine Forest Mine	pH, DO, specific conductance (~1x/ two weeks) Hach Kit total iron (~1x/month)	SCD & SHA	Grab sample as possible
Any new systems		SCD, SHA or PADEP	

Abbreviations:

Schuylkill Conservation District (SCD)

Pennsylvania Department of Environmental Protection (PADEP)

Schuylkill Headwaters Association (SHA)

Stream Monitoring

Monitoring of the stream should continue after another system has been constructed by one of the project partners. Monitoring in 2014-2015 after construction of the Pine Forest Mine treatment system showed some improvement but more work needed to be done. The TMDL point M6 (Table 19) was chosen as a monitoring point for several reasons. Background data from the TMDL shows what the stream was like before passive treatment systems were installed. Changes in the stream can be tracked and improvements can be seen with good background data. Also sampling at this point the data can be used to see if TMDL's are being met.

Table 29. Monitoring of Stream at TMDL points for Mill Creek Subwatershed			
In-stream Point Being Monitored	Type	Frequency	Responsible Party
Mouth of Mill Creek (M6)	TMDL	Will be sampled after installation of 2 of the priorities 3/times year	SCD/SHA/PADEP

WEST BRANCH

SCHUYLKILL

RIVER

Pollution Sources (AMD Discharges) in West Branch Subwatershed

The West Branch is in central Schuylkill County, Pa. and encompasses many communities that include Minersville, Pottsville, and Cressona (See Map 4, Appendix A). The Pine Knot/Oak Hill Tunnel discharges AMD directly into the West Branch Schuylkill River. It is the largest single source of AMD in the entire Upper Schuylkill River Watershed. The Oak Hill Boreholes are another source of AMD that also discharges directly to the West Branch Schuylkill River. The boreholes are an overflow point for several connected mine pools outside the Heckscherville Valley. Sources of AMD are nonexistent once the West Branch Schuylkill River flows south of Sharp Mountain and out of the Southern Anthracite Coalfield. West West Branch and Muddy Branch are tributaries to the West Branch. The one priority in the West West Branch will be covered under this subwatershed. Muddy Branch will be covered later in this watershed implementation plan.

Overall Metals Rank in the Schuylkill River	Location in West Branch Subwatershed starting at upstream point	AMD Site Name	Status
2	1	Pine Knot Mine (AMD187)	Not built
5	2	Oak Hill Boreholes (AMD188)	Not built
22	1 (West West Branch)	Neumeister Mine/Buck Mtn Drift (AMD314)	Not built

Projects that have been completed

Many of the following projects have all been completed deal mostly with the flow of water exiting the Pine Knot discharge. The goal of much of the work done so far in the watershed is to try to keep as much excess water out of the dep mine workings that feed the discharge.

- ***Mackeysburg*** – Stormwater run-off accumulated in cropfalls located along Valley Road, near Mackeysburg. This water would then infiltrate down thru the subsidence features into the minepool below only to resurface from the Pine Knot discharge. A drop inlet box was constructed to capture stormwater from a cross pipe under Valley Road on the west end of the cropfalls. This inlet structure diverted the stormwater thru a pipe to a tributary to the West Branch of the Schuylkill River thereby preventing the water from entering the minepool. On the east side of the cropfalls, a swale was constructed to divert stormwater into a large culvert placed under Valley Road, also preventing stormwater from accumulating into the cropfalls. These two features were constructed in 2007 and continue to work well today. Project was funded by William Penn Foundation.
- ***Glen Dower Breach*** – During the high-water flooding event of 2006, a small pond along Valley Road near Glen Dower breached, sending the stream channel into an abandoned dewatering coal refuse dam. The stream severely eroded the coal refuse sending tons of the sediment into the West Branch of the Schuylkill River. Every subsequent rainfall after that event left the West Branch running black for days from the sedimentation. The stream channel was restored during a project completed in November 2011 with a Schuylkill River Restoration Grant

of \$60,000. The stream channel was re-established and lined using very large rip-rap. The reconstructed channel diverted the stream around the abandoned coal refuse dam keeping the water clean. The stream channel continues to work well.

- **Oak Hill Mine:** A Growing Greener Grant (West Creek Flow Loss Assessment & Remediation Plan) was awarded in 2013 to determine areas of flow loss from West Creek into the Oak Hill Mine workings and develop mitigation strategy.

- **Wheeler Run Flume** -An old wooden flume erected to prevent water from entering the minepool by miners many years ago was rotting and allowed surface water to spill into the original stream channel and infiltrate into the minepool. This water then emerged at the Pine Knot discharge. The flume was removed, and the stream channel secured to prevent streamflow loss to the mine pool below. Construction completed September 2010. Stream channel was excavated and reconstructed using fabric liner underneath rip-rap. The rip-rap was then grouted with cement. No flow loss occurs now.

- **West Branch Headwaters Phase I** – Nearly 1,800 linear feet of the West Branch and tributary Dyer Run was lined with an impervious liner to reduce flow into the Pine Knot Mine workings. Construction as complete in 2012. This project also helps keep a perennial flow in the West Branch above the Pine Knot Discharge.

- **West Branch Headwaters Phase II** – This project was the design and permitting of another 2,500 linear feet of the West Branch that needs to be lined. This project also looked at also implementing practices that would reduce the potential for flooding.

- **Wagner Run** - The stream channel was overtopping in heavy rains sending clean water into a stripping to end up in the minepool. This water then emerged at the Pine Knot discharge. The stream channel was reconstructed with higher berms and a swale along the access road to the nearby mine was established. This work ensured the stream would not over top in high water events. The streamflow was observed during Tropical Storm Sandy. No stream loss occurred during that high-water event.

Water Quality Improvements

To demonstrate improvements in the watershed after installation of projects a TMDL point is the best choice (See Map 1, Appendix A). This point serves as a background water quality data that can be used to compare quality after construction of the above treatment systems. In the case the TMDL point that can be used is WB4, a point just upstream of a confluence of another major tributary, West West Branch. Since the two major discharges have not been addressed no known sampling has occurred at TMDL point WB4.

Site	Timeframe	pH	Acidity	Alkalinity	Iron	Aluminum	Manganese
WB4 TMDL Point	2002-2003	6.6	3.78	47.9	4.629	1.061	2.538
WB6 TMDL Point	2002-2003	6.96	0	38.15	2.24	0.9	1.45

TMDL

The TMDL goal for this particular stretch of stream came from the WB6 TMDL point located near the mouth of West Branch. Goals were set using the West Branch TMDL approved in 2005. Reduction at the WB6 point was calculated taking existing load and subtracting both the load tracked from upstream points and the allowable load at the point. No AMD treatment projects have been completed. Therefore, no reductions have been shown.

	Project Name/ID	Project Cost	Load Reduction-Acidity (lbs/day)	Load Reduction-Aluminum (lbs/day)	Load Reduction-Iron (lbs/day)	Load Reduction-Manganese (lbs/day)
None						
Total for Subwatershed			0	0	0	0
TMDL Load Reduction Required			0	246.78	798.01	245.98

Priorities and BMP's needed

The table below shows the BMP's needed for the priorities for this newly revised WIP. It should be noted that these are ranked based on their location in the watershed with the first priority being the furthest up in the stream. Ideally these would be addressed in this order, but this could change depend on the metal rank, status of landowner, ability to work with other partners, etc.

It must be stressed that these are probable project cost opinions and are based solely upon information from AMDTreat, experience with construction, and knowledge of the proposed sites. This requires a number of assumptions as to actual conditions which will be encountered on the site; the specific decisions of other design professionals engaged; the means and methods of construction the contractor will employ; the cost and extent of labor, equipment, and materials that the contractor will employ; the contractor's techniques in determining prices and market conditions at the time; and other factors over which there is no control. Given these

assumptions, which must be made, it is believed that the below probable project cost opinion to be a fair and reasonable estimate for project costs for each priority discharge.

Table 33. AMD Treatment Systems Needed in the West Branch Subwatershed				
Priority Discharge	Active or Passive	BMP Main component	Estimated Construction Costs	Estimated Operation and Maintenance Costs/Year
Pine Knot Mine (AMD187)	Active	Some type of active	\$1,091,763	\$121,440
Oak Hill Boreholes (AMD188)	Active	Some type of active	\$521,793	\$52,981
Neumeister Mine/Buck Mtn Drift (AMD314)	Passive	Vertical Flow Wetland	\$516,328	\$18,776
TOTAL			\$2,129,884	\$193,197

New Priorities

1) *Pine Knot Tunnel (AMD187)*: This discharge has a high flow (up to 30,000 gpm) and high iron and aluminum concentrations. The Pine Knot discharge has been designated as the top priority for the Schuylkill Action Network Abandoned Mine Drainage team. Issues dealing with the discharge are complex. A joint effort between the US Army Corps of Engineers, DEP and US Geological Survey is underway to understand the hydrology and recharge points of the Pine Knot Tunnel Discharge mine complex. The Schuylkill Conservation District submitted a Restoration Plan to the Set-Aside Program administered by PA BAMR for review. The plan would look at treating the Oak Hill Boreholes & Pine Knot Tunnel under one large active treatment system. An active treatment system is needed for this discharge due to its volume and site constraints. Discussions are being held with the property owner, a local coal company, to utilize area near the discharge. Currently the property owner has plans to mine in the proposed treatment area and has provided an alternative location for treatment. The alternative location would require extensive pumping of the Pine Knot Mine pool. The alternative location is being evaluated to determine the physical and economic feasibility. Should the alternative location be found not feasible, the area near the discharge will be explored once mining operations are completed.

Table 34. Predicted Load Reductions for the Pine Knot Tunnel						
Pine Knot Tunnel (AMD187)	pH	Alkalinity (lbs/day)	Acidity (lbs/day)	Iron (lbs/day)	Aluminum (lbs/day)	Manganese (lbs/day)
Average water quality	6.13	31.19 mg/L	-7.87 mg/L	7.1 mg/L	1.59 mg/L	3.44 mg/L
Loadings using 10,593 gpm				889.6	199.2	431.0
Assumed % removal after treatment				90	90	90
Loadings removed after treatment				800.6	179.3	387.9

2) **Oak Hill Mine (AMD188):** This discharge provides the majority of flow to the West Branch Schuylkill River north of Minersville. The cold-water discharge (3,860 gpm) flows from a complex of 9 separate seep areas, 6 boreholes, and a drainage tunnel. A treatment system of open limestone channels was installed. However, project budget constraints did not allow for maintenance measures to clean out the channels which have become heavily clogged with iron sludge. Smaller discharges downstream of the road could be treated by wetlands to remove iron. This site could benefit from upstream stream and land restoration to reduce water flow into the mine. A Growing Greener Grant (West Creek Flow Loss Assessment & Remediation Plan) was awarded to determine areas of flow loss from West Creek (a tributary to the west) into the Oak Hill Mine workings and develop mitigation strategy. Despite the heavy iron precipitate covering the stream bottom, the West Branch supports a naturally reproducing population of brook trout downstream of the discharge. Treatment of the discharges should result in reduction of precipitated iron but may also cause a warming of stream water with a potential to affect the trout. A treatment system at this site would not only reduce significant loadings to the river but would also provide significant visible reduction in iron sediment in the river. Due to various space constrains, an active treatment system may be required.

Another Growing Greener Grant (Oak Hill Boreholes Restoration Project Feasibility Study) was awarded to develop a conceptual treatment system for the Oak Hill Boreholes. The project under the Growing Greener Grant was modified to develop a treatment strategy for both the Oak Hill Boreholes and Pine Knot Tunnel. As stated above the

Schuylkill Conservation District submitted a Restoration Plan to the Set-Aside Program administered by PA BAMR for review. The plan would look at treating the Oak Hill Boreholes & Pine Knot Tunnel under one large active treatment system. Currently PA BAMR AMD Set-Aside Staff are coordinating with the landowner on the feasibility of the treatment system project. The visibility of these reductions would create an even greater benefit to the nearby communities and revitalization efforts of Schuylkill County.

Oak Hill Borehole (AMD188)	pH	Alkalinity (lbs/day)	Acidity (lbs/day)	Iron (lbs/day)	Aluminum (lbs/day)	Manganese (lbs/day)
Average water quality	6.22	111.07 mg/L	-74.4 mg/L	14.44 mg/L	0.56 mg/L	4.18 mg/L
Loadings using 2,844 gpm				495.1	19.1	143.3
Assumed % removal after treatment				90	90	90
Loadings removed after treatment				445.6	17.2	129.0

One of the strategies to treat the Pine Knot and Oak Hill Boreholes discharges are to complete projects that keep the water out of the mine pool, thus decreasing the amount of water to treat. In 2008, the Pine Knot Watershed Study was completed. This listed several projects all with the same goal, keeping water on the surface and not entering the mine pool through cracks in the stream beds. As seen above, many projects have been completed that consisted of lining streams to keep water on the surface. By keeping water out of the mine pool, there will be less to treat with the system. A similar study was completed on West Creek. The West Creek Flow Loss Assessment & Remediation plan identified an area of stream where flow loss occurs. Implementation of as many of these projects as possible will help reduce the amount of flow coming out of the Pine Knot and Oak Hill discharges. Priority projects still to do are below:

Table 36. Water Loss Projects		
Site	AMD Discharge Impacted	Approximate Costs
Valley Road Culvert Area	Pine Knot	\$240,000
Replier Area	Pine Knot	\$440,000
Pine Knot Pit	Pine Knot	\$340,000
West Branch Schuylkill – Headwaters Phase 3	Pine Knot	\$510,000
West Branch Schuylkill – Headwaters Phase 4	Pine Knot	\$475,000
Pott Bannon Area	Pine Knot	\$465,000
Whimsey Pond Area	Pine Knot	\$215,000
West Creek	Oak Hill Boreholes	\$2,500,000
TOTAL		\$5,185,000

3) Neumeister Mine/Buck Mtn Drift (AMD314):

Abandoned mine drainage from the Neumeister discharge contributes metals and acidity to the West Creek, a tributary to West West Branch, a tributary to West Branch, Schuylkill River. The discharge flows into a man-made ditch that diverts the polluted water away from West Creek and prevents it from going into the Crystal Run Reservoir, a municipal water supply for the borough of Forestville. However, the diversion takes the water into an abandoned mine pit that has no surface outlet. The water in this pit ends up at the Pine Knot discharge through the underground mine pool. Future treatment would keep water out of the mine pool and possibly provide extra water for the Crystal Run Reservoir.

Table 37. Predicted Load Reductions for Neumeister Mine						
Neumeister Mine (AMD314)	pH	Alkalinity (lbs/day)	Acidity (lbs/day)	Iron (lbs/day)	Aluminum (lbs/day)	Manganese (lbs/day)
Average water quality	3.45	0.14 mg/L	47.87 mg/L	3.87 mg/L	3.55 mg/L	1.84 mg/L
Loadings using 595 gpm			343.4	27.8	25.5	13.2
Assumed % removal after treatment			100	90	90	90
Loadings removed after treatment			343.4	25	23	11.9

Total Load Reductions

Using the load reductions from completed and future systems the TMDL table can be examined again to see what results could be expected. Each system provides a measurable milestone of loadings removed. When the three priorities are addressed the load reductions called for in the TMDL should be met, even though the numbers indicate aluminum will not be. This could be for a couple of reasons. One is that flow rates are variable over time. Mean flow of the discharges at the time for the TMDL could be different from the mean flow of discharges now, which is what has been used to calculate the reductions for this revision. Since amount of loadings is based on flow, there can be huge differences trying to compare flows, and in turn loadings of acidity and metals, in different time periods. Second, the calculations for the systems are based on a conservative 90% removal rate for the metals. In reality, there will be a higher percentage removed in treatment, especially active. If each system had 100% removal rate, aluminum would be met.

Table 38. Project and TMDL information for West Branch Subwatershed.					
	Project Name/ID	Load Reduction-Acidity (lbs/day)	Load Reduction-Aluminum (lbs/day)	Load Reduction-Iron (lbs/day)	Load Reduction-Manganese (lbs/day)
Loadings of finished systems		0	0	0	0
Priorities	Pine Knot Mine (AMD187)	0	179.3	800.6	387.9
	Oak Hill Boreholes (AMD188)	0	17.2	445.6	129
	Neumeister Mine (AMD314)	343.4	23	25	11.9
Total for Subwatershed		343.4	219.5*	1271.2	528.8
TMDL Load Reduction Required		0	246.78*	798.01	245.98

*Due to variabilities in flow and removal rates, it is believed the reduction required for aluminum will be met with the systems.

Schedule for Implementation

The main milestone for this section of the stream is the restoration of the West Branch Schuylkill River. The table below shows steps in reaching this milestone. Again, it needs mentioned that a Qualified Hydrologic Unit Plan is in review with PA BAMR. This would create an opportunity for funding from the PA AMD Set-aside Program. This is included as a milestone for the West Branch Schuylkill River.

Table 39. Timeline and Milestones for West Branch Subwatershed		
Timeline and Milestones	Dates	Responsible Parties
Review and acceptance of Qualified Hydrologic Unit Plan	2021	SHA/SCD/PADEP
Interim Milestone: Approved Qualified Hydrologic Unit Plan		
Acquire funding to address West West Branch priority discharge along with water loss projects.	2020-2025	SHA/SCD/PADEP
Interim milestone: Priorities have been addressed and are removing acidity and metal loadings form the watershed. OM&R is occurring on all constructed systems. The water quality at WB4 (Table 31) is showing improvement.		
Acquire funding to address West Branch priority discharges.	2025-2028	SHA/SCD/PADEP
Interim milestone: The two priorities have been addressed and are removing acidity and metal loadings form the watershed. OM&R is occurring on all constructed systems. The water quality at WB4 and WB6 (Table 30) has a pH 6.0-9.0, iron < 1.5 mg/L and aluminum < 0.75 mg/L and is still net alkaline.		
Stream from mouth to headwaters reassessed	By 2029	PADEP

Specific Monitoring for West Branch Schuylkill River

Treatment Systems

Once systems are built monitoring will begin. The goal is to ensure that the systems are working at removing metals and acidity and adding alkalinity. Below is a table showing what parameters will be monitored on each of the built treatment systems and who is responsible. As systems are built they will be added on the schedule for monitoring.

Table 40. Monitoring of AMD Treatment Systems for West Branch Subwatershed			
Systems monitored	Frequency	Responsible Party	Comments
Any new systems	pH, DO, specific conductance (~1x/ two weeks) Hach Kit total iron (~1x/month)	SCD, SHA or PADEP	Grab sample as possible

Abbreviations:

Schuylkill Conservation District (SCD)

Pennsylvania Department of Environmental Protection (PADEP)

Schuylkill Headwaters Association (SHA)

Stream Monitoring

Monitoring of the stream should commence once the priorities are addressed. The TMDL points WB4 and WB6 (Table 31) was chosen as monitoring points for several reasons. Background data from the TMDL shows what the stream was like before treatment systems were installed. Changes in the stream can be tracked and improvements can be seen with good background data. Also sampling at these points the data can be used to see if TMDL's are being met.

In-stream Point Being Monitored	Type	Frequency	Responsible Party
West Branch upstream of West West Creek (WB4)	TMDL	Will be sampled once priorities are addressed 3 times/year	SCD/SHA/PADEP
West Branch at mouth (WB6)	TMDL	Will be sampled once priorities are addressed 3 times/year	SCD/SHA/PADEP

MUDDY BRANCH
(TRIBUTARY OF
WEST WEST
BRANCH)

Pollution Sources (AMD Discharges) in Muddy Branch Subwatershed

Muddy Branch is in Branch Dale, Pa. in Western Schuylkill County (See Map 4, Appendix A). The main source of AMD is from the Otto Mine Pool, which formed after the Otto Colliery closed and the workings were allowed to flood. Along with the Otto Primary Discharge, three other deep mine discharges exist near the headwaters and are known as the Otto Secondary Discharge, Primrose Slope Discharge and Whitepipe Discharge.

Priorities for Muddy Run

Table 42. Ranking of Priority AMD Discharges in Muddy Run Subwatershed			
Overall Metals Rank in the Schuylkill River	Location in the Muddy Branch subwatershed starting at upstream point	AMD Site Name	Status
4	4	Otto Mine Primary Airshaft (AMD190)	Completed (#2321)
20	3	Otto Mine Secondary (AMD189)	Not built
21	1	Primrose Slope Discharge (AMD317)	Not built
27	2	Whitepipe Discharge (AMD318)	Not built

Discharges that have been addressed

The following is the discharge that now has a passive treatment system treating the water. Operation and maintenance continues on this system. It should be mentioned that even though a system is in place, it does not mean there will never be a need for more funding in the future for upgrades as the systems age.

- ***Otto Colliery Airshaft Discharge (AMD190):*** This discharge originates from an old airshaft of the Otto Colliery and contributes most of the flow of water in the Muddy Branch. The treatment system consists of an oxidation /settling pond, a series of two shallow wetland treatment cells and an oxic limestone drain (OLD). The purpose of the OLD at the end is to maintain ground-water temperatures and remove some dissolved metals while adding alkalinity. The system is designed and built to treat up to 2,600 gallons per minute of water. The system was finished in 2006 (Project #2321) and was funded in 2017 (Project #1713) for modifications.

Water Quality Improvements

To demonstrate improvements in the watershed after installation of projects a TMDL point is the best choice (See Map 1, Appendix A). This point serves as a background water quality data that can be used to compare quality after construction of the above treatment systems. In this case

the TMDL point that can be used is MB6, a point at the mouth of Muddy Branch. Since only one of the priority discharges have been addressed no known monitoring is occurring at this point at this time.

Site	Timeframe	pH	Acidity	Alkalinity	Iron	Aluminum	Manganese
TMDL Point MB6	2002-2003	6.72	5.22	31.71	3.03	1.46	1.26

TMDL

The TMDL goal for this particular stretch of stream came from the MB6 TMDL point located at the mouth of Muddy Branch. Goals were set using the Muddy Branch TMDL approved in 2005. Reduction at the MB6 point was calculated taking existing load and subtracting both the load tracked from upstream points and the allowable load at the point. Loadings from the only completed project, Otto Colliery Airshaft system, are shown in the table.

	Project Name/ID	Project Cost	Load Reduction-Acidity (lbs/day)	Load Reduction-Aluminum (lbs/day)	Load Reduction-Iron (lbs/day)	Load Reduction-Manganese (lbs/day)
	Otto Colliery Airshaft Discharge/ 2321	\$457,220	0	45.5	335.2	73.1
Total for Subwatershed			0	45.5	335.2	73.1
TMDL Load Reduction Required			3.03	52.22	106.92	1

Priorities and BMP’s needed

The table below shows the BMP’s needed for the priorities for this newly revised WIP. It should be noted that these are ranked based on their location in the watershed with the first priority being the furthest up in the stream. Ideally these would be addressed in this order, but this could change depend on metal rank, the status of landowner, ability to work with other partners, etc.

It must be stressed that these are probable project cost opinions and are based solely upon information from AMDTreat, experience with construction, and knowledge of the proposed sites. This requires a number of assumptions as to actual conditions which will be encountered on the site; the specific decisions of other design professionals engaged; the means and methods of construction the contractor will employ; the cost and extent of labor, equipment, and materials

that the contractor will employ; the contractor's techniques in determining prices and market conditions at the time; and other factors over which there is no control. Given these assumptions, which must be made, it is believed that the below probable project cost opinion to be a fair and reasonable estimate for project costs for each priority discharge.

Table 45. AMD Treatment Systems Needed in the Muddy Branch Subwatershed				
Priority Discharge	Active or Passive	BMP Main component	Estimated Construction Costs	Estimated Operation and Maintenance Costs/year
Primrose Slope Discharge (AMD317)	Passive	Vertical Flow Wetland	\$422,667	\$15,370
Whitepipe Discharge (AMD318)	Passive	Aerobic Wetland	\$250,000	\$15,000
Otto Mine Secondary (AMD189)	Passive	Aerobic Pond	\$158,201	\$5,753
TOTALS			\$830,868	\$36,123

New Priorities

- 1) *Primrose Slope Discharge (AMD317)* This one seems to only now flow very irregularly and temporary. Further investigation is warranted because it is a high source of acidity and aluminum.

Primrose Slope Discharge (AMD317)	pH	Alkalinity (lbs/day)	Acidity (lbs/day)	Iron (lbs/day)	Aluminum (lbs/day)	Manganese (lbs/day)
Average water quality	3.93	2.57 mg/L	41.1 mg/L	0.89 mg/L	5.67 mg/L	2.44
Loadings using 544 gpm			272.2	5.8	31.2	16
Assumed % removal after treatment			100	90	90	90
Loadings removed after treatment			272.2	5.2	28.1	14.4

2) *White Pipe (White Stone Seep/Maple Springs) Discharge (AMD318)*: Further investigation of flow and chemistry of this discharge and series of ponds that it flows through before entering Muddy Branch is needed especially with the amount of iron present.

White Pipe Discharge (AMD318)	pH	Alkalinity (lbs/day)	Acidity (lbs/day)	Iron (lbs/day)	Aluminum (lbs/day)	Manganese (lbs/day)
Average water quality	6.58	76.35 mg/L	-38.42 mg/L	14.22 mg/L	0.27 mg/L	1.27 mg/L
Loadings using 170 gpm				29.1	0.55	2.6
Assumed % removal after treatment				90	90	90
Loadings removed after treatment				26.2	0.5	2.3

- 3) ***Otto Secondary Discharge (AMD189)***: Discharge appears to be a shaft opening along Muddy Branch, ¾-mile upstream of the Otto Colliery Airshaft (Otto Primary) Discharge. It creates a small wetland before entering Muddy Branch where it coats the streambed orange with iron and at times white with aluminum down to where the Otto Colliery Airshaft Discharge enters Muddy Branch. Flow and chemical monitoring is needed to determine potential treatment options as site space is limited near the discharge.

Table 48. Predicted Load Reductions for the Otto Secondary Discharge

Otto Secondary Discharge	pH	Alkalinity (lbs/day)	Acidity (lbs/day)	Iron (lbs/day)	Aluminum (lbs/day)	Manganese (lbs/day)
Average water quality	6.42	33.36 mg/L	-15.4 mg/L	5.39 mg/L	0.83 mg/L	2.0 mg/L
Loadings using 576 gpm				37.4	5.8	13.9
Assumed % removal after treatment				90	90	90
Loadings removed after treatment				33.7	5.2	12.5

Total Load Reductions

Using the load reductions from completed and future systems the TMDL table can be examined again to see what results could be expected. Each system provides a measurable milestone of loadings removed. When all the priorities are addressed the load reductions called for in the TMDL should be met.

	Project Name/ID	Load Reduction-Acidity (lbs/day)	Load Reduction-Aluminum (lbs/day)	Load Reduction-Iron (lbs/day)	Load Reduction-Manganese (lbs/day)
Loadings of finished systems		0	45.5	335.2	73.1
Priorities	Otto Mine Secondary (AMD189)		5.2	33.7	12.5
	Primrose Slope Discharge (AMD317)	272.2	28.1	5.2	14.4
	Whitepipe Discharge (AMD318)		0.5	26.2	2.3
Total for Subwatershed		272.2	78.8	400.3	102.3
TMDL Load Reduction Required		3.03	52.22	106.92	1

Schedule for Implementation

The main milestone for this section of the stream is the restoration of Muddy Branch. The table below shows steps in reaching this milestone.

Timeline and Milestones	Dates	Responsible Parties
Continue OM&R on Otto Colliery Airshaft (Primary) Discharge Passive treatment system	Ongoing	SHA/SCD
Interim Milestone: Provide OM&R on 1 constructed system so it continues to function and remove acidity and metal loadings from the watershed.		
Acquire funding to address one of the priority discharges.	2025-2028	SHA/SCD
Interim milestone: One of the 3 priorities have been addressed and are removing acidity and metal loadings from the watershed. OM&R is occurring on all constructed systems. Water quality should be improved by 50% at MB6 TMDL point (Table 41).		
Continue acquiring funding for rest of priorities depending on water quality MB6 TMDL point.	2027-2030	PADEP/SHA/SCD
Interim milestone: All 4 priorities have been addressed (if needed) and water quality at MB6 has a pH 6.0-9.0, iron < 1.5 mg/L and aluminum < 0.75 mg/L and is net alkaline.		

Stream from mouth to headwaters reassessed	By 2030	PADEP
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Specific Monitoring for Muddy Branch

Treatment Systems

Monitoring of the passive treatment system have been ongoing and will continue. The goal is to ensure that the system is working at removing metals and acidity and adding alkalinity. Below is a table showing what parameters are being monitored on each of the built passive treatment systems and who is responsible. As systems are built they will be added on the schedule for monitoring.

Systems monitored	Frequency	Responsible Party	Comments
Otto Colliery Airshaft (Primary) Discharge	pH, DO, specific conductance (~1x/ two weeks) Hach Kit total iron (~1x/month)	SCD & SHA	Grab sample as possible
Any new systems		SCD, SHA or PADEP	

Abbreviations:

Schuylkill Conservation District (SCD)

Pennsylvania Department of Environmental Protection (PADEP)

Schuylkill Headwaters Association (SHA)

Stream Monitoring

Monitoring of the stream should commence once one more of the priorities are addressed. The TMDL point MB6 (Table 43) was chosen as a monitoring point for several reasons. Background data from the TMDL shows what the stream was like before passive treatment systems were installed. Changes in the stream can be tracked and improvements can be seen with good background data. Also sampling at this point the data can be used to see if TMDL's are being met.

In-stream Point Being Monitored	Type	Frequency	Responsible Party
Mouth of Muddy Branch (MB6)	TMDL	Will be sampled after installation of 2 of the priorities 3/times year	SCD/SHA/PADEP

LITTLE
SCHUYLKILL
RIVER

Pollution Sources (AMD Discharges) in Little Schuylkill River Subwatershed

The Little Schuylkill River Watershed is in eastern Schuylkill County, about a mile south of Haddock, Pa (See Appendix A, Map 5). The Little Schuylkill River flows 31.44 miles south from its headwaters near Haddock in Kline Township, Schuylkill County to its confluence with the Schuylkill River at Port Clinton in West Brunswick Township, Schuylkill County.

The Little Schuylkill River Watershed is affected by pollution from AMD. This pollution has caused high levels of metals and low pH in the main stem of the Little Schuylkill River at numerous sources as well as from two tributaries, the Wabash and Panther Creeks. AMD begins near the headwaters from the Silverbrook Discharge. Sources of AMD are nonexistent once the Little Schuylkill River flows south of Sharp Mountain and out of the Southern Anthracite Coalfield.

Table 53. Ranking of Priority AMD Discharges in Little Schuylkill River Subwatershed

Overall Metals Rank in the Schuylkill River	Location in Little Schuylkill River subwatershed starting at upstream point	AMD Site Name	Status
7	1	Silverbrook Mine (AMD110)	

Discharge that have been addressed

- **Silverbrook Diversion Wells:** The Silverbrook Mine discharge was the result of abandonment of an extensive deep mine that became inundated to form a huge mine pool. It is still one of the largest discharges and contributors to the headwaters of the Little Schuylkill River Watershed. PA-DEP, BAMR installed a series of limestone diversion wells in 1996 to divert water from the discharge for treatment of the acidic waters before flowing into the Little Schuylkill River. At this point these are not functioning. Therefore, even though a system was built, this discharge will be a priority to be addressed.

Water Quality Improvements

To demonstrate improvements in the watershed after installation of projects a TMDL point is the best choice (See Map 1, Appendix A). This point serves as a background water quality data that can be used to compare quality after construction of the above treatment systems. In this case the TMDL point that can be used is LS9, a point on Little Schuylkill River upstream of Wabash Creek and Panther Creek. No known monitoring is occurring at this point at this time.

Table 54. Water Quality at Selected Site in Little Schuylkill River Subwatershed

Site	Timeframe	pH	Acidity (mg/L)	Alkalinity (mg/L)	Iron (mg/L)	Aluminum (mg/L)	Manganese (mg/L)
TMDL Point LS9	2000	6.8	4.3	12.5	0.42	<0.5	0.09

TMDL

The TMDL goal for this particular stretch of stream came from the LS9 TMDL point located upstream of two major tributaries, Wabash Creek and Panther Creek. Goals were set using the Little Schuylkill River TMDL approved in 2007. Reduction at the LS9 point was calculated taking existing load and subtracting both the load tracked from upstream points and the allowable load at the point. Even though diversion wells were built, they are not functioning. Therefore, no reductions have been shown.

Table 55. Project and TMDL information for Little Schuylkill River Subwatershed.						
	Project Name/ID	Project Cost	Load Reduction-Acidity (lbs/day)	Load Reduction-Aluminum (lbs/day)	Load Reduction-Iron (lbs/day)	Load Reduction-Manganese (lbs/day)
None						
Total for Subwatershed			0	0	0	0
TMDL Load Reduction Required			458.49	0	0	0

Priorities and BMP’s needed

The table below shows the BMP’s needed for the priorities for this newly revised WIP. It should be noted that these are ranked based on their location in the watershed with the first priority being the furthest up in the stream. Ideally these would be addressed in this order, but this could change depend on metal rank, the status of landowner, ability to work with other partners, etc.

It must be stressed that these are probable project cost opinions and are based solely upon information from AMDTreat, experience with construction, and knowledge of the proposed sites. This requires a number of assumptions as to actual conditions which will be encountered on the site; the specific decisions of other design professionals engaged; the means and methods of construction the contractor will employ; the cost and extent of labor, equipment, and materials that the contractor will employ; the contractor’s techniques in determining prices and market conditions at the time; and other factors over which there is no control. Given these assumptions, which must be made, it is believed that the below probable project cost opinion to be a fair and reasonable estimate for project costs for the priority discharge.

Priority Discharge	Active or Passive	BMP Main component	Estimated Construction Costs	Estimated Operation and Maintenance Costs/year
Silverbrook Mine (AMD110)	Passive	Vertical Flow Wetland	\$1,855,638	\$67,478
TOTAL			\$1,855,638	\$67,478

New Priorities

- **Silverbrook Mine (AMD110):** As stated earlier, the Silverbrook Mine discharge was the result of abandonment of an extensive deep mine that became inundated to form a huge mine pool. PA-DEP, BAMR installed a series of limestone diversion wells in 1996 to divert water from the discharge for treatment of the acidic waters before flowing into the Little Schuylkill River. At this point these are not functioning and not producing and load reductions. Therefore, some type of systems needs to be constructed to treat the discharge.

Silverbrook Mine (AMD 110)	pH	Alkalinity (lbs/day)	Acidity (lbs/day)	Iron (lbs/day)	Aluminum (lbs/day)	Manganese (lbs/day)
Average water quality	4.0	0.87 mg/L	61.9 mg/L	17.1 mg/L	5.4 mg/L	1.6 mg/L
Loadings using 1577 gpm			1,176.2	325.5	101.7	29.7
Assumed % removal after treatment			100	90	90	90
Loadings removed after treatment			1,176.2	293	91.5	26.7

Total Load Reductions

Using the load reductions from completed and future systems the TMDL table can be examined again to see what results could be expected. Each system provides a measurable milestone of

loadings removed. When the priority is addressed the reductions called for in the TMDL should be met.

Table 58. Project and TMDL information for Little Schuylkill River Subwatershed					
	Project Name/ID	Load Reduction-Acidity (lbs/day)	Load Reduction-Aluminum (lbs/day)	Load Reduction-Iron (lbs/day)	Load Reduction-Manganese (lbs/day)
Loadings of finished systems		0	0	0	0
Construction Milestones					
	Silverbrook Mine (AMD110)	1,176.2	91.5	293	29.7
Total for Subwatershed		1,176.2	91.5	293	29.7
TMDL Load Reduction Required		458.49	0	0	0

Schedule for Implementation

The main milestone for this section of the stream is the restoration of Little Schuylkill River. The table below shows steps in reaching this milestone.

Table 59. Timeline and Milestones for Little Schuylkill River Subwatershed		
Timeline and Milestones	Dates	Responsible Parties
Acquire funding to address priority discharge.	2026-2028	SHA/SCD/PADEP
Interim milestone: The priority has been addressed and is removing acidity and metal loadings from the watershed. OM&R is occurring on all constructed systems. The water quality at LS9 (Table 54) has a pH 6.0-9.0, iron < 1.5 mg/L and aluminum < 0.75 mg/L and is still net alkaline.		
Stream from mouth to headwaters reassessed	By 2029	PADEP

Specific Monitoring for Little Schuylkill River

Treatment Systems

Monitoring of the passive treatment system will start once system is built. The goal is to ensure that the system is working at removing metals and acidity and adding alkalinity. Below is a table

showing what parameters are being monitored on each of the built passive treatment systems and who is responsible. As systems are built they will be added on the schedule for monitoring.

Table 60. Monitoring of AMD Treatment Systems for the Little Schuylkill River Subwatershed			
Systems monitored	Frequency	Responsible Party	Comments
Any new systems	pH, DO, specific conductance (~1x/ two weeks) Hach Kit total iron (~1x/month)	SCD, SHA or PADEP	

Abbreviations:

Schuylkill Conservation District (SCD)

Pennsylvania Department of Environmental Protection (PADEP)

Schuylkill Headwaters Association (SHA)

Stream Monitoring

Monitoring of the stream should commence once the priority has been addressed. The TMDL point LS9 (Table 54) was chosen as a monitoring point for several reasons. Background data from the TMDL shows what the stream was like before passive treatment systems were installed. Changes in the stream can be tracked and improvements can be seen with good background data. Also sampling at this point the data can be used to see if TMDL's are being met.

Table 61. Monitoring of Stream at TMDL points for Little Schuylkill Creek Subwatershed			
In-stream Point Being Monitored	Type	Frequency	Responsible Party
Little Schuylkill River upstream of Wabash creek and Panther Creek	TMDL	Will be sampled after installation of 2 of the priorities 3/times year	SCD/SHA/PADEP

WABASH CREEK
(TRIBUTARY OF
LITTLE
SCHUYLKILL
CREEK)

Pollution Sources (AMD Discharges) in Wabash Creek Subwatershed

Wabash Creek originates west of the village of Reevesdale and flows northeast 3.2 miles, along Route 209, to the confluence with the Little Schuylkill River in the borough of Tamaqua (See Map 5, Appendix A). Four deep mine discharges from the two deep mine pools are negatively impacting the water quality and macroinvertebrate community in Wabash Creek.

Overall Metals Rank in the Schuylkill River	Location in Wabash Creek subwatershed starting at upstream point	AMD Site Name	Status
1	3	Newkirk Mine Tunnel North Dip (AMD114)	Completed (BAMR)
23	4	Newkirk Mine Tunnel South Dip (AMD116)	Not built
24	1	Reevesdale Mine South Dip (AMD118)	Completed (#2416)
26	2	Reevesdale Mine North Dip Tunnel (AMD117)	Not built

Discharges that have been addressed

The following is a list of the discharges that now have a passive treatment system treating the water. Operation and maintenance continue on all these systems. It should be mentioned that even though a system is in place, it does not mean there will never be a need for more funding in the future for upgrades as the systems age.

- ***Newkirk Tunnel - North Dip:*** This treatment system is comprised of oxic/anoxic trenches and a settling pond was installed by PADEP, BAMR in 2002. The system was not working properly and needed to be redesigned and reconstructed. In 2010 PA BAMR converted the OLD into an upflow limestone pond system.
- ***Reevesdale No. 2 Outflow:*** This outflow is one of several Reevesdale discharges. A BAMR land reclamation project was completed in the early 2000's adjacent to the discharge, however it did not address water quality. The discharge has an average flow of 904 gpm and the land adjacent to the discharge is being used for a passive wetland treatment system that finished in 2006 (Project#2416). The system consists of an oxic limestone drain (OLD) and two wetland ponds. The system was not working to its full potential and was recently redesigned (Project #1608) to treat more of the discharge.

Water Quality Improvements

To demonstrate improvements in the watershed after installation of projects a TMDL point is the best choice (See Map 1, Appendix A). This point serves as a background water quality data that can be used to compare quality after construction of the above treatment systems. In this case

the TMDL point that can be used is 11WB, a point at the mouth of Wabash Creek. Since only two of the priority discharges have been addressed, no known monitoring is occurring at this point at this time.

Site	Timeframe	pH	Acidity (mg/L)	Alkalinity (mg/L)	Iron (mg/L)	Aluminum (mg/L)	Manganese (mg/L)
TMDL Point 11WB	1997--2002	4.7	21.2	1.8	0.56	2.66	1.07

TMDL

Wabash Creek had its own TMDL approved in 2003, unlike the other subwatersheds in this WIP. The TMDL goal for this stream came from the 11WB TMDL point located at the mouth of Wabash Creek. The summary of the loads that affect 11WB found in the TMDL document are the ones used as the goals for this revision. Loadings from the completed projects, Newkirk Mine Tunnel North Dip and Reevesdale Mine South Dip, are shown in the table below.

	Project Name/ID	Project Cost	Load Reduction-Acidity (lbs/day)	Load Reduction-Aluminum (lbs/day)	Load Reduction-Iron (lbs/day)	Load Reduction-Manganese (lbs/day)
	Newkirk Mine Tunnel North Dip (AMD114)	\$153,151	967.7	103.0	50.9	22.8
	Reevesdale Mine South Dip (AMD118)	\$226,156	43.4	5.7	16.7	3.5
Total for Subwatershed			1,011.1	108.7	67.6	26.3
TMDL Load Reduction Required			1,464.0	121.7	43.4	32.8

Priorities and BMP’s needed

The table below shows the BMP’s needed for the priorities for this newly revised WIP. It should be noted that these are ranked based on their location in the watershed with the first priority being the furthest up in the stream. Ideally these would be addressed in this order, but this could change depend on metal rank, the status of landowner, ability to work with other partners, etc.

It must be stressed that these are probable project cost opinions and are based solely upon information from AMDTreat, experience with construction, and knowledge of the proposed sites. This requires a number of assumptions as to actual conditions which will be encountered on the site; the specific decisions of other design professionals engaged; the means and methods of construction the contractor will employ; the cost and extent of labor, equipment, and materials that the contractor will employ; the contractor's techniques in determining prices and market conditions at the time; and other factors over which there is no control. Given these assumptions, which must be made, it is believed that the below probable project cost opinion to be a fair and reasonable estimate for project costs for each priority discharge.

Table 65. AMD Treatment Systems Needed in the Wabash Creek Subwatershed				
Priority Discharge	Active or Passive	BMP Main component	Estimated Construction Costs	Estimated Operation and Maintenance Costs/year
Newkirk Mine Tunnel South Dip (AMD116)	Passive	Aerobic Pond	\$255,290	\$15,000
Reevesdale Mine North Dip Tunnel (AMD117)	Passive	Oxic Limestone Drain	\$216,895	\$15,000
TOTAL			\$472,185	\$30,000

*System needs to be redesigned and reconstructed

New Priorities

- ***Newkirk Mine Tunnel - South Dip (AMD 116):*** This is a high flow tunnel discharge located along Wabash Creek just west of Tamaqua. Discharges collect in a pond prior to entering Wabash Creek. Depending on the depth of the pond, possible solutions include modification of the pond to increase oxidation through limestone dosing and addition of an organic substrate. There is evidence that this is being treated naturally but more investigation is needed.

Table 66. Predicted Load Reductions for Newkirk Mine Tunnel – South Dip
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Newkirk Mine Tunnel – South Dip (AMD116)	pH	Alkalinity (lbs/day)	Acidity (lbs/day)	Iron (lbs/day)	Aluminum (lbs/day)	Manganese (lbs/day)
Average water quality	5.79	24.0 mg/L	-7.62 mg/L	7.25 mg/L	0 mg/L	1.21 mg/L
Loadings using 314 gpm				27.4		4.6
Assumed % removal after treatment				90		90
Loadings removed after treatment				24.7		4.1

Reevesdale Mine North Dip Tunnel (AMD 117): This is a tunnel discharge to Wabash Creek on the west side of Tamaqua. Reasonable flow and sufficient space are available for passive treatment. Another possible solution is the conversion of nearby ponds to a vertical drain system. Land owner cooperation and additional ground truthing is required before treatment selection.

Reevesdale Mine North Dip Tunnel (AMD117)	pH	Alkalinity (lbs/day)	Acidity (lbs/day)	Iron (lbs/day)	Aluminum (lbs/day)	Manganese (lbs/day)
Average water quality	4.71	10.41 mg/L	2.95 mg/L	3.28 mg/L	0.66 mg/L	1.27 mg/L
Loadings using 106 gpm			3.8	4.2	0.8	1.6
Assumed % removal after treatment			100	90	90	90
Loadings removed after treatment			3.8	3.8	0.7	1.4

Total Load Reductions

Using the load reductions from completed and future systems the TMDL table can be examined again to see what results could be expected. Each system provides a measurable milestone of loadings removed. When all the priorities are addressed the load reductions called for in the TMDL should be met except for acidity and aluminum. The figures are close enough for aluminum that any differences could be attributed to flows used to calculate loadings. The table still shows the need to reduce acidity. One item that is not shown in the loadings tables is the amount of alkalinity that is produced in treatment systems. This alkalinity will buffer the leftover acidity in the stream. Therefore, acidity will be reduced more than is shown below in Table 68, the stream will be net alkaline and hopefully water quality should be improved enough to restore the subwatershed.

Table 68. Project and TMDL information for Wabash Creek Subwatershed					
	Project Name/ID	Load Reduction-Acidity (lbs/day)	Load Reduction-Aluminum (lbs/day)	Load Reduction-Iron (lbs/day)	Load Reduction-Manganese (lbs/day)
Loadings of finished systems		1,011	108.7	67.6	26.3
Construction Milestones					
	Newkirk Mine Tunnel South Dip (AMD116)	0	0	24.7	4.1
	Reevesdale Mine North Dip Tunnel (AMD117)	3.8	0.7	3.8	1.4
Total for Subwatershed		1,014.8*	109.4	96.4	31.8
TMDL Load Reduction Required		1,453.0	115.7	33.6	23.1

*Even though it appears that acidity still needs decreased, excess alkalinity from treatment systems will help neutralized remaining acidity.

Schedule for Implementation

The main milestone for this section of the stream is the restoration of Wabash Creek. The table below shows steps in reaching this milestone.

Table 69. Timeline and Milestones for Wabash Creek Subwatershed		
Timeline and Milestones	Dates	Responsible Parties
Continue OM&R on Newkirk Mine Tunnel North Dip and Reevesdale Mine North Dip Tunnel	Ongoing	SHA/SCD
Interim Milestone: Provide OM&R on 2 constructed system so they continue to function and remove acidity and metal loadings from the watershed.		
Acquire funding to address one of the priority discharges.	2025-2027	SHA/SCD
Interim milestone: One of the 2 priorities have been addressed and are removing acidity and metal loadings form the watershed. Systems that are not working up to par will be rehabilitated. OM&R is occurring on all constructed systems. Water quality should be improved by 50% at 11WB TMDL point (Table 63).		
Continue acquiring funding for rest of priorities depending on water quality 11WB TMDL point.	2028-2030	PADEP/SHA/SCD
Interim milestone: All 4 priorities have been addressed (if needed) and water quality at 11WB has a pH 6.0-9.0, iron < 1.5 mg/L and aluminum < 0.75 mg/L and is net alkaline.		
Stream from mouth to headwaters reassessed	By 2030	PADEP

Specific Monitoring for Wabash Creek

Treatment Systems

Monitoring of the passive treatment system have been ongoing and will continue. The goal is to ensure that the system is working at removing metals and acidity and adding alkalinity. Below is a table showing what parameters are being monitored on each of the built passive treatment systems and who is responsible. As systems are built they will be added on the schedule for monitoring.

Systems monitored	Frequency	Responsible Party	Comments
Reevesdale Mine South Dip (AMD118)	pH, DO, specific conductance (~1x/ two weeks) Hach Kit total iron (~1x/month)	SCD & SHA	Grab sample as possible
Newkirk Mine Tunnel North Dip (AMD114)	pH, DO, specific conductance (~1x/ two weeks) Hach Kit total iron (~1x/month)	PA DEP	Grab sample as possible
Any new systems		SCD, SHA or PADEP	

Abbreviations:

Schuylkill Conservation District (SCD)

Pennsylvania Department of Environmental Protection (PADEP)

Schuylkill Headwaters Association (SHA)

Stream Monitoring

Monitoring of the stream should commence once one more of the priorities are addressed. The TMDL point 11WB (Table 63) was chosen as a monitoring point for several reasons. Background data from the TMDL shows what the stream was like before passive treatment systems were installed. Changes in the stream can be tracked and improvements can be seen with good background data. Also sampling at this point the data can be used to see if TMDL's are being met.

In-stream Point Being Monitored	Type	Frequency	Responsible Party
Mouth of Wabash Creek (11WB)	TMDL	Will be sampled after installation of 2 of the priorities 3/times year	SCD/SHA/PADEP

PUBLIC INFORMATION AND PARTICIPATION FOR ALL SUBWATERSHEDS

Partners and Stakeholders

The Schuylkill Headwaters Association, Inc. (SHA) is a watershed group formed in 1997 and dedicated to protecting, preserving and restoring the Schuylkill watershed within Schuylkill County. SHA maintains an active all-volunteer membership with monthly work sessions, regular public meetings and implementation of group projects.

The Schuylkill Conservation District (SCD) works to improve water quality throughout Schuylkill County. The SCD administers six key water quality protection programs: nutrient management, erosion and sediment pollution control, environmental education, The Chesapeake Bay program, Coastal Non-Point Pollution program, and National Pollution Discharge Elimination System (NPDES) permitting. Conservation districts, sub-units of state government supported by state and county funding, are governed by locally appointed boards of volunteer citizen directors who have a long-term interest in the welfare of their communities.

The Schuylkill Action Network (SAN), formed in 2003, is a group of watershed organizations, water suppliers, industry representatives, and government agencies that work collectively to improve the water quality of the Schuylkill River. The SAN established the Abandoned Mine Drainage Workgroup to work together towards reducing large sources of AMD.

Watershed restoration efforts have received endorsements from Schuylkill County Board of Commissioners, Schuylkill River Greenway Association, Philadelphia Water Department, The Schuylkill Center for Environmental Education, and the Patrick Center for Environmental Research.

Many local groups or businesses including the Schuylkill Economic Development Corp. (SEDCO), Schuylkill County Conservancy, Retired and Senior Volunteer Program of Schuylkill County, City of Pottsville, Eastern Schuylkill Recreation Commission, Schuylkill County Trout Unlimited, Hawk Mountain Sanctuary Association, Alcoa Engineered Products, Northeastern Power Company, Wheelabrator Frackville Energy Co., and Harriman Coal Corp. have provided additional support and assistance. Landowners that have given approval for construction of treatment systems on their property include Reading Anthracite Company, Blaschak Coal Co., Kuperavage Enterprises, Inc., Branch Township, and Reading and Northern Railroad Company. These groups and landowners are expected to continue their roles in support of the watershed restoration plan.

Outreach Activities

Outreach activities are a vital component of improving the overall health of the Upper Schuylkill River Watershed. Additionally, education and outreach will be a critical component in the remediation of the pollution problems of the prioritized sites identified in this report. Various levels of outreach will be required from governmental agencies and nonprofit groups working to alleviate the negative effect of pollution in the Upper Schuylkill River Watershed. Outreach activities must be focused on the general public, area businesses and landowners, farmers, and

municipal officials. An overall educational mission must aim to inform these stakeholders of the causes, remediation, and prevention of pollution problems.

The SHA is a local watershed group providing outreach on issues affecting the Upper Schuylkill River Watershed. Public meetings of the SHA are held monthly at the Schuylkill County Agricultural Center, Pottsville, Pa. The SHA publishes a monthly newsletter entitled Headwaters, gives educational presentations to local civic groups, and maintains a web site at www.pottsville.com/headwaters/. The organization mans a booth at the Bear Creek Festival, an annual environmental festival offered free to the public, and participates in the annual Schuylkill Watershed Congress by presenting lectures and leading field tours of AMD treatment sites. The SHA has also participated in presentations at the annual Statewide Conference on AMD/AMR.

The SCD, through its various departments and programs, provides various forms of outreach to all stakeholders in the implementation of remedial actions of pollution problems in the Upper Schuylkill River Watershed. The SCD has active programs promoting the remediation of pollution from agriculture, AMD, erosion and sedimentation, and stormwater runoff. The SCD has a fulltime environmental educator, erosion and sediment control technicians, nutrient management technicians, and a county natural resource specialist, who all provide outreach for their respective programs and activities. The SCD provides technical assistance for landowners, municipal officials, farmers, and the general public. The SCD also assists municipalities, farmers, and non-profits obtain grant funding for educational and pollution remediation projects.

Schuylkill Acts & Impacts (SAI) continued in June 2018, making this the 5th continuous year of the trip. SAI is an 8-day, 7-night educational expedition for high school students living in the 5 main counties of the Schuylkill River Watershed – Schuylkill, Berks, Montgomery, Chester, and Philadelphia. Throughout the week, students study different land use activities, such as mining, agriculture, and urban development, and investigate the water quality impacts of these activities. Students take daily water quality samples and record their results, with a whole watershed analysis occurring at the end of the trip. Students tour different related facilities, hear presentations from field professionals, and get to experience some recreational fun in the form of camping and kayaking throughout the week. SAI is a partnership between SHA, the Fairmount Water Works, Stroud Water Research Center, and Take It Outdoors Adventures.

The Schuylkill Action Network performs many outreach activities throughout the Schuylkill River. The organization just unveiled their new website SchuylkillWaters.org that is full of the many events being held to protect and improve water quality of the Schuylkill River. As one of the workgroups, AMD has their own section of the website which demonstrates the many projects that have been completed to help with this source of nonpoint pollution. Also, in the spring of every year the Schuylkill Scrub is held. This event is a watershed-wide clean-up initiative that is a great way to get the public involved.

Additionally, organizations such as the PADEP, Schuylkill County Chapter of Trout Unlimited, Schuylkill County Conservancy and United States Geologic Service (USGS) provide various levels of outreach on issues affecting the Upper Schuylkill River Watershed. Through partnerships and coalitions, the various agencies and organizations listed above will play a critical role in meeting the important need of outreach in the watershed.

TECHNICAL AND FINANCIAL ASSISTANCE FOR ALL SUBWATERSHEDS

Estimate of Remediation Costs

The table below shows the total estimated costs for each subwatershed and costs for operation and maintenance. As shown, the cost to restore the Upper Schuylkill River is over 24 million dollars.

Subwatershed	Construction Costs	Operation and Maintenance	Other costs
Upper Schuylkill River	\$3,428,489	\$154,673	
Mill Creek	\$2,918,082	\$326,820	
Refuse Pile Removal			19,250,000
West Branch	\$2,129,884	\$193,197	
Water Loss Projects			\$5,185,000
Muddy Run	\$830,868	\$36,123	
Little Schuylkill River	\$1,855,638	\$67,478	
Wabash Creek	\$472,185	\$30,000	
TOTAL	\$11,635,146	\$808,291	24,435,000

Funding Sources

Sources of funding for restoration design and construction have been identified and secured for portions of the required restoration measures. It is expected that these same funding sources will be available for design and construction of the additional treatment systems required.

Funding or in-kind support for watershed restoration and environmental education efforts in the Upper Schuylkill River Watershed has been provided by:

- EPA Section 319 and Watershed Initiative programs.
- PA BAMR Set-Aside funds
- OSM Appalachian Clean Streams Initiative, Summer Internship, and Title IV AML programs.
- PA DEP Growing Greener Environmental Stewardship/Watershed Protection and Technical Assistance Grant (TAG) programs.
- PA Department of Community and Economic Development (DCED) grant programs.
- Pa Fish and Boat Commission Water Trail Grant program.
- Delaware River Basin Commission's proposed use of funds from Exelon Corporation for water quality restoration.
- Philadelphia Water Department environmental education grant program.

Additional Support for Watershed Restoration Efforts

- The U.S. Geological Survey provided projection of parameters for design, monitoring, and technical expertise.

- The PA DEP BAMR provided engineering assistance, flow, and water quality data and reclaimed thousands of acres of mine land in the watershed.
- PA DEP Office of Water Resources Planning, Watershed Support Section, assisted in providing EPA Section 319 and other funding for mine drainage abatement projects.
- PA DEP Bureau of Mining and Reclamation contributed historical mining data and Scarlift Reports.
- PA DEP District Mining Operations Pottsville Office coordinated and assisted with data collection, acquiring funding for abatement projects and working with the local community, encouraged re-mining, and provided technical assistance.
- The PFBC and USGS conducted aquatic surveys and water monitoring.
- Various consultants provide technical assistance for conceptual design and engineering through various grants.
- The Schuylkill Conservation District provided technical assistance in project design, coordinating water quality improvement efforts, data collection, publicity, and in acquiring funding.
- Schuylkill County assisted with GIS mapping and identification of landowners.
- Minersville Water Authority, Duncott Fire Company, Phoenix Park Fire Company, Middleport American Legion, and Tamaqua Community Center hosted public meetings.

MILESTONES TO DETERMINE IF IMPLEMENTATION MEASURES ARE BEING MET

The implementation projects planned for each year will serve as the implementation milestones of the restoration plan. SHA and the SCD will continue their regular meetings to follow the progress of the implementation plan and to determine if the milestones are being met. Meetings with the PA DEP Pottsville District Mining Office will be scheduled as needed after receipt of grants for additional phases of the restoration plan to determine if the milestones associated with those phases are still appropriate.

Progress on the implementation schedule will be noted on a quarterly basis at the SHA regular meetings. Since the mine discharges are large and difficult to treat, and passive treatment technology is experimental in nature, implementation of the next project in line is dependent on the evaluation of the success of the previous project. When construction of a project is complete, the evaluation process will begin and the conceptual designs of the next project will be reconsidered to determine if changes should be made prior to submittal of a proposal for the next grant. Difficulties in successful completion of projects may slow the implementation schedule.

Maintaining the implementation schedule is also dependent on the availability of funds. If funding sources receive less money than expected, then some of the proposed projects may not be funded according to schedule. In addition, competition for the limited grant funds increases every year as more watershed associations develop their own restoration plans and submit proposals for implementation projects. In these cases, the project proposals would be submitted again the following year, but the implementation schedules would have to be changed.

WATER QUALITY MONITORING AND EVALUATION IN THE UPPER SCHUYLKILL RIVER

Treatment systems will continue to be monitored on a regular basis as shown earlier. If performance of individual treatment systems is less than expected, SHA will make adjustments to the treatment systems, as necessary, to try to improve results. Accumulated metals in the passive treatment systems will be flushed regularly to ensure that metals are not being retained in the system. If additional metals reductions or alkalinity increases are determined to be needed at some systems, an evaluation of the design parameters will be made, and changes such as enlargement of treatment ponds or adding treatment or settling ponds could be made. Chemical and physical parameter monitoring should follow the efficiency and progress of each AMD treatment system on a quarterly basis. Aquatic biological surveys can be completed once water quality has improved enough to warrant such activities. SHA and SCD can use the Trout Unlimited AMD technical assistance program to complete these surveys.

SHA and its partners will analyze water quality data. Annual evaluations of performance of installed treatment systems, in-stream load reductions, and restoration of aquatic life will be held through meetings and discussions between SHA, PA DEP Harrisburg and Pottsville Offices, consultants, and any other individuals who could provide ideas or assistance in determining how restoration goals may be better achieved. Quarterly progress reports will be completed and submitted to U.S. EPA and placed on the SCD and SHA web sites.

Since the TMDLs established load reductions for each of the discharges in the Upper Schuylkill River Watershed, these load reductions are the targets to be met in evaluating stream recovery. The Technical Committee will meet annually to evaluate the progress and milestones of the monitoring to determine if these TMDL load reductions are being met. Results of the previous year's monitoring will be used to calculate the loadings and percent reductions the completed projects achieve. The newly calculated loadings will be compared with the overall required TMDL loading reductions for the TMDL. The effects of the individual treatment systems on the watershed will be evaluated by comparisons with the downstream TMDL points. The comparisons and load reduction achievements will be used to determine what type of additional implementation measures are necessary to achieve the desired load reductions or if any improvements to the treatment systems efficiency need to be considered.

Each subwatershed in this revised WIP has an established TMDL point for which to monitor improvements. As those begin to be met, there are other points along the Schuylkill River that can be monitored to see how much more of the main stem is improving. Below is a table with background water sample data at the time of the TMDL from the points not mentioned in the subwatershed sections. If these points are not improving and meeting water quality standards, then the river and its tributaries will need to be reevaluated to identify problems.

TMDL Point in Schuylkill River	pH	Hot Acidity (mg/L)	Alkalinity (mg/L)	Iron (mg/L)	Aluminum (mg/L)	Manganese (mg/L)
In Cressona upstream of West Branch and downstream of Mill Creek (SR4)	7.32	-31.6	71.48	1.38	0.17	0.84
At Landingville at USGS Gauge Station (S14) downstream	7.08	4.58	35.23	1.98	0.4	1.11

REMEDIAL ACTIONS IN THE UPPER SCHUYLKILL RIVER

The SHA and SCD has assumed operation and maintenance responsibility for all the projects they have implemented in the watershed. The Association has conducted a volunteer water quality monitoring program in the watershed for years and has accumulated an impressive water quality database. These data have been very beneficial in the development of new AMD remediation project proposals and the evaluation of how well existing projects are functioning. The Association and its partners are committed to continuing this monitoring for new project development and existing project operation and maintenance.

The SHA has also enlisted the services of numerous partnering agencies to assist with operation and maintenance planning. The SCD and the SHA have developed a very close relationship and continue to partner with project development, grant writing, and water quality monitoring activities. SCD staff members are also committed to the long-term operation and maintenance of the projects that they sponsor. The Conservation District’s County Natural Resource Specialist will play a key role in project monitoring and maintenance coordination.

Annual evaluations of performance of installed treatment systems, in-stream load reductions, and restoration of aquatic life will be held through meetings and discussions between the watershed association, PA DEP Harrisburg and Pottsville Offices, consultants, and any other individuals who could provide ideas or assistance in determining how restoration goals may be better achieved.

APPENDIX A –
MAPS OF THE
WATERSHED