FINAL

PINE RUN WATERSHED TMDL
Armstrong and Jefferson Counties

For Acid Mine Drainage Affected Segments

Prepared by:

Pennsylvania Department of Environmental Protection

January 3, 2007

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Pine Run Watershed
Armstrong and Jefferson Counties, Pennsylvania

Introduction

This report presents the Total Maximum Daily Loads (TMDLs) developed for segments in the Pine Run Watershed (Attachments A). These were done to address the impairments noted on the 1996 Pennsylvania Section 303(d) list of impaired waters, required under the Clean Water Act, and covers five segments on this list. All impairments resulted from acid drainage from abandoned coalmines. The TMDL addresses the three primary metals associated with acid mine drainage (iron, manganese, aluminum) and pH. The Pine Run listings for other inorganics will be addressed at a future date.

Table 1. 303(d) Sub-List
State Water Plan (SWP) Subbasin: 17-D Mahoning Creek

Year	Miles	Segment ID	DEP Stream Code	Stream Name	Designated Use	Data Source	Source	EPA 305(b) Cause Code
1996	4.6	5273	47327	Pine Run	CWF	305(b) Report	RE	Metals
1998	5.47	5273	47327	Pine Run	CWF	SWMP	AMD	Metals & *Other Inorganics
2002	5.47	5273	47327	Pine Run	CWF	SWMP	AMD	Metals & *Other Inorganics
2004	5.48	5273	47327	Pine Run	CWF	SWMP	AMD	Metals & *Other Inorganics
1996	2.4	5275	47327	Pine Run	CWF	305(b) Report	RE	Metals
1998	2.33	5275	47327	Pine Run	CWF	SWMP	AMD	Metals
2002	2.4	5275	47327	Pine Run	CWF	SWMP	AMD	Metals
2004	2.4	5275	47327	Pine Run	CWF	SWMP	AMD	Metals
1996	0.5	5274	47327	Pine Run	CWF	305(b) Report	RE	*Other Inorganics
1998	1.75	5274	47327	Pine Run	CWF	SWMP	AMD	*Other Inorganics & Metals
2002	1.7	5274	47327	Pine Run	CWF	SWMP	AMD	*Other Inorganics & Metals
2004	1.7	5274	47327	Pine Run	CWF	SWMP	AMD	*Other Inorganics & Metals
1996	3.7	5277	47352	Nye Branch	CWF	305(b) Report	RE	Metals
1998	3.75	5277	47352	Nye Branch	CWF	SWMP	AMD	Metals
2002	3.7	5277	47352	Nye Branch	CWF	SWMP	AMD	Metals
2004	3.8	5277	47352	Nye	CWF	SWMP	AMD	Metals

[1] Pennsylvania's 1996, 1998, and 2002 Section 303(d) lists were approved by the Environmental Protection Agency (EPA). The 1996 Section 303(d) list provides the basis for measuring progress under the 1996 lawsuit settlement of *American Littoral Society and Public Interest Group of Pennsylvania v. EPA.*

Table 1. 303(d) Sub-List								
State Water Plan (SWP) Subbasin: 17-D Mahoning Creek								
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
				Branch				
1996	0.9	5278	47438	Caylor Run	CWF	305(b) Report	RE	Metals
1998	0.91	5278	47438	Caylor Run	CWF	SWMP	AMD	Metals
2002	0.9	5278	47438	Caylor Run	CWF	SWMP	AMD	Metals
2004	0.9	5278	47438	Caylor Run	CWF	SWMP	AMD	Metals

*Other Inorganics listing is not included on the 2006 Integrated List.
Resource Extraction=RE
Cold Water Fishes = CWF
Surface Water Monitoring Program = SWMP
Abandoned Mine Drainage = AMD

See Attachment D, *Excerpts Justifying Changes Between the 1996, 1998, and 2002 Section 303(d) Lists.*

The use designations for the stream segments in this TMDL can be found in PA Title 25 Chapter 93.

Directions to the Pine Run Watershed

The Pine Run Watershed is located in Central Western Pennsylvania, occupying a northeastern portion of Armstrong County in Redbank Township and a southwestern portion of Jefferson County in Porter and Ringgold Townships and Timblin Borough. The watershed area is found on United States Geological Survey maps covering portions of the Distant, Dayton, and Valier 7.5-Minute Quadrangles. The area within the watershed consists of 32.5 square miles. Land uses within the watershed include abandoned mine lands, forestlands, and rural residential properties with small communities scattered throughout the area.

The mouth of Pine Run can be accessed by taking exit 64 of Interstate 80 (Clarion/New Bethlehem). At the end of the exit ramp turn right onto State Highway 66 South. Travel approximately 12.5 miles to New Bethlehem. In New Bethlehem, turn left onto SR 839 South and travel approximately 5.9 miles to the town of Charleston. Veer right onto State Highway 1021 and travel for approximately 2.0 miles. Take a right onto T-748 (Lower Mudlick Road) and travel approximately 0.1 mile. Pine Run runs under the bridge at this point and the mouth of the stream is approximately 180 feet downstream from this point.

Hydrology and Geology

Pine Run flows until the confluence with Mahoning Creek. Named tributaries to Pine Creek in Armstrong County include Mudlick Creek and Sugarcamp Run. Named tributaries in Jefferson

County include Painter Run, Eagle Run, Caylor Run, Middle Branch and Nye Branch. The streams drain the area from west to east. Pine Run flows from an elevation of 1660 feet above sea level near its headwaters to an elevation 1000 feet above sea level at its confluence with Mahoning Creek.

The Pine Run Watershed lies within the Pittsburgh Low Plateau Physiographic Province. Surface rocks are divided into the Conemaugh and Allegheny groups of the Pennsylvanian period, with the rocks of Conemaugh group found on the hilltops and rocks of the Allegheny group below. Alluvium is located in the flood plains and valley bottoms. Rocks of the Pottsville and Pocono groups are exposed near the confluence with Mahoning Creek.

The dominant structural feature is the Sprankle Mills anticline. The axis enters the watershed near the headwaters and trends southwest. The stream flows along the northwest flank of the anticline. The axis has a plunge of 25 to 50 feet per mile in the vicinity of the Nye Branch. The Worthville syncline is the next feature to the northwest terminating at Pine Run. The North Freedom anticline is to the west terminating north of Pine Run.

The Upper Freeport, Lower Freeport and Lower Kittanning coal seams have been mined extensively in the watershed. Locally, the Upper and Middle Kittanning have also been mined (Geology and Mineral Resources of the Smicksburg Quadrangle, Pennsylvania, Marchant N. Shaffner).

Segments addressed in this TMDL

The Pine Run Watershed is affected by pollution from AMD. This pollution has caused high levels of metals and low pH in the main stem of Pine Run and in its tributaries. The sources of the AMD are seeps and discharges from areas disturbed by surface mining. Most of the discharges originate from mining on the Upper, Middle and Lower Kittanning and Upper and Lower Freeport coal seams or refuse piles associated with them.

There are four surface mining permits still bonded and inspected in the Pine Run Watershed. Original Fuels, Inc. SMP 33890113 Pine Run Mine (NPDES PA0207438), Falls Creek Energy Co., Inc. SMP 33030106 Adams Mine (NPDES PA0242373), Opal Industries, Inc. SMP 33960108 Schreckengost Mine (NPDES PA0227315) and Reichard Contracting, Inc. SMP 33000101 Caylor Mine (NPDES PA0241768). Active mining has been completed on the Original Fuels, Inc. SMP 33890113 and Reichard Contracting, Inc. SMP 33000101 permits; therefore, these operations no longer have treatment or sediment ponds that discharge and do not require waste load allocations (WLA). Mining is currently being conducted on the Opal Industries, Inc. SMP 33960108 site. Treated water from this mining operation flows into unnamed tributaries to Painter Run, a tributary to Pine Run, and a WLA has been assigned to this mining permit. Mining has not been initiated on the Falls Creek Energy Co., Inc, SMP 33030106 site. All of the remaining discharges in the watershed are from abandoned surface and deep mines and are treated as non-point sources of pollution because they are from abandoned Pre-Act mining operations. Each segment on the Section 303(d) list is addressed as a separate TMDL. These TMDLs are expressed as long-term, average loadings. Due to the nature and complexity of mining effects on the watershed, expressing the TMDL as a long-term average gives a better representation of the data used for the calculations. See Attachment C for TMDL calculations.

Clean Water Act Requirements

Section 303(d) of the 1972 Clean Water Act requires states, territories, and authorized tribes to establish water quality standards. The water quality standards identify the uses for each waterbody and the scientific criteria needed to support that use. Uses can include designations for drinking water supply, contact recreation (swimming), and aquatic life support. Minimum goals set by the Clean Water Act require that all waters be "fishable" and "swimmable."

Additionally, the federal Clean Water Act and the Environmental Protection Agency's (EPA) implementing regulations (40 CFR Part 130) require:

- States to develop lists of impaired waters for which current pollution controls are not stringent enough to meet water quality standards (the list is used to determine which streams need TMDLs);

- States to establish priority rankings for waters on the lists based on severity of pollution and the designated use of the waterbody; states must also identify those waters for which TMDLs will be developed and a schedule for development;

- States to submit the list of waters to EPA every two years (April 1 of the even numbered years);

- States to develop TMDLs, specifying a pollutant budget that meets state water quality standards and allocate pollutant loads among pollution sources in a watershed, e.g., point and nonpoint sources; and

- EPA to approve or disapprove state lists and TMDLs within 30 days of final submission.

Despite these requirements, states, territories, authorized tribes, and EPA had not developed many TMDLs. Beginning in 1986, organizations in many states filed lawsuits against the EPA for failing to meet the TMDL requirements contained in the federal Clean Water Act and its implementing regulations. While EPA has entered into consent agreements with the plaintiffs in several states, other lawsuits still are pending across the country.

In the cases that have been settled to date, the consent agreements require EPA to backstop TMDL development, track TMDL development, review state monitoring programs, and fund studies on issues of concern (e.g., AMD, implementation of nonpoint source Best Management Practices (BMPs), etc.).

These TMDLs were developed in partial fulfillment of the 1996 lawsuit settlement of *American Littoral Society and Public Interest Group of Pennsylvania v. EPA.*

Section 303(d) Listing Process

Prior to developing TMDLs for specific waterbodies, there must be sufficient data available to assess which streams are impaired and should be on the Section 303(d) list. With guidance from the EPA, the states have developed methods for assessing the waters within their respective jurisdictions.

The primary method adopted by the Pennsylvania Department of Environmental Protection (DEP) for evaluating waters changed between the publication of the 1996 and 1998 Section 303(d) lists. Prior to 1998, data used to list streams were in a variety of formats, collected under differing protocols. Information also was gathered through the Section 305(b)[2] reporting process. DEP is now using the Statewide Surface Waters Assessment Protocol (SSWAP), a modification of the EPA's 1989 Rapid Bioassessment Protocol II (RBP-II), as the primary mechanism to assess Pennsylvania's waters. The SSWAP provides a more consistent approach to assessing Pennsylvania's streams.

The assessment method requires selecting representative stream segments based on factors such as surrounding land uses, stream characteristics, surface geology, and point source discharge locations. The biologist selects as many sites as necessary to establish an accurate assessment for a stream segment; the length of the assessed stream segment can vary between sites. All the biological surveys included kick-screen sampling of benthic macroinvertebrates and habitat evaluations. Benthic macroinvertebrates are identified to the family level in the field.

After the survey is completed, the biologist determines the status of the stream segment. The decision is based on habitat scores and a series of narrative biological statements used to evaluate the benthic macroinvertebrate community. If the stream is determined to be impaired, the source and cause of the impairment is documented. An impaired stream must be listed on the state's Section 303(d) list with the source and cause. A TMDL must be developed for the stream segment and each pollutant. In order for the process to be more effective, adjoining stream segments with the same source and cause listing are addressed collectively, and on a watershed basis.

Basic Steps for Determining a TMDL

Although all watersheds must be handled on a case-by-case basis when developing TMDLs, there are basic processes or steps that apply to all cases. They include:

1. Collection and summarization of pre-existing data (watershed characterization, inventory contaminant sources, determination of pollutant loads, etc.);
2. Calculating the TMDL for the waterbody using EPA approved methods and computer models;
3. Allocating pollutant loads to various sources;
4. Determining critical and seasonal conditions;

[2] Section 305(b) of the Clean Water Act requires a biannual description of the water quality of the waters of the state.

5. Public review and comment and comment period on draft TMDL;
6. Submittal of final TMDL; and
7. EPA approval of the TMDL.

Watershed History

Historical data shows that underground mining was being conducted as early as 1940 and continued until the early 1970s in the Pine Run Watershed. Surface mining was most active in this watershed in the 1970's and 1980's, but a few surface mines began or continued operations in the 1990's and up to the date of this report. There are currently four issued surface mining permits in the Pine Run watershed. The following provides a brief outline of mining permit information that is still available. Although a majority of the files no longer exist, some of the information has been saved through microfiche:

<u>Cookport Coal Company, MDP#3871BSM11 (Adams #1 Mine)</u> - Issued on July 5, 1979 for 143 acres of which 114 acres were to be mined. The coal seams listed for this site include the Upper Freeport, Lower Freeport and Lower Kittanning. Mining was completed on this site and bonds were released on March 9, 1989.

<u>T & T Company, MDP#3875SM58 (Reeseman Mine)</u> – Permit transferred from Glen Irvan Corporation. Issued on February 4, 1982 for 304 acres of which 310 acres were to be mined. The coal seams listed for this site include the Upper Freeport, Lower Freeport and Lower Kittannning. Mining was completed on this site and bonds were released on August 6, 1985.

<u>Markle Bullers Coal Company, MDP#3875SM62 (Bullers #15 Mine)</u> – Issued on August 25, 1976 for 800 acres of which 744 acres were to be mined. This permit was returned and the site was not mined.

<u>Doverspike Brothers Coal Company, MDP#3875SM65 (Eagles #3 Strip Mine)</u> – Issued on August 31, 1976 for 251 acres of which 202 acres were to be mined. This site was never mined under this permit. No additional information is available.

<u>J.D.S Energy Corporation, MDP#3877SM13 (Bish-Phillips Tract)</u> – Permitted for 58 acres of which 51.1 were to be mined. Coal seam listed for this permit is the Lower Freeport. No additional information is available.

<u>Glen Irvan Corporation, MDP#3877SM14 (Toth Mine)</u> – Issued on January 26, 1978 for 205 acres. Coal seams listed for this permit include Upper Freeport and Lower Freeport. No additional information is available.

<u>Blake Becker, Jr., MDP#3877SM12 (Saline-Serafini Tract)</u> – Issued on April 3, 1978 for 81.5 acres. Coal seams listed for this permit include the Upper Kittanning, Lower Freeport and Upper Freeport. No additional information is available.

<u>Doverspike Brothers Coal Company, MDP#3877SM24 (Gaul Mine)</u> - Issued on February 1, 1978 for 306 acres of which 242 were to be affected. Coal seam listed for this site is the Lower

Freeport. Mining was completed, the site reclaimed and the bonds were released on November 14, 1988.

Doverspike Brothers Coal Company, MDP#3872BSM11 (Dora Strip) – Issued January 31,1978 for 695 acres of which 657 were to be affected. Coal seams listed for this site include the Upper Freeport, Lower Freeport, Middle Kittanning, Lower Kittanning and Clarion. No additional information is available.

Markle Bullers Coal Company, MDP#3068BSM20 (Marsh #1 Mine) – Issued February 2, 1978 for 1599 acres of which 1442 were to be mined. Cols seams listed for this site include the Upper Freeport, Lower Freeport, Upper Kittanning, Middle Kittanning and Lower Kittanning. Mining was completed, the site reclaimed and bonds were released on July 30, 1970.

Markle Bullers Coal Company, MDP#3878SM3 (Sakal Mine) – Permit issued for 269 acres on August 4, 1978. The permit was transferred on June 10, 1985 to the Cookport Coal Company under SMP#33783003. Coal seams listed include the Upper Freeport, Lower Freeport, Upper Kittanning, Middle Kittanning and Lower Kittannning. Site was mined, reclamation completed and Stage III bond release occurred on November 16, 1988.

Cookport Coal Company, MDP#3379132 (Coleman Mine) – Permit issued for 18.4 acres of which 9 acres were to be mined. Coal seams listed include the Lower Kittanning and Middle Kittanning. No additional information is available.

Markle Bullers Coal Company, MDP#33800109 (Toth Mine) – Permit for 259.32 acres of which 93.3 acres were to be affected. Upper Freeport coal seam listed. Permit was withdrawn on December 2, 1980.

Markle Bullers Coal Company, MDP#33810104 (Toth Strip and Auger Mine) – Permit issued for 203.9 acres on June5, 1981. The site was mined, reclaimed and stage III bond release occurred on November 16, 1988.

Doverspike Brothers Coal Company, SMP#33820112 (Crozier Mine) – Permit originally issued on July 12, 1984 to the Seven Sisters Mining Company, Inc. for 115.9 acres of which 51.1were to be affected. This permit was transferred to Doverspike Brothers Coal Company. Mining was completed and stage III bond release occurred on May 19, 1993.

S.B.P Coal Company, SMP#33820222 (Lost Hill Reclamation #1) – Permit issued May 31, 1984 for 23.0 acres of which 15.5 acres were to be affected. This permit involved the removal and reprocessing of Lower Kittanning coal refuse that originated from the Schrock #2 Mine on this site twelve years earlier. The waste disposal operation that placed the refuse on this site was implemented under a Permit for Coal Refuse Disposal Area, Permit No. B-32-69 dated December 19, 1969. No additional information is available.

Cookport Coal Company, Inc. SMP#33820125 (Brocious Mine) – Permit issued April 26, 1983 for 71.0 acres of which 61.0 acres were to be affected. Coal seam listed for this site is the Lower

Kittanning. This site was mined and reclaimed and stage III bond release occurred on May 20, 1993.

Doverspike Brothers Coal Company, SMP#33820133 (Shumaker Mine) – Permit issued on October 6, 1983 for 195.0 acres of which 70.0 acres were to be affected. Coal seams listed for this permit are the Upper Freeport, Lower Freeport and Upper Kittanning. This site was mined and reclaimed and stage III bond release occurred on July 12, 1990.

M. B. Energy, Inc., SMP#33890117 (Toothman No. 2 Mine) – Permit issued on March 5, 1990 for 73.5 acres of which 56.9 were to be affected. The coal seam listed for this permit is the Upper Freeport. The site was mined and reclaimed and stage III bond release occurred on November 9, 1998.

Harmon Coal Company, SMP#33830112 (Powell-Snyder-Bunt Mine) – Permit issued on January 13, 1986 for 61.4 acres of which 49.6 were to be affected. Coal seams listed for this permit include Upper Freeport, Lower Kittanning and Upper Kittanning. No additional information is available.

Doverspike Brothers Coal Company, SMP#33840111 (Mowrey Mine) – Permit originally issued to Seven Sisters Mining Company on January 22, 1985 for 82.5 acres of which 46 acres were to be affected. This permit was transferred to Doverspike Brothers Coal Company on April 26, 1990. The coal seam listed for this site is the Upper Freeport. Mining was completed and the site reclaimed. A post mining discharge developed on this site, which is being passively treated through a limestone bed and polishing pond. A Mine Conservation Inspector from the Knox DMO inspects the site and collects water samples on a quarterly basis. Bonds for this site were forfeited and collected on January 8, 2001 due to the bankruptcy of the Doverspike Bros. Coal Co.

Doverspike Brothers Coal Company, SMP#33850120 (Lost Hill Mine) – Permit issued April 29, 1986 for 483.2 acres of which 136.6 acres were to be affected. The coal seam listed for this permit is the Upper Freeport. Mining was completed, the site reclaimed bonds were released on May 11, 1992.

SBP Coal Company, SMP#33813004 (Toth Mine) – Permit issued on June 10, 1985 for 98.7 acres of which 26.3 acres were to be affected. The Upper Freeport coal seam was listed. The site was mined and reclaimed and stage III bond release occurred on January 31, 1992.

Seven Sisters Mining Company, SMP#33850127 (United Industries Mine) – Permit issued November 17, 1986 for 18.7 acres of which 15.4 acres were to be affected. This permit was canceled on October 6, 1993.

Seven Sisters Mining Company, SMP#33880107 (Porter Mine) - Permit issued March 21, 1989 for 122.5 acres of which 91 acres were to be affected. The coal seam listed for this site is the Upper Freeport. Mining was completed, the site reclaimed and stage III bond release occurred on January 14, 1997.

Walter L. Houser Coal Company, Inc., SMP#33900117 (Allen Mine) – Permit issued September 30, 1991 for 82 acres of which 55 acres were to be affected. The coal seams listed for this site include the Upper Freeport and Lower Freeport. Mining was completed, the site reclaimed and Stage III bond release occurred on December 21, 2000.

Cookport Coal Company, Inc., SMP#339201101 (Adams Mine) – Permit issued March 31, 1994 for 201.7 acres of which 61.2 acres were to be affected. The Lower Freeport coal seam was listed. Mining was completed and bonds were released.

Dutch Run Coal Company, Inc., SMP#33920104 (Copus Mine) – Permit issued September 17, 1992 for 68.8 acres of which 45 acres were to be affected. The coal seam listed for this site is the Upper Freeport. The site was mined, reclaimed and stage III bond release occurred on October 29, 2001.

Original Fuels, Inc., SMP#33890113 (Pine Run Mine) – Permit issued on April 10, 1990 for 508.0 acres. This permit included the mining of Lower Kittanning and Lower Freeport coal seams along with limestone and sandstone. Mining was completed and the site was recently backfilled and planted.

Falls Creek Energy Company, Inc., SMP#33030106 (Adams Mine) – Permit issued on January 1, 2005 for 163.5 acres. Coal seams for this site include the Upper Freeport and Lower Freeport. Mining on this site has not yet been initiated as of March 2006.

Reichard Contracting, Inc., SMP#33000101 (Caylor Mine) – Issued on October 18, 2000 for 86 acres. Coal seam listed for this site is the Upper Freeport. Mining has been completed and the site has been reclaimed. Stage 1 bond release occurred on March 25, 2002.

Opal Industries, Inc., SMP#33960108 (Schreckengost Mine) – The permit originally issued on April 15, 1998 to MSM Coal Company, Inc for 54.1 acres. The permit was transferred to Opal Industries, Inc. on March 8, 2005. Coal seam listed for this site is the Upper Freeport. Mining is currently being conducted on this site.

Doverspike Brothers Coal Company operated a coal refuse disposal facility (permit #33763701) located in the town of Dora. An additional slurry impounding coal refuse disposal facility and coal preparation plant known as the Weisner Hollow Coal Refuse Disposal Area was operated by Doverspike Bros. Coal Company (permit #33860101), also located in Dora. The bonds from this site were forfeited in January 2001 after the bankruptcy of Doverspike Bros. Coal Co. The PA DEP California District Office is currently working with a company that is considering removing the refuse at these abandoned coal refuse sites for use as fuel in a cogeneration plant. The most recent word out of California is that they will have to pursue a contract for reclamation. The coal preparation plant has since been dismantled and this portion of the site has been reclaimed.

The Pine Run Watershed Assessment and Restoration Plan, funded by a Growing Greener grant, was completed by CWM Environmental, Inc. in March 2003 for the Pine Run Watershed Association in order to determine the impacts non-point source pollution was having on the watershed. The watershed was broken down into 8 separate sub-study areas and each of the areas was studied separately. Collected data, including water chemistry, flow measurements and biological samples, were organized in a GIS database and used to develop recommendations for each of the sub-study areas. Four major areas were listed as high priorities due to the fact that they contribute the greatest amount of AMD in the Pine Run Watershed (Wiesner Hollow/Dora Cleaning Plant, Caylor Run, The Corbettown Discharge and The Harmon Tipple area). Conceptual designs of passive treatment systems for the Upper Nye Branch, Corbettown and McGregor sites were also provided.

The Jefferson County Conservation District (JCCD), in partnership with the Pine Run Watershed Association, received a Growing Greener grant in 2004 to design a passive treatment system to treat the Caylor Run discharge, listed as a high priority in the Pine Run Watershed Assessment and Restoration Plan. CWM Environmental, Inc. is currently working on the design for the passive treatment system, which will involve channeling numerous low flow discharges into a series of three vertical flow wetlands. Once the design is completed, the JCCD plans to submit another Growing Greener grant for the construction of the Caylor Run treatment system.

The JCCD also received a Section 319(h) Nonpoint Source Watershed Management Grant in 2004 to design and construct a passive treatment system to treat the Corbettown Discharge, determined to be the largest contributor of iron loading in the Pine Run Watershed. CWM Environmental, Inc. is currently working on the design for the passive treatment system, which will consist of four vertical flow wetlands. Initially, the coal refuse piles on site were going to be reprocessed by a waste coal facility. However, sampling of the refuse determined that it was not an acceptable quality for the waste coal plant. The JCCD may pursue additional funding to reclaim the refuse piles.

AMD Methodology

A two-step approach is used for the TMDL analysis of AMD impaired stream segments. The first step uses a statistical method for determining the allowable instream concentration at the point of interest necessary to meet water quality standards. This is done at each point of interest (sample point) in the watershed. The second step is a mass balance of the loads as they pass through the watershed. Loads at these points will be computed based on average annual flow.

The statistical analysis described below can be applied to situations where all of the pollutant loading is from non-point sources as well as those where there are both point and non-point sources. The following defines what are considered point sources and non-point sources for the purposes of our evaluation; point sources are defined as permitted discharges or a discharge that has a responsible party, non-point sources are then any pollution sources that are not point sources. For situations where all of the impact is due to non-point sources, the equations shown below are applied using data for a point in the stream. The load allocation made at that point will be for all of the watershed area that is above that point. For situations where there are point-source impacts alone, or in combination with non-point sources, the evaluation will use the point-source data and perform a mass balance with the receiving water to determine the impact of the point source.

Allowable loads are determined for each point of interest using Monte Carlo simulation. Monte Carlo simulation is an analytical method meant to imitate real-life systems, especially when other analyses are too mathematically complex or too difficult to reproduce. Monte Carlo simulation calculates multiple scenarios of a model by repeatedly sampling values from the probability distribution of the uncertain variables and using those values to populate a larger data set. Allocations were applied uniformly for the watershed area specified for each allocation point. For each source and pollutant, it was assumed that the observed data were log-normally distributed. Each pollutant source was evaluated separately using @Risk[3] by performing 5,000 iterations to determine the required percent reduction so that the water quality criteria, as defined in the *Pennsylvania Code. Title 25 Environmental Protection, Department of Environmental Protection, Chapter 93, Water Quality Standards,* will be met instream at least 99 percent of the time. For each iteration, the required percent reduction is:

PR = maximum {0, (1-Cc/Cd)} where (1)

PR = required percent reduction for the current iteration

Cc = criterion in mg/l

Cd = randomly generated pollutant source concentration in mg/l based on the observed data

Cd = RiskLognorm(Mean, Standard Deviation) where (1a)

Mean = average observed concentration

Standard Deviation = standard deviation of observed data

The overall percent reduction required is the 99th percentile value of the probability distribution generated by the 5,000 iterations, so that the allowable long-term average (LTA) concentration is:

LTA = Mean * (1 – PR99) where (2)

LTA = allowable LTA source concentration in mg/l

Once the allowable concentration and load for each pollutant is determined, mass-balance accounting is performed starting at the top of the watershed and working down in sequence. This mass-balance or load tracking is explained below.

Load tracking through the watershed utilizes the change in measured loads from sample location to sample location, as well as the allowable load that was determined at each point using the @Risk program.

[3] @Risk – Risk Analysis and Simulation Add-in for Microsoft Excel, Palisade Corporation, Newfield, NY, 1990-1997.

There are two basic rules that are applied in load tracking; rule one is that if the sum of the measured loads that directly affect the downstream sample point is less than the measured load at the downstream sample point it is indicative that there is an increase in load between the points being evaluated, and this amount (the difference between the sum of the upstream and downstream loads) shall be added to the allowable load(s) coming from the upstream points to give a total load that is coming into the downstream point from all sources. The second rule is that if the sum of the measured loads from the upstream points is greater than the measured load at the downstream point this is indicative that there is a loss of instream load between the evaluation points, and the ratio of the decrease shall be applied to the load that is being tracked (allowable load(s)) from the upstream point.

Tracking loads through the watershed gives the best picture of how the pollutants are affecting the watershed based on the information that is available. The analysis is done to insure that water quality standards will be met at all points in the stream. The TMDL must be designed to meet standards at all points in the stream, and in completing the analysis, reductions that must be made to upstream points are considered to be accomplished when evaluating points that are lower in the watershed. Another key point is that the loads are being computed based on average annual flow and should not be taken out of the context for which they are intended, which is to depict how the pollutants affect the watershed and where the sources and sinks are located spatially in the watershed.

For pH TMDLs, acidity is compared to alkalinity as described in Attachment B. Each sample point used in the analysis of pH by this method must have measurements for total alkalinity and total acidity. Net alkalinity is alkalinity minus acidity, both in units of milligrams per liter (mg/**l**) $CaCO_3$. Statistical procedures are applied, using the average value for total alkalinity at that point as the target to specify a reduction in the acid concentration. By maintaining a net alkaline stream, the pH value will be in the range between six and eight. This method negates the need to specifically compute the pH value, which for streams affected by low pH from AMD may not a true reflection of acidity. This method assures that Pennsylvania’s standard for pH is met when the acid concentration reduction is met.

Information for the TMDL analysis performed using the methodology described above is contained in the “TMDLs by Segment” section of this report.

Method to Quantify Treatment Pond Pollutant Load

The following is an explanation of the quantification of the potential pollution load reporting to the stream from permitted pit water treatment ponds that discharge water at established effluent limits.

Surface coal mines remove soil and overburden materials to expose the underground coal seams for removal. After removal of the coal the overburden is replaced as mine spoil and the soil is replaced for revegetation. In a typical surface mining operation the overburden materials is removed and placed in the previous cut where the coal has been removed. In this fashion, an active mining operation has a pit that progresses through the mining site during the life of the mine. The pit may have water reporting to it, as it is a low spot in the local area. Pit water can be the result of limited shallow groundwater seepage, direct precipitation into the pit, and surface runoff from partially regarded areas that have been backfilled but not yet revegetated. Pit water is pumped to nearby treatment ponds where it is treated to the required treatment pond effluent limits. The standard effluent limits are as follows, although stricter effluent limits may be applied to a mining permit's effluent limits to insure that the discharge of treated water does not cause in-stream limits to be exceeded.

Standard Treatment Pond Effluent Limits:
Alkalinity > Acidity
$6.0 \le pH \le 9.0$
$Fe \le 3.0$ mg/l
$Mn \le 2.0$ mg/l
$Al \le 2.0$ mg/l

Discharge from treatment ponds on a mine site is intermittent and often varies as a result of precipitation events. Measured flow rates are almost never available. If accurate flow data are available, it is used along with the Best Available Technology (BAT) limits to quantify the WLA for one or more of the following: aluminum, iron, and manganese. The following formula is used:

$$\text{Flow (MGD)} \times \text{BAT limit (mg/l)} \times 8.34 = \text{lbs/day}$$

The following is an approach that can be used to determine a waste load allocation for an active mining operation when treatment pond flow rates are not available. The methodology involves quantifying the hydrology of the portion of a surface mine site that contributes flow to the pit and then calculating waste load allocation using NPDES treatment pond effluent limits.

The total water volume reporting to ponds for treatment can come from two primary sources: direct precipitation to the pit and runoff from the unregraded area following the pit's progression through the site. Groundwater seepage reporting to the pit is considered negligible compared to the flow rates resulting from precipitation.

In an active mining scenario, a mine operator pumps pit water to the ponds for chemical treatment. Pit water is often acidic with dissolved metals in nature. At the treatment ponds, alkaline chemicals are added to increase the pH and encourage dissolved metals to precipitate and settle. Pennsylvania averages 41.4 inches of precipitation per year (Mid-Atlantic River Forecast Center, National Weather Service, State College, PA, 1961-1990, http://www.dep.state.pa.us/dep/subject/hotopics/drought/PrecipNorm.htm). A maximum pit dimension without special permit approval is 1500 feet long by 300 feet wide. Assuming that 5 percent of the precipitation evaporates and the remaining 95 percent flows to the low spot in the active pit to be pumped to the treatment ponds, results in the following equation and average flow rates for the pit area.

41.4 in. precip./yr x 0.95 x 1 ft./12/in. x 1500'x300'/pit x 7.48 gal/ft^3 x 1yr/365days x 1day/24hr. x 1hr./60 min. =

= 21.0 gal/min average discharge from direct precipitation into the open mining pit area.

Pit water can also result from runoff from the unregraded and revegetated area following the pit. In the case of roughly backfilled and highly porous spoil, there is very little surface runoff. It is estimated that 80 percent of precipitation on the roughly regraded mine spoil infiltrates, 5 percent evaporates, and 15 percent may run off to the pit for pumping and potential treatment (Jay Hawkins, Office of Surface Mining, Department of the Interior, Personal Communications 2003). Regrading and revegetation of the mine spoil is conducted as the mining progresses. DEP encourages concurrent backfilling and revegetation through its compliance efforts and it is in the interest of the mining operator to minimize the company's reclamation bond liability by keeping the site reclaimed and revegetated. Experience has shown that reclamation and revegetation is accomplished two to three pit widths behind the active mining pit area. DEP uses three pit widths as an area representing potential flow to the pit when reviewing the NPDES permit application and calculating effluent limits based on best available treatment technology and insuring that in-stream limits are met. The same approach is used in the following equation, which represents the average flow reporting to the pit from the unregraded and unrevegetated spoil area.

41.4 in. precip./yr x 3 pit areas x 1 ft./12/in. x 1500'x300'/pit x 7.48 gal/ft^3 x 1yr/365days x 1day/24hr. x 1hr./60 min. x 15 in. runoff/100 in. precipitation =

= 9.9 gal./min. average discharge from spoil runoff into the pit area.

The total average flow to the pit is represented by the sum of the direct pit precipitation and the water flowing to the pit from the spoil area as follows:

Total Average Flow = Direct Pit Precipitation + Spoil Runoff

Total Average Flow = 21.0 gal./min + 9.9 gal./min. = 30.9 gal./min.

The resulting average waste load from a permitted treatment pond area is as follows.

Allowable Iron Waste Load Allocation:
30.9 gal./min. x 3 mg/l x 0.01202 = 1.1 lbs./day

Allowable Manganese Waste Load Allocation:
30.9 gal./min. x 2 mg/l x 0.01202 = 0.7 lbs./day

Allowable Aluminum Waste Load Allocation:
30.9 gal./min. x 2 mg/l x 0.01202 = 0.7 lbs./day

(Note: 0.01202 is a conversion factor to convert from a flow rate in gal/min. and a concentration in mg/l to a load in units of lbs./day.)

There is little or no documentation available to quantify the actual amount of water that is typically pumped from active pits to treatment ponds. Experience and observations suggest that the above approach is very conservative and overestimates the quantity of water, creating a large margin of safety in the methodology. County specific precipitation rates can be used in place of the long-term state average rate, although the margin of safety is greater than differences from individual counties. It is common for many mining sites to have very “dry” pits that rarely accumulate water that would require pumping and treatment.

Also, it is the goal of DEP’s permit review process to not issue mining permits that would cause negative impacts to the environment. As a step to insure that a mine site does not produce acid mine drainage, it is common to require the addition of alkaline materials (waste lime, baghouse lime, limestone, etc.) to the backfill spoil materials to neutralize any acid-forming materials that may be present. This practice of ‘alkaline addition’ or the incorporation of naturally occurring alkaline spoil materials (limestone, alkaline shale or other rocks) may produce alkaline pit water with very low metals concentrations that does not require treatment. A comprehensive study in 1999 evaluated mining permits issued since 1987 and found that only 2.2 percent resulted in a post-mining pollution discharge (Evaluation of Mining Permits Resulting in Acid Mine Drainage 1987-1996: A Post Mortem Study, March 1999). As a result of efforts to insure that acid mine drainage is prevented, most mining operations have alkaline pit water that often meets effluent limits and requires little or no treatment.

While most mining operations are permitted and allowed to have a standard, 1500’ x 300’ pit, most are well below that size and have a corresponding decreased flow and load. Where pit dimensions are greater than the standard size or multiple pits are present, the calculations to define the potential pollution load can be adjusted accordingly. Hence, the above calculated Waste Load Allocation is very generous and likely high compared to actual conditions that are generally encountered. A large margin of safety is included in the WLA calculations.

This is an explanation of the quantification of the potential pollution load reporting to the stream from permitted pit water treatment ponds that discharge water at established effluent limits. This allows for including active mining activities and their associated Waste Load in the TMDL calculations to more accurately represent the watershed pollution sources and the reductions necessary to achieve in-stream limits. When a mining operation is concluded its WLA is available for a different operation. Where there are indications that future mining in a watershed are greater than the current level of mining activity, an additional WLA amount may be included to allow for future mining.

TMDL Endpoints

One of the major components of a TMDL is the establishment of an instream numeric endpoint, which is used to evaluate the attainment of applicable water quality. An instream numeric endpoint, therefore, represents the water quality goal that is to be achieved by implementing the load reductions specified in the TMDL. The endpoint allows for a comparison between observed instream conditions and conditions that are expected to restore designated uses. The endpoint is based on either the narrative or numeric criteria available in water quality standards.

Because most of the pollution sources in the watershed are nonpoint sources, the TMDLs' component makeup will be Load Allocations (LAs). All allocations will be specified as long-term average daily concentrations. These long-term average concentrations are expected to meet water-quality criteria 99% of the time as required in PA Title 25 Chapter 96.3(c). The following table shows the applicable water-quality criteria for the selected parameters.

Table 2. Applicable Water Quality Criteria

Parameter	*Criterion Value (mg/l)*	*Total Recoverable/Dissolved*
Aluminum (Al)	0.75	Total Recoverable
Iron (Fe)	1.50	30 day average; Total Recoverable
Manganese (Mn)	1.00	Total Recoverable
pH *	6.0-9.0	N/A
Sulfates	250	Total Recoverable

*The pH values shown will be used when applicable. In the case of freestone streams with little or no buffering capacity, the TMDL endpoint for pH will be the natural background water quality.

TMDL Elements (WLA, LA, MOS)

$$TMDL = WLA + LA + MOS$$

A TMDL equation consists of a waste load allocation (WLA), load allocation (LA), and a margin of safety (MOS). The waste load allocation is the portion of the load assigned to point sources. The load allocation is the portion of the load assigned to non-point sources. The margin of safety is applied to account for uncertainties in the computational process. The margin of safety may be expressed implicitly (documenting conservative processes in the computations) or explicitly (setting aside a portion of the allowable load). The TMDL allocations in this report are based on available data. Other allocation schemes could also meet the TMDL.

Allocation Summary

These TMDLs will focus remediation efforts on the identified numerical reduction targets for each watershed. The reduction schemes in Table 3 for each segment are based on the assumption that all upstream allocations are achieved and take into account all upstream reductions. Attachment C contains the TMDLs by segment analysis for each allocation point in a detailed discussion. As changes occur in the watershed, the TMDLs may be re-evaluated to reflect current conditions. An implicit MOS based on conservative assumptions in the analysis is included in the TMDL calculations.

The allowable LTA concentration in each segment is calculated using Monte Carlo Simulation as described previously. The allowable load is then determined by multiplying the allowable concentration by the flow and a conversion factor at each sample point. The allowable load is the TMDL.

Each permitted discharge in a segment is assigned a waste load allocation and the total waste load allocation for each segment is included in this table. The difference between the TMDL and the WLA at each point is the load allocation (LA) at the point. The LA at each point includes all loads entering the segment, including those from upstream allocation points. The percent reduction is calculated to show the amount of load that needs to be reduced within a segment in order for water quality standards to be met at the point.

In some instances, instream processes, such as settling, are taking place within a stream segment. These processes are evidenced by a decrease in measured loading between consecutive sample points. It is appropriate to account for these losses when tracking upstream loading through a segment. The calculated upstream load lost within a segment is proportional to the difference in the measured loading between the sampling points.

In the instance that the allowable load is equal to the existing load (e.g. aluminum point PINE29, Table 3), the simulation determined that water quality standards are being met instream 99% of the time and no TMDL is necessary for the parameter at that point. Although no TMDL is necessary, the loading at the point is considered at the next downstream point.

Table 3. TMDL Component Summary for the Pine Run Watershed

Station	Parameter	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	Load Reduction (lbs/day)	Percent Reduction %
PINE31	*Pine Run, upstream of Unnamed Tributary 47391*						
	Al	2.2	2.3	0.1	2.2	0.0	0
	Fe	5.1	5.3	0.2	5.1	0.0	0
	Mn	0.9	1.0	0.1	0.9	0.0	0
	Acidity	0.0	0.0	0.0	0.0	0.0	0
PINE30	*Mouth of Unnamed Tributary 47391*						
	Al	7.1	5.4	0.0	5.4	1.7	24
	Fe	551.0	16.5	0.0	16.5	534.5	97
	Mn	36.4	12.8	0.0	12.8	23.6	65
	Acidity	258.3	113.6	0.0	113.6	144.7	56
PINE29	*Pine Run, upstream of Middle Branch*						
	Al	5.9	5.9	NA	NA	0.0	0
	Fe	428.6	25.7	0.0	25.7	0.0	0
	Mn	40.0	14.4	0.0	14.4	2.0	12
	Acidity	298.7	98.6	0.0	98.6	55.5	36
MBCH01	*Mouth of Middle Branch*						
	Al	25.2	5.0	0.1	4.9	20.3	80
	Fe	11.5	8.9	0.2	8.7	2.8	25
	Mn	5.2	5.3	0.1	5.2	0.0	0
	Acidity	0.0	0.0	0.0	0.0	0.0	0
PINE27	*Pine Run, upstream of Unnamed Tributary 47383*						
	Al	44.7	17.0	0.0	17.0	6.5	28
	Fe	470.3	28.2	0.0	28.2	27.6	49
	Mn	55.7	16.1	0.0	16.1	14.0	46
	Acidity	444.7	160.1	0.0	160.1	84.5	35
PINE26	*Mouth of Unnamed Tributary 47383*						
	Al	26.3	2.6	0.0	2.6	23.7	90
	Fe	13.6	3.8	0.0	3.8	9.8	72
	Mn	13.7	3.7	0.0	3.7	10.0	73

Station	Parameter	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	Load Reduction (lbs/day)	Percent Reduction %
	Acidity	304.1	0.0	0.0	0.0	304.1	100
CYLR02	*Mouth of Unnamed Tributary 47382*						
	Al	1.00	0.05	0.0	0.05	0.95	95
	Fe	0.72	0.11	0.0	0.11	0.61	85
	Mn	3.13	0.09	0.0	0.09	3.04	97
	Acidity	9.11	0.09	0.0	0.09	9.02	99
CYLR01	*Mouth for Caylor Run*						
	Al	67.0	3.4	0.0	3.4	63.6	95
	Fe	87.2	5.2	0.0	5.2	82.0	94
	Mn	55.2	5.0	0.0	5.0	50.2	91
	Acidity	831.9	0.0	0.0	0.0	831.9	100
PINE22	*Pine Run, upstream of Unnamed Tributary 47376*						
	Al	159.7	36.7	0.0	36.7	6.9	16
	Fe	616.3	49.3	0.0	49.3	32.5	40
	Mn	162.9	37.5	0.0	37.5	22.6	38
	Acidity	1,224.9	85.7	0.0	85.7	37.7	31
PINE21	*Mouth of Unnamed Tributary 47376*						
	Al	0.1	0.1	NA	NA	0.0	0
	Fe	0.2	0.2	NA	NA	0.0	0
	Mn	0.4	0.4	NA	NA	0.0	0
	Acidity	0.0	0.0	NA	NA	0.0	0
PINE20	*Pine Run, upstream of Eagle Run*						
	Al	175.5	42.1	0.0	42.1	10.4	20
	Fe	950.7	85.6	0.0	85.6	298.2	78
	Mn	234.3	58.6	0.0	58.6	50.3	46
	Acidity	1,375.6	206.3	0.0	206.3	30.1	13
EGLE01	*Mouth of Eagle Run*						
	Al	2.5	2.5	NA	NA	0.0	0
	Fe	3.2	3.2	NA	NA	0.0	0
	Mn	4.4	4.4	NA	NA	0.0	0
	Acidity	0.0	0.0	NA	NA	0.0	0
PINE18	*Pine Run, upstream of Painter Run*						
	Al	163.0	39.1	0.0	39.1	1.8	4
	Fe	854.8	76.9	0.0	76.9	2.7	3
	Mn	228.0	59.3	0.0	59.3	0.9	1
	Acidity	1,191.1	214.4	0.0	214.4	0.0	0
NYRN03	*Nye Branch, near headwaters*						
	Al	7.7	2.7	0.0	2.7	5.0	65
	Fe	3.4	3.4	NA	NA	0.0	0
	Mn	10.4	4.9	0.0	4.9	5.5	53
	Acidity	56.3	6.8	0.0	6.8	49.6	88

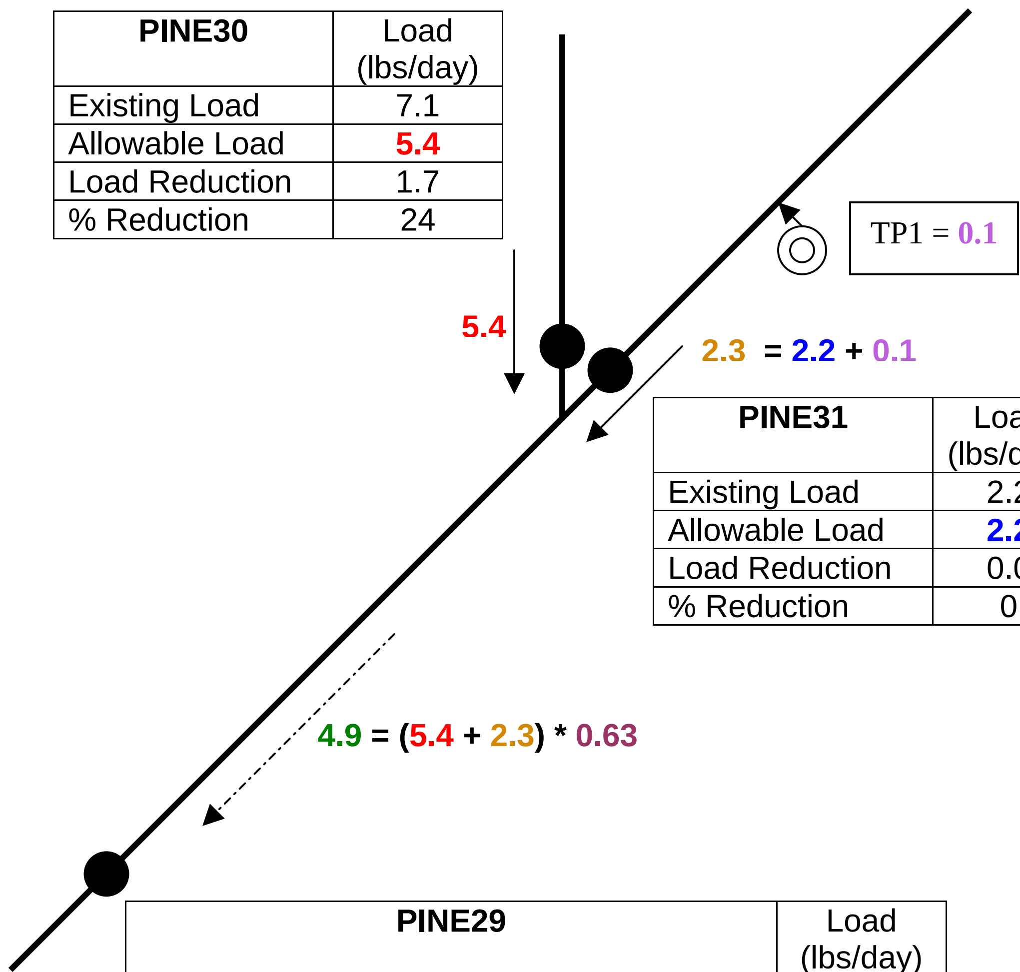
Station	Parameter	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	Load Reduction (lbs/day)	Percent Reduction %
NYRN02	*Nye Branch, upstream of Unnamed Tributary 47355*						
	Al	5.8	5.8	NA	NA	0.0	0
	Fe	12.5	12.5	NA	NA	0.0	0
	Mn	27.9	14.5	0.0	14.5	7.9	35
	Acidity	100.0	20.0	0.0	20.0	30.5	60
NYRN01	*Mouth of Nye Branch*						
	Al	6.5	6.5	NA	NA	0.0	0
	Fe	14.1	14.1	NA	NA	0.0	0
	Mn	29.3	23.8	0.0	23.8	0.0	0
	Acidity	73.6	33.9	0.0	33.9	0.0	0
PNTR01	*Mouth of Painter Run*						
	Al	3.3	3.3	0.1	3.2	0.0	0
	Fe	9.5	9.5	0.1	9.4	0.0	0
	Mn	3.2	3.2	0.1	3.1	0.0	0
	Acidity	0.0	0.0	0.0	0.0	0.0	0
PINE13	*Pine Run, downstream of Nye Branch*						
	Al	132.0	60.7	0.0	60.7	0.0	0
	Fe	737.3	118.0	0.0	118.0	0.0	0
	Mn	241.6	89.4	0.0	89.4	0.0	0
	Acidity	918.3	248.0	0.0	248.0	0.0	0
PINE12	*Mouth of Unnamed Tributary 47350*						
	Al	1.1	1.1	NA	NA	0.0	0
	Fe	1.1	1.1	NA	NA	0.0	0
	Mn	0.5	0.5	NA	NA	0.0	0
	Acidity	0.0	0.0	NA	NA	0.0	0
PINE11	*Mouth of Unnamed Tributary 47439*						
	Al	24.8	1.7	0.0	1.7	23.1	93
	Fe	17.1	2.4	0.0	2.4	14.7	86
	Mn	17.4	2.4	0.0	2.4	15.0	86
	Acidity	216.8	0.0	0.0	0.0	216.8	100
PINE10	*Pine Run, upstream of Sugarcamp Run*						
	Al	176.8	81.3	0.0	81.3	0.0	0
	Fe	941.4	160.0	0.0	160.0	113.6	42
	Mn	289.4	101.3	0.0	101.3	4.3	4
	Acidity	1,630.7	277.2	0.0	277.2	358.7	56
SUGR01	*Mouth of Sugarcamp Run*						
	Al	4.3	4.3	NA	NA	0.0	0
	Fe	2.2	2.2	NA	NA	0.0	0
	Mn	11.5	5.4	0.0	5.4	6.1	53
	Acidity	25.5	9.7	0.0	9.7	15.8	62
PINE08	*Pine Run, upstream of Mudlick Creek*						

Station	Parameter	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	Load Reduction (lbs/day)	Percent Reduction %
	Al	200.5	64.2	0.0	64.2	15.8	20
	Fe	979.6	137.1	0.0	137.1	61.1	31
	Mn	313.4	103.4	0.0	103.4	15.8	13
	Acidity	1,838.3	294.1	0.0	294.1	174.9	37
MDLK01	*Mouth of Mudlick Creek*						
	Al	4.0	4.0	NA	NA	0.0	0
	Fe	7.7	7.7	NA	NA	0.0	0
	Mn	13.3	13.3	NA	NA	0.0	0
	Acidity	0.0	0.0	NA	NA	0.0	0
PINE06	*Mouth of Unnamed Tributary 47337*						
	Al	1.0	1.0	NA	NA	0.0	0
	Fe	1.8	1.8	NA	NA	0.0	0
	Mn	0.4	0.4	NA	NA	0.0	0
	Acidity	0.0	0.0	NA	NA	0.0	0
PINE05	*Pine Run, downstream of Unnamed Tributary 47337*						
	Al	219.6	83.5	0.0	83.5	0.0	0
	Fe	1,007.6	171.3	0.0	171.3	0.0	0
	Mn	352.6	144.6	0.0	144.6	0.0	0
	Acidity	993.5	347.7	0.0	347.7	0.0	0
PINE03	*Mouth of Unnamed Tributary 47329*						
	Al	5.8	5.8	NA	NA	0.0	0
	Fe	7.2	7.2	NA	NA	0.0	0
	Mn	5.4	5.4	NA	NA	0.0	0
	Acidity	0.0	0.0	NA	NA	0.0	0
PINE02	*Mouth of Unnamed Tributary 47335*						
	Al	0.2	0.2	NA	NA	0.0	0
	Fe	0.6	0.6	NA	NA	0.0	0
	Mn	0.2	0.2	NA	NA	0.0	0
	Acidity	0.0	0.0	NA	NA	0.0	0
PINE01	*Mouth of Pine Run*						
	Al	185.1	124.0	0.0	124.0	0.0	0
	Fe	837.7	201.0	0.0	201.0	0.0	0
	Mn	344.3	196.3	0.0	196.3	0.0	0
	Acidity	680.4	483.1	0.0	483.1	0.0	0

NA, meets WQS. No TMDL necessary.

Following is an example of how the allocations, presented in Table 3 are calculated. For this example, aluminum allocations for points PINE31, PINE30 and PINE29 are shown. As demonstrated in the example, all upstream contributing loads are accounted for at each point. Attachment C contains the TMDLs by segment analysis for each allocation point in a detailed discussion. These analyses follow the example. Attachment A contains a map of the sampling point locations for reference.

PINE30	Load (lbs/day)
Existing Load	7.1
Allowable Load	**5.4**
Load Reduction	1.7
% Reduction	24



PINE31	Load (lbs/day)
Existing Load	2.2
Allowable Load	**2.2**
Load Reduction	0.0
% Reduction	0

PINE29	Load (lbs/day)
Existing Load	5.9
Difference in Existing Load between points	-3.4
Load tracked from upstream	7.7
Percent load lost	37
Percent load tracked	**63**
Total Load tracked between points	**4.9**
Allowable Load at PINE29	5.9
Additional Reduction at PINE29	0.0
% Reduction required at PINE29	0

Waste load allocations are assigned to the permitted discharges for the following; Opal Industries, Inc. Schreckengost Mine SMP 33960108 and the Falls Creek Energy Co., Inc. Adams Mine SMP 33030106.

For both sites the WLAs are calculated using the method as described in *The Method to Quantify Treatment Pond Pollutant Load* section of the report.

On the Adams Mine there are two permitted treatment pond discharges, TP1 and TP2. The permitted dimensions are 100' W x 600' L, for a pit area of 60,000 square feet. Included in the permit are the standard BAT limits of 3.0 mg/L for iron and 2.0 mg/L for manganese. Although aluminum is not included in the permit, a waste load allocation is calculated to allow for the discharge of aluminum. The standard BAT limit of 2.0 mg/L is used for the calculations. The WLA for TP1 is being evaluated at sample point PINE31 and for TP2 at sample point MBCH01.

The Adams Mine was recently activated and did not exist at the time of TMDL sampling so loads from the site, namely discharges TP1 and TP2, are not reflected in the water quality data. At sample point PINE 31 water quality standards are met for all parameters. To ensure that the stream has the necessary assimilative capacity to accept the additional loading from the Adams Mine, the following mass balance equation was solved to determine the resulting instream concentration for iron, aluminum and manganese. For this equation, the measured instream concentration and flow, the BAT limits for each parameter, and the calculated discharge flow of 0.0061 MGD is used.

$$Q_{(\text{stream + discharge})} * C_{(\text{stream + discharge})} = Q_{(\text{stream})} * C_{(\text{stream})} + Q_{(\text{discharge})} * C_{(\text{discharge})}$$

where,
Q = flow, MGD and C= concentration, mg/L

The resulting instream concentrations are; Al of 0.11 mg/L, Fe of 0.27 mg/L, and Mn of 0.06 mg/L. The stream has the necessary assimilative capacity to accept the mine discharge. The total load tracked to the next downstream point is the measured load plus the additional load from the discharge.

At sample point MBCH01 the water quality standard is met for manganese, but not for aluminum and iron. For manganese, the same rationale is applied to the TP2 discharge as that used for the TP1 discharge. The resulting instream concentration is 0.36 mg/L. For aluminum and iron, a portion of the allowable load is assigned to the discharge resulting in an increased nonpoint source reduction.

The one permitted treatment discharge from the Schreckengost Mine, TP-1, is evaluated at sample point PNTR01. The permitted pit dimensions are 100'L x 100' W and 700' L x 50' W, for a total pit area of 45,000 square feet. Included in the permit are the standard BAT limits of 3.0 mg/L for iron and 2.0 mg/L for manganese. Although aluminum is not included in the permit, a waste load allocation is calculated to allow for the discharge of aluminum. The standard BAT limit of 2.0 mg/L is used for the calculations. Water quality standards are met for all parameters at PNTR01. Because loading from TP-1 is reflected in the sampling results for PNTR01, a portion of the load is assigned to the discharge and the remaining load is assigned to nonpoint sources.

No required reductions of permit limits are required at this time. All necessary reductions are assigned to non-point sources. Table 4 below contains the WLAs for the Pine Run Watershed permitted discharges.

Table 4. Waste Load Allocations of Permitted Discharges

Mine	Station	Parameter	Allowable Average Monthly Conc. (mg/L)	Average Flow (MGD)	WLA (lbs/day)
Falls Creek Energy Co., Inc.	**TP1**	Al	2.0	0.0061	0.10
SMP 33030106		Fe	3.0	0.0061	0.15
NPDES PA0242373		Mn	2.0	0.0061	0.10
Adams Mine					
	TP2	Al	2.0	0.0061	0.10
		Fe	3.0	0.0061	0.15
		Mn	2.0	0.0061	0.10
Opal Industries, Inc.	**010**	Al	2.0	0.0046	0.08
SMP 33960108		Fe	3.0	0.0046	0.11
NPDES PA0227315		Mn	2.0	0.0046	0.08
Schreckengost Mine					

Recommendations

Two primary programs provide maintenance and improvement of water quality in the watershed. DEP's efforts to reclaim abandoned mine lands, coupled with its duties and responsibilities for issuing NPDES permits, will be the focal points in water quality improvement.

Additional opportunities for water quality improvement are both ongoing and anticipated. Historically, a great deal of research into mine drainage has been conducted by DEP's Bureau of Abandoned Mine Reclamation, which administers and oversees the Abandoned Mine Reclamation Program in Pennsylvania; the United States Office of Surface Mining; the National Mine Land Reclamation Center; the National Environmental Training Laboratory; and many other agencies and individuals. Funding from EPA's CWA Section 319(a) Grant program and Pennsylvania's Growing Greener program has been used extensively to remedy mine drainage impacts. These many activities are expected to continue and result in water quality improvement.

The DEP Bureau of Mining and Reclamation administers an environmental regulatory program for all mining activities, mine subsidence regulation, mine subsidence insurance, and coal refuse disposal; conducts a program to ensure safe underground bituminous mining and protect certain structures form subsidence; administers a mining license and permit program; administers a regulatory program for the use, storage, and handling of explosives; provides for training, examination, and certification of applicants for blaster's licenses; administers a loan program for bonding anthracite underground mines and for mine subsidence; and administers the EPA Watershed Assessment Grant Program, the Small Operator's Assistance Program (SOAP), and the Remining Operators Assistance Program (ROAP).

Mine reclamation and well plugging refers to the process of cleaning up environmental pollutants and safety hazards associated with a site and returning the land to a productive condition, similar to DEP's Brownfields program. Since the 1960's, Pennsylvania has been a national leader in establishing laws and regulations to ensure reclamation and plugging occur after active operation is completed.

Pennsylvania is striving for complete reclamation of its abandoned mines and plugging of its orphaned wells. Realizing this task is no small order, DEP has developed concepts to make abandoned mine reclamation easier. These concepts, collectively called Reclaim PA, include legislative, policy land management initiatives designed to enhance mine operator, volunteer land DEP reclamation efforts. Reclaim PA has the following four objectives.

- To encourage private and public participation in abandoned mine reclamation efforts
- To improve reclamation efficiency through better communication between reclamation partners
- To increase reclamation by reducing remining risks
- To maximize reclamation funding by expanding existing sources and exploring new sources.

Reclaim PA is DEP's initiative designed to maximize reclamation of the state's quarter million acres of abandoned mineral extraction lands. Abandoned mineral extraction lands in Pennsylvania constituted a significant public liability – more than 250,000 acres of abandoned surface mines, 2,400 miles of streams polluted with mine drainage, over 7,000 orphaned and abandoned oil and gas wells, widespread subsidence problems, numerous hazardous mine openings, mine fires, abandoned structures and affected water supplies – representing as much as one third of the total problem nationally.

An Assessment and Restoration Plan for the Pine Run Watershed was completed by CWM Environmental, Inc. in March 2003 for the Pine Run Watershed Association (PRWA) under a Growing Greener grant. The Plan documented the impacts non-point source pollution was having on the watershed and identified four major areas as high priorities do to the fact that they contribute the greatest amount of AMD in the Pine Run Watershed (Wiesner Hollow/Dora Cleaning Plant, Caylor Run, The Corbettown Discharge and The Harmon Tipple area).

Currently the Jefferson County Conservation District (JCCD), in partnership with the PRWA, is pursuing two projects to remediate AMD in two of the priority areas identified in the Assessment and Restoration Plan. The design for a passive treatment system to remediate the Caylor Run discharges is currently being completed, funded through a Growing Greener grant received by the JCCD in 2004. Both the design and construction of a passive treatment system to remediate the Corbettown Discharge was funded in 2004 under a Section 319(h) Nonpoint Source

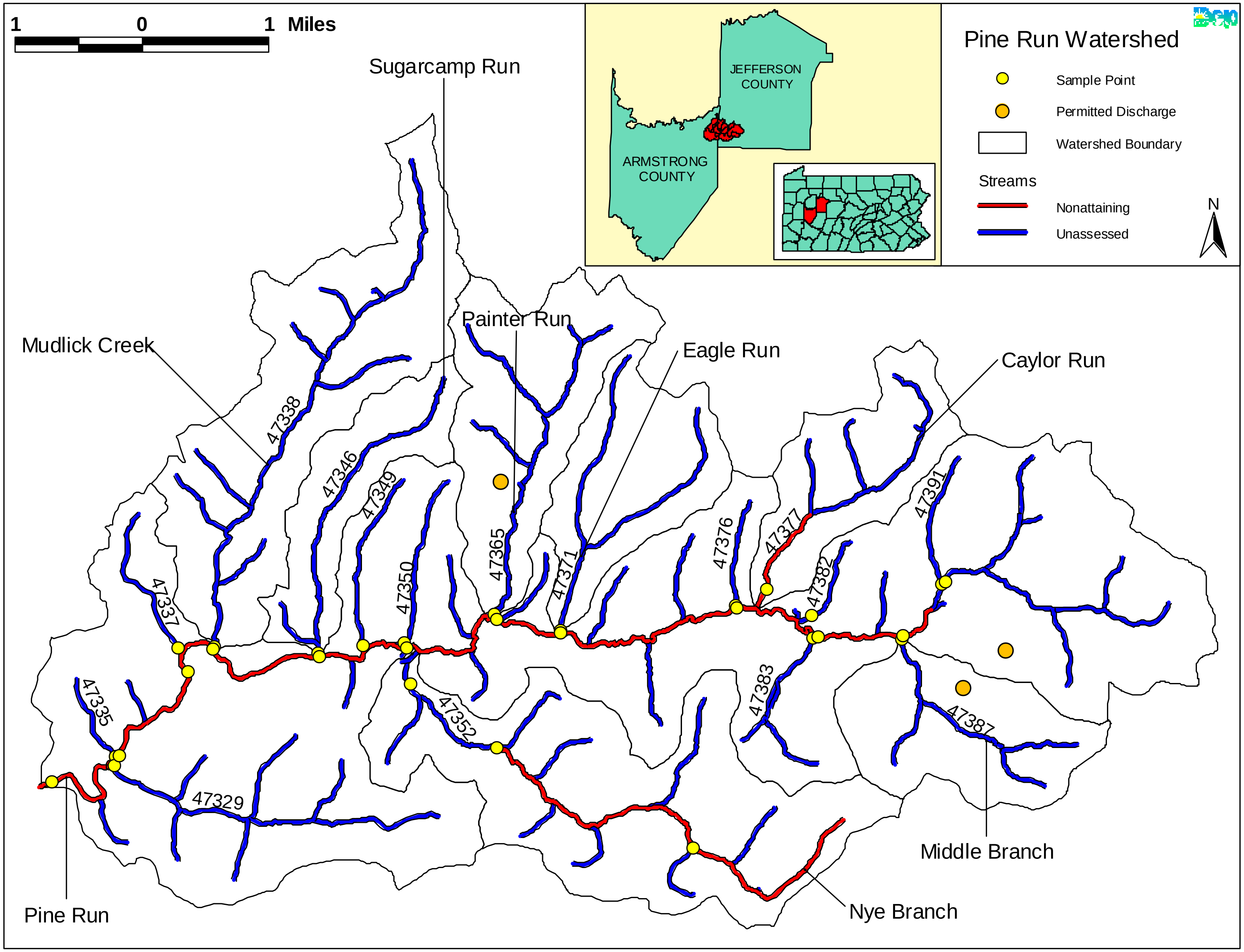
Watershed Management Grant. The design is currently being completed and construction is expected to begin once the design is finalized.

Public Participation

Public notice of the draft TMDL was published in the *Pennsylvania Bulletin* and the Punxsutawney Spirit, Punxsutawney, PA on September 25, 2006 to foster public comment on the allowable loads calculated. The public comment period on this TMDL was open from September 30, 2006 to November 29, 2006. A public meeting was held on October 4, 2006 at the Jefferson County Conservation District Office, Brookville, PA to discuss the proposed TMDL.

Attachment A

Pine Run Watershed Maps



1 0 1 Miles
Pine Run Watershed
Sample Point
Permitted Discharge
Watershed Boundary
Streams
Nonattaining
Unassessed
N
JEFFERSON COUNTY
ARMSTRONG COUNTY
Sugarcamp Run
Painter Run
Eagle Run
Caylor Run
Mudlick Creek
Middle Branch
Nye Branch
Pine Run
47338
47346
47349
47350
47365
47371
47376
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47382
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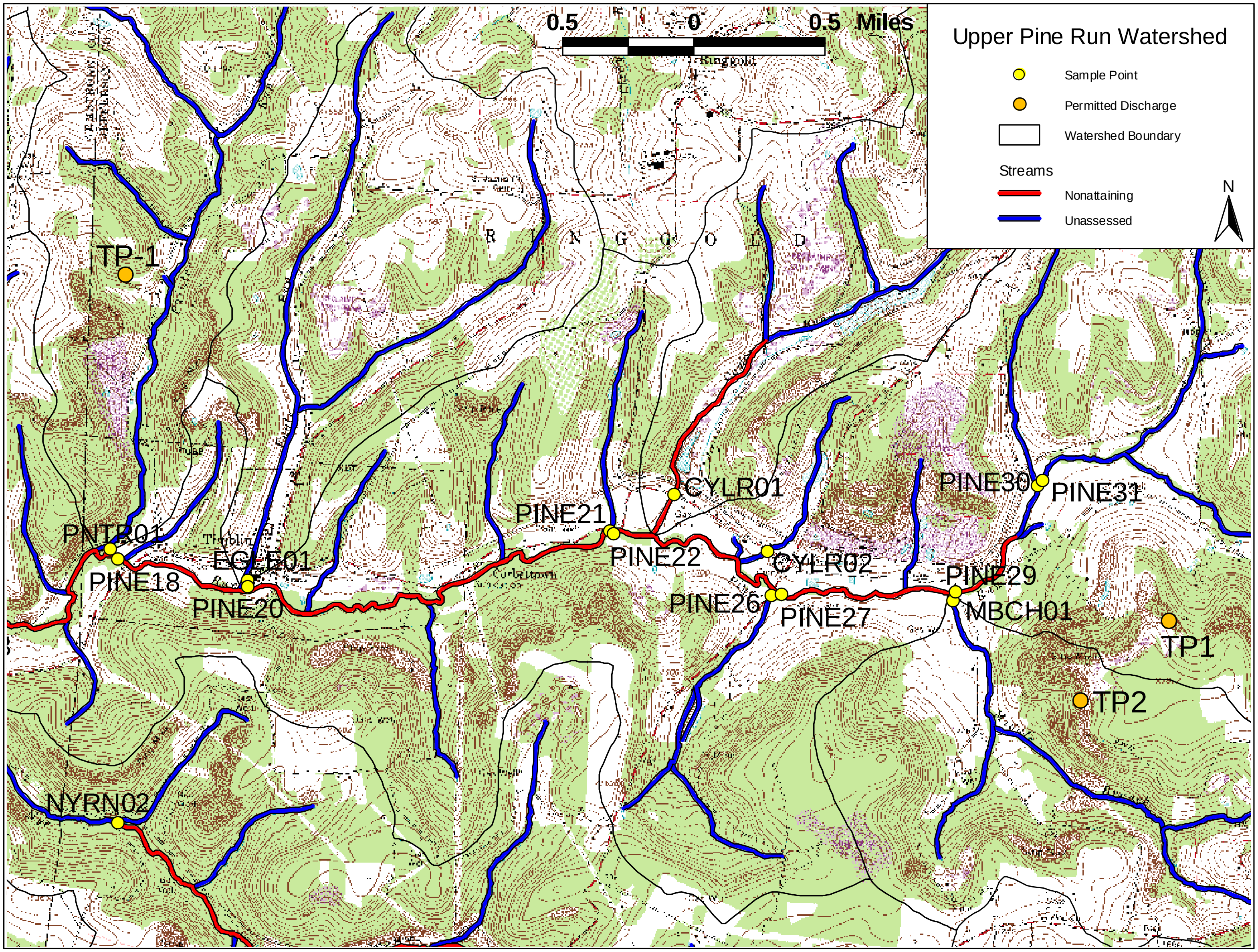
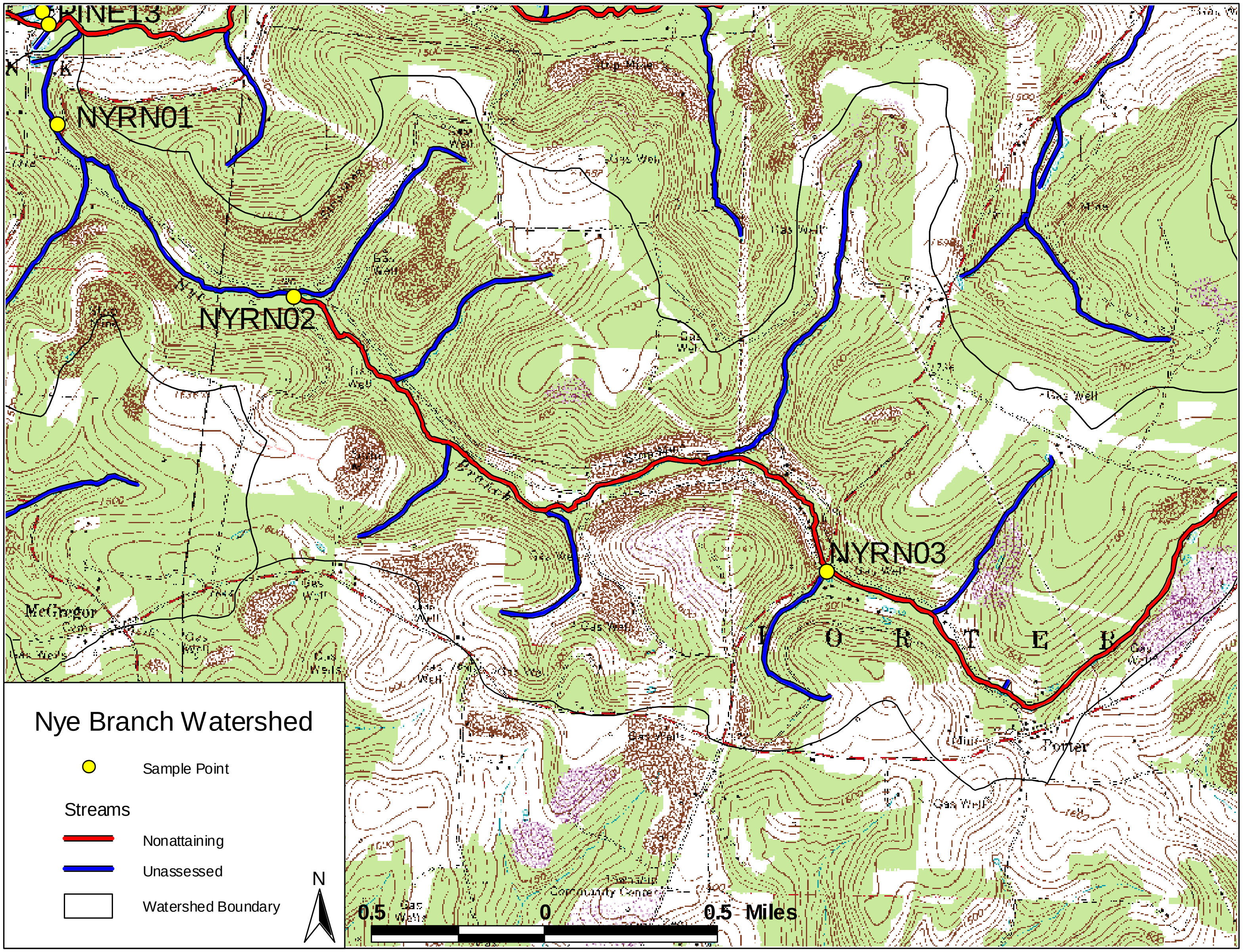
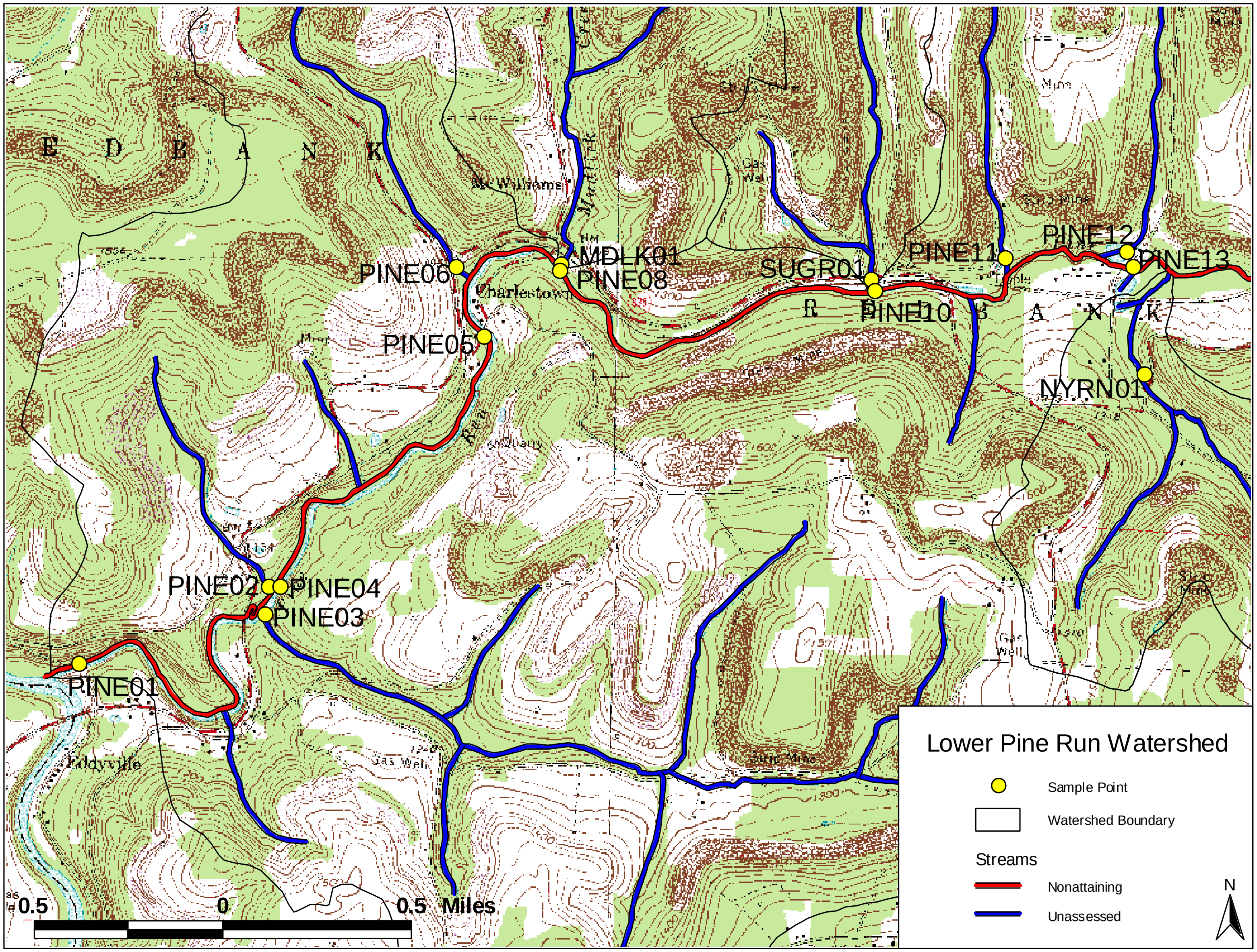
47329
47352
47383
47387

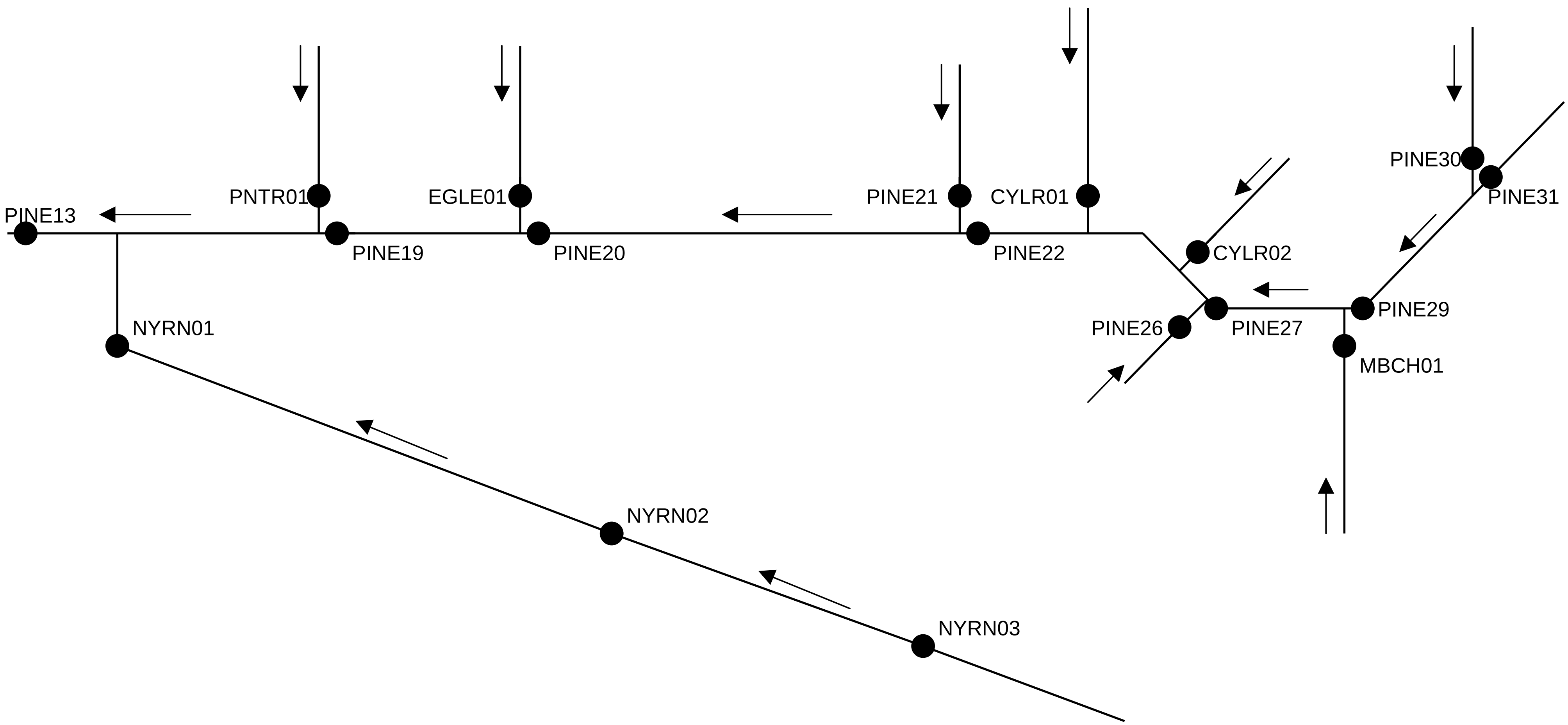

0.5 0 0.5 Miles
Upper Pine Run Watershed
Sample Point
Permitted Discharge
Watershed Boundary
Streams
Nonattaining
Unassessed
N
TP-1
PNTR01
PINE18
EGLE01
PINE20
PINE21
PINE22
CYLR01
CYLR02
PINE26
PINE27
PINE30
PINE31
PINE29
MBCH01
TP1
TP2
NYRN02



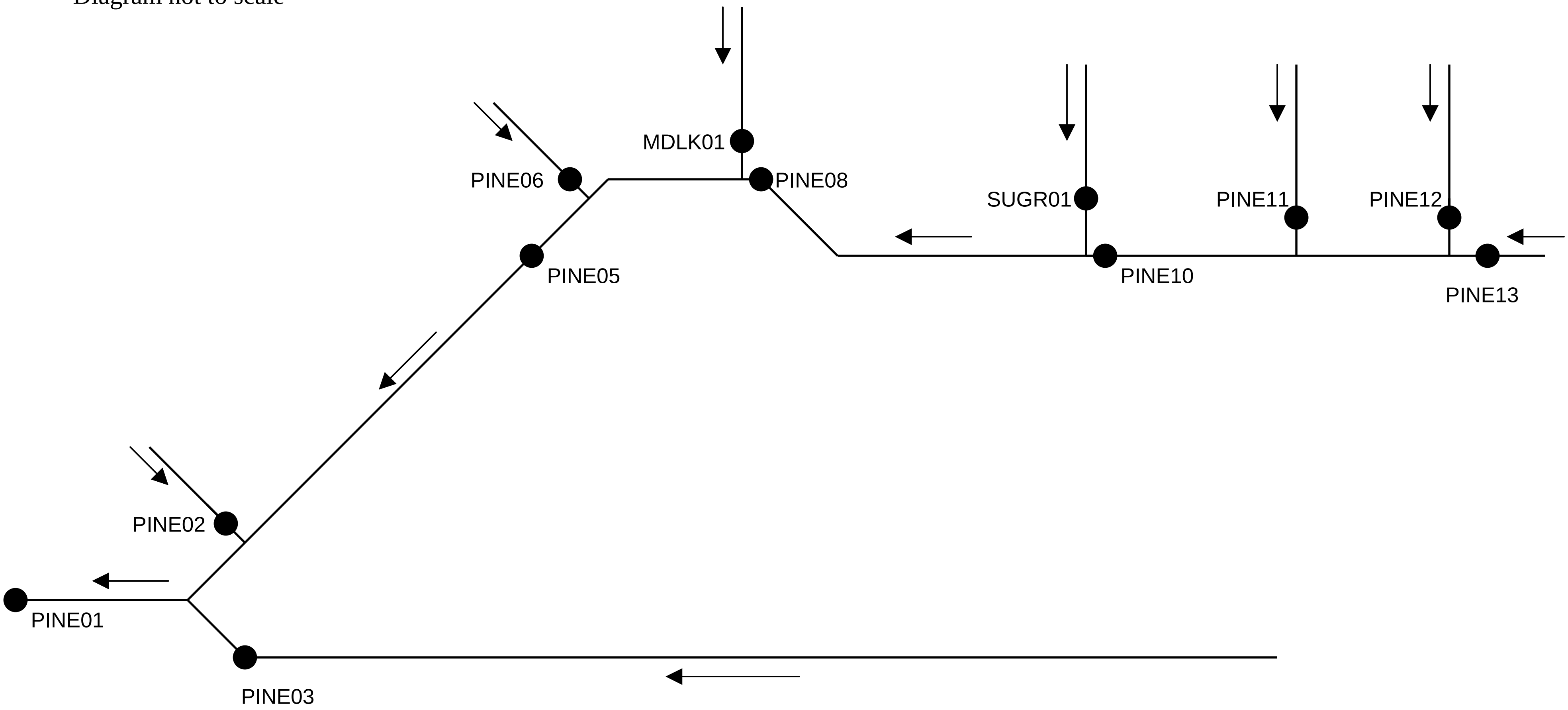
PINE13
NYRN01
NYRN02
NYRN03
Nye Branch Watershed
Sample Point
Streams
Nonattaining
Unassessed
Watershed Boundary
N
0.5
0
0.5 Miles
McGregor
Porter


Lower Pine Run Watershed
Sample Point
Watershed Boundary
Streams
Nonattaining
Unassessed
N
0.5
0
0.5 Miles
PINE01
PINE02
PINE03
PINE04
PINE05
PINE06
PINE08
PINE10
PINE11
PINE12
PINE13
MDLK01
SUGR01
NYRN01
Charlestown
Eddyville

Upper Pine Run Sampling Station Diagram
Arrows represent direction of flow
Diagram not to scale



Lower Pine Run Sampling Station Diagram
Arrows represent direction of flow
Diagram not to scale



Attachment B

Method for Addressing Section 303(d) Listings for pH

Method for Addressing Section 303(d) Listings for pH

There has been a great deal of research conducted on the relationship between alkalinity, acidity, and pH. Research published by the Department of Environmental Protection demonstrates that by plotting net alkalinity (alkalinity-acidity) vs. pH for 794 mine sample points, the resulting pH value from a sample possessing a net alkalinity of zero is approximately equal to six (Figure 1). Where net alkalinity is positive (greater than or equal to zero), the pH range is most commonly six to eight, which is within the EPA's acceptable range of six to nine and meets Pennsylvania water quality criteria in Chapter 93.

The pH, a measurement of hydrogen ion acidity presented as a negative logarithm, is not conducive to standard statistics. Additionally, pH does not measure latent acidity. For this reason, and based on the above information, Pennsylvania is using the following approach to address the stream impairments noted on the Section 303(d) list due to pH. The concentration of acidity in a stream is at least partially chemically dependent upon metals. For this reason, it is extremely difficult to predict the exact pH values, which would result from treatment of abandoned mine drainage. Therefore, net alkalinity will be used to evaluate pH in these TMDL calculations. This methodology assures that the standard for pH will be met because net alkalinity is a measure of the reduction of acidity. When acidity in a stream is neutralized or is restored to natural levels, pH will be acceptable. Therefore, the measured instream alkalinity at the point of evaluation in the stream will serve as the goal for reducing total acidity at that point. The methodology that is applied for alkalinity (and therefore pH) is the same as that used for other parameters such as iron, aluminum, and manganese that have numeric water quality criteria.

Each sample point used in the analysis of pH by this method must have measurements for total alkalinity and total acidity. Net alkalinity is alkalinity minus acidity, both being in units of milligrams per liter (mg/l) $CaCO_3$. The same statistical procedures that have been described for use in the evaluation of the metals is applied, using the average value for total alkalinity at that point as the target to specify a reduction in the acid concentration. By maintaining a net alkaline stream, the pH value will be in the range between six and eight. This method negates the need to specifically compute the pH value, which for mine waters is not a true reflection of acidity. This method assures that Pennsylvania's standard for pH is met when the acid concentration reduction is met.

Reference: *Rose, Arthur W. and Charles A. Cravotta, III 1998. Geochemistry of Coal Mine Drainage. Chapter 1 in Coal Mine Drainage Prediction and Pollution Prevention in Pennsylvania. Pa. Dept. of Environmental Protection, Harrisburg, Pa.*

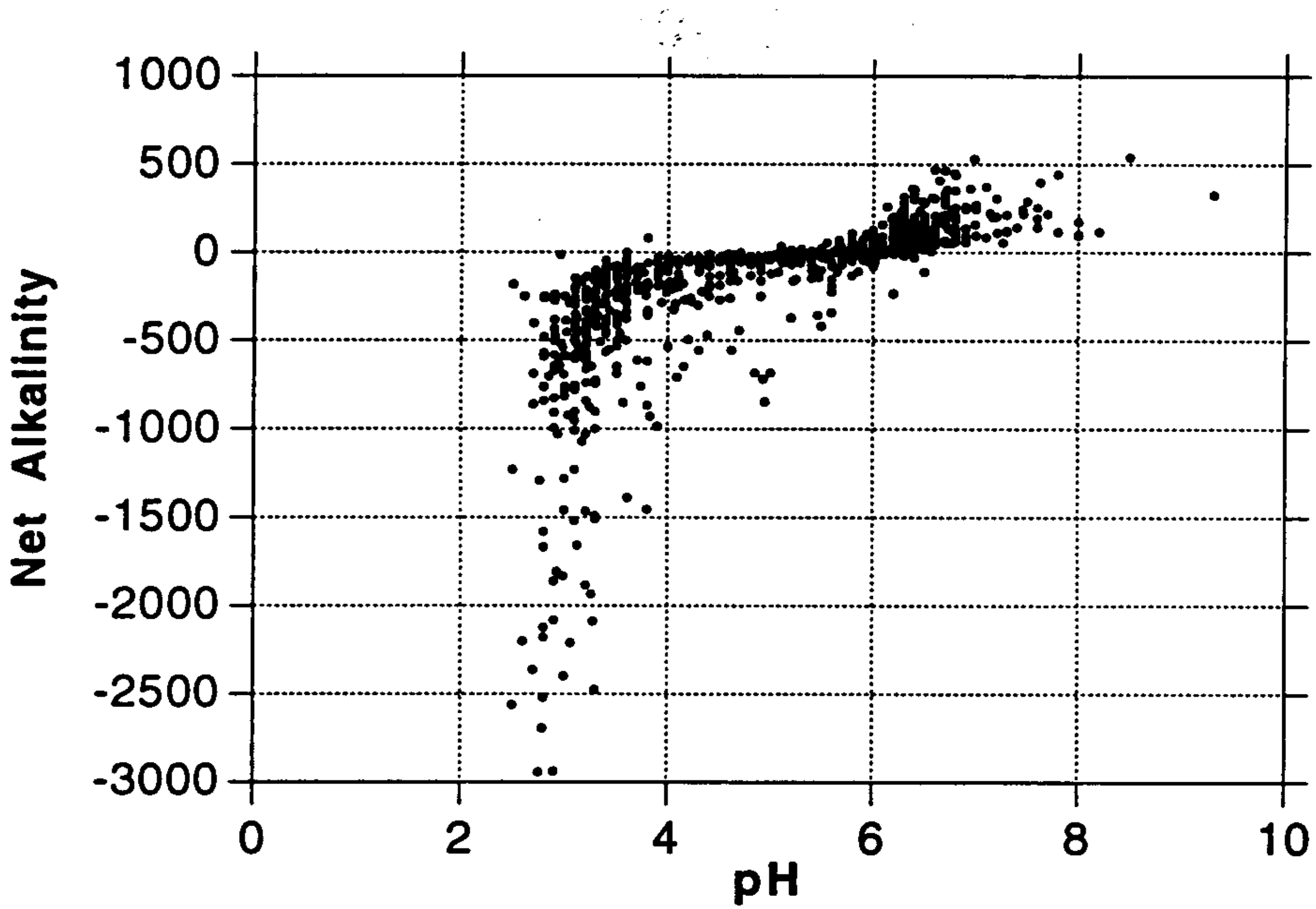


Figure 1. Net Alkalinity vs. pH. Taken from Figure 1.2 Graph C, pages 1-5, of Coal Mine Drainage Prediction and Pollution Prevention in Pennsylvania

Attachment C

TMDLs By Segment

Pine Run

The TMDL for the Pine Run Watershed consists of waste load allocations to the three permitted discharges and load allocations of sixteen tributaries (including Nye Branch and Caylor Run) and twelve sampling sites along the stream.

Pine Run, Nye Branch and Caylor Run are listed as impaired on the PA Section 303(d) list by high metals from AMD as being the cause of the degradation to the stream. Although pH is not listed, in some areas data indicates depressed pH. For pH, the objective is to reduce acid loading to the stream that will in turn raise the pH to the acceptable range. The result of this analysis is an acid loading reduction that equates to meeting standards for pH (see TMDL Endpoint section in the report, Table 3). The method and rationale for addressing pH is contained in Attachment B.

An allowable long-term average in-stream concentration was determined at each point for iron, manganese, aluminum, and acidity. The analysis is designed to produce an average value that, when met, will be protective of the water-quality criterion for that parameter 99% of the time. An analysis was performed using Monte Carlo simulation to determine the necessary long-term average concentration needed to attain water-quality criteria 99% of the time. The simulation was run assuming the data set was lognormally distributed. Using the mean and standard deviation of the data set, 5000 iterations of sampling were completed, and compared against the water-quality criterion for that parameter. For each sampling event a percent reduction was calculated, if necessary, to meet water-quality criteria. A second simulation that multiplied the percent reduction times the sampled value was run to insure that criteria were met 99% of the time. The mean value from this data set represents the long-term average concentration that needs to be met to achieve water-quality standards.

Waste Load Allocations– Permitted Discharges

The Opal Industries, Inc. SMP 33960108, Schreckengost Mine has one permitted treatment pond, TP-1, that discharges to Painter Run. The waste load allocation for the discharge is calculated with average monthly permit limits and average flow, which is estimated with permitted pit areas and average rainfall. There are two permitted pits in the permit with a total combined pit area of 45,000 square feet. Included in the permit are limits for iron and manganese. Although aluminum is not included in the permit, waste load allocations are calculated to allow for the discharge of aluminum. The standard BAT limit of 2.0 mg/L is used for the calculations. The WLA for TP-1 is evaluated at point PNTR01.

The Falls Creek Energy Co., Inc. SMP 33030106, Adams Mine has two permitted treatment ponds, TP1 that discharges to Pine Run and TP2 that discharges to Middle Branch. The waste load allocations for the discharges are calculated with average monthly permit limits and average flow, which is estimated with permitted pit areas and average rainfall. There is one permitted pit with a total pit area of 60,000 square feet. Included in the permit are limits for iron and manganese. Although aluminum is not included in the permit, waste load allocations are calculated to allow for the discharge of aluminum. The standard BAT limit of 2.0 mg/L is used for the calculations. The WLA for TP1 is evaluated at point PINE31 and for TP2 at point MBCH01.

The following table contains the waste load allocations for each discharge.

Table C1. Waste Load Allocations for Permitted Discharges					
Mine	**Discharge Id**	**Parameter**	**Monthly Avg. Allowable Conc. (mg/L)**	**Average Flow (MGD)**	**Allowable Load (lbs/day)**
Falls Creek Energy Co., Inc. SMP 33030106 NPDES PA0242373 Adams Mine	**TP1**	Al	2.0	0.0061	0.10
		Fe	3.0	0.0061	0.15
		Mn	2.0	0.0061	0.10
	TP2	Al	2.0	0.0061	0.10
		Fe	3.0	0.0061	0.15
		Mn	2.0	0.0061	0.10
Opal Industries, Inc. SMP 33960108 NPDES PA0227315 Schreckengost Mine	**TP-1**	Al	2.0	0.0046	0. 08
		Fe	3.0	0.0046	0. 11
		Mn	2.0	0.0046	0.08

TMDL Calculations - Sample Point PINE31, Pine Run upstream Unnamed Tributary 47391

The TMDL for sample point PINE31 consists of a waste load allocation to the permitted treatment discharge, TP1 from the Adams Mine and a load allocation to all of the area above the point (Attachment A). The load allocation for this segment was computed using water-quality sample data collected at point PINE31. The average flow of 2.37 MGD, measured at the point, is used for these computations.

This segment is not included on the PA Section 303(d) list impairments from AMD. Sample data at point PINE31 shows pH ranging between 7.16 and 7.89, pH is not addressed as part of this TMDL.

Water quality analysis determined that the measured iron, aluminum, and manganese loads are equal to the allowable loads. Because WQS are met, TMDLs for iron, aluminum, and manganese are not necessary. Although TMDLs are not necessary, the measured loads are considered at the next downstream point, PINE29.

The Adams Mine was recently activated and did not exist at the time of TMDL sampling so loads from the site are not reflected in the water quality data. It was verified in the *Allocation Summary* section of the report that the addition will not cause instream criterion to be exceeded. The additional loading is considered at the next downstream point also.

Table C2. TMDL Calculations at Point PINE31				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	0.11	2.2	0.11	2.2
Fe	0.26	5.1	0.26	5.1
Mn	0.05	0.9	0.05	0.9
Acidity	0.00	0.0	0.00	0.0
Alkalinity	52.32	1,032.3		

Table C3. Calculation of Load Reduction Necessary at Point PINE31				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	2.2	5.1	0.9	0.0
Allowable Load	2.2	5.1	0.9	0.0
Load Reduction	0.0	0.0	0.0	0.0
% Reduction Required	0	0	0	0

TMDL Calculations - Sample Point PINE30, Mouth of Unnamed Tributary 47391

The TMDL for sample point PINE30 consists of a load allocation to all of the area above the point (Attachment A). The load allocation for this tributary was computed using water-quality sample data collected at point PINE30. The average flow of 2.76 MGD, measured at the point, is used for these computations.

This segment is not included on the PA Section 303(d) list for impairments from AMD. Sample data at point PINE30 shows pH ranging between 5.86 and 6.46, pH is addressed in this TMDL.

Table C4. TMDL Calculations at Point PINE30				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	0.31	7.1	0.23	5.4
Fe	23.92	551.0	0.72	16.5
Mn	1.58	36.4	0.55	12.8
Acidity	11.21	258.3	4.93	113.6
Alkalinity	20.65	475.7		

Table C5. Calculation of Load Reduction Necessary at Point PINE30				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	7.1	551.0	36.4	258.3
Allowable Load	5.4	16.5	12.8	113.6
Load Reduction	1.7	534.5	23.6	144.7
% Reduction	24	97	65	56

TMDL Calculations - Sample Point PINE29, Pine Run upstream of Middle Branch

The TMDL for sample point PINE29 consists of a load allocation to all of the area between points PINE29, PINE30 and PINE31 (Attachment A). The load allocation for this segment was computed using water-quality sample data collected at point PINE29. The average flow of 3.20 MGD, measured at the point, is used for these computations.

This segment was included on the 1996 PA Section 303(d) list for metals and other inorganic impairments from AMD. Sample data at point PINE29 shows pH ranging between 5.94 and 6.46, pH is addressed in this TMDL.

Water quality analysis determined that the measured aluminum load is equal to the allowable aluminum load. Because the WQS is met, a TMDL for aluminum is not necessary. Although a TMDL is not necessary, the measured load is considered at the next downstream point, PINE27.

Table C6. TMDL Calculations at Point PINE29				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	0.22	5.9	0.22	5.9
Fe	16.04	428.6	0.96	25.7
Mn	1.50	40.0	0.54	14.4
Acidity	11.18	298.7	3.69	98.6
Alkalinity	15.56	415.7		

The calculated load reductions for all the loads that enter point PINE29 must be accounted for in the calculated reductions at the sample point shown in Table C7. A comparison of measured loads between points PINE29, PINE30 and PINE31 shows that there is an increase in loading for manganese and acidity and a loss of aluminum and iron load. For loss of loading, the percent of load lost within the segment is calculated and applied to the upstream loads to determine the amount of load that is tracked through the segment. For increase in load, the total segment load is the sum of the upstream loads and any additional load entering the segment.

Table C7. Calculation of Load Reduction Necessary at Point PINE29				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	5.9	428.6	40.0	298.7
Difference in Existing Load between PINE31, PINE30 & PINE29	-3.4	-127.5	2.6	40.5
Load tracked from PINE30 & PINE31	7.7	21.8	13.8	113.6
Percent load lost	37	23	-	-
Percent load tracked	63	77	-	-
Total Load tracked between points PINE31, PINE30 & PINE29	4.9	16.8	16.4	154.1
Allowable Load at PINE29	5.9	25.7	14.4	98.6
Additional Reduction at PINE29	0.0	0.0	2.0	55.5
% Reduction required at PINE29	0	0	12	36

TMDL Calculations - Sample Point MBCH01, Mouth of Middle Branch

The TMDL for sample point MBCH01 consists of a waste load allocation to the Adams Mine permitted treatment discharge, TP2 and a load allocation to all of the area above the point (Attachment A). The load allocation for this segment was computed using water-quality sample data collected at point MBCH01. The average flow of 1.80 MGD, measured at the point, is used for these computations.

This segment is not included on the PA Section 303(d) list. Sample data at point MBCH01 shows pH ranging between 6.79 and 7.73, pH is not addressed in this TMDL.

Water quality analysis determined that allowable manganese load is equal to the existing manganese load. Because the WQS is met, a TMDL for manganese is not necessary. Although a TMDL is not necessary, the measured load is considered at the next downstream point, PINE27.

The Adams Mine was recently activated and did not exist at the time of TMDL sampling so loads from the site are not reflected in the water quality data. It was verified in the Allocation Summary section of the report that the additional manganese load will not cause instream criterion to be exceeded. The additional loading is considered at the next downstream point also. For iron and aluminum, a portion of the allowable load is assigned to the discharge, resulting in an increased nonpoint source reduction.

Table C8. TMDL Calculations at Point MBCH01				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	1.68	25.2	0.34	5.0
Fe	0.77	11.5	0.59	8.9
Mn	0.34	5.2	0.34	5.2
Acidity	0.00	0.0	0.00	0.0
Alkalinity	42.42	638.1		

Table C9. Calculation of Load Reduction Necessary at Point MBCH01				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	25.2	11.5	5.2	0.0
Allowable Load	5.0	8.9	5.2	0.0
Load Reduction	20.3	2.8	0.0	0.0
% Reduction Required	80	25	0	0

TMDL Calculation - Sampling Point PINE27, Pine Run upstream of Unnamed Tributary 47383

The TMDL for sampling point PINE27 consists of a load allocation of the area between sample points PINE27, MBCH01 and PINE29. The load allocation for this stream segment was computed using water-quality sample data collected at point PINE27. The average flow of 5.19 MGD, measured at the point, is used for these computations.

This segment was included on the 1996 PA Section 303(d) list for metals and other inorganic impairments from AMD. Sample data at point PINE27 shows pH ranging between 5.26 and 6.82, pH is addressed in this TMDL.

Table C10. TMDL Calculations at Point PINE27				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	1.03	44.7	0.39	17.0
Fe	10.86	470.3	0.65	28.2
Mn	1.29	55.7	0.37	16.1
Acidity	10.27	444.7	3.70	160.1
Alkalinity	15.64	677.3		

The calculated load reductions for all the loads that enter point PINE27 must be accounted for in the calculated reductions at the sample point shown in Table C11. A comparison of measured loads between points PINE27, MBCH01 and PINE29 shows that there is additional loading entering the segment for all parameters. The total segment load is the sum of the upstream loads plus the additional loading entering the segment.

Table C11. Calculation of Load Reduction Necessary at Point PINE27				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	44.7	470.3	55.7	444.7
Difference in Existing Load between PINE29, PINE27 & MBCH01	13.6	30.2	10.5	146.0
Load tracked from PINE29 & MBCH01	9.9	25.6	19.6	98.6
Total Load tracked between points PINE29 & MBCH01	23.5	55.8	30.2	244.6
Allowable Load at PINE27	17.0	28.2	16.1	160.1
Additional Reduction at PINE27	6.5	27.6	14.0	84.5
% Reduction required at PINE27	28	49	46	35

TMDL Calculations - Sample Point PINE26, Mouth of Unnamed Tributary 47383

The TMDL for sample point PINE26 consists of a load allocation to all of the area above the point (Attachment A). The load allocation for this tributary was computed using water-quality sample data collected at point PINE26. The average flow of 0.81 MGD, measured at the point, is used for these computations.

This segment is not included on the PA Section 303(d) list. Sample data at point PINE26 shows pH ranging between 3.42 and 3.73, pH is addressed in this TMDL.

Table C12. TMDL Calculations at Point PINE26				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	3.90	26.3	0.39	2.6
Fe	2.01	13.6	0.56	3.8
Mn	2.02	13.7	0.54	3.7
Acidity	44.96	304.1	0.00	0.0
Alkalinity	0.00	0.0		

Table C13. Calculation of Load Reduction Necessary at Point PINE26				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	26.3	13.6	13.7	304.1
Allowable Load	2.6	3.8	3.7	0.0
Load Reduction	23.7	9.8	10.0	304.1
% Reduction	90	72	73	100

TMDL Calculations - Sample Point CYLR02, Mouth of Unnamed Tributary 47382

The TMDL for sample point CYLR01 consists of a load allocation to all of the area above the point (Attachment A). The load allocation for this tributary was computed using water-quality sample data collected at point CYLR01. The average flow of 0.02 MGD, measured at the point, is used for these computations.

This segment is not included on the PA Section 303(d) list. Sample data at point CYLR02 shows pH ranging between 4.49 and 5.56, pH is addressed in this TMDL.

Table C14. TMDL Calculations at Point CYLR02

	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	4.97	1.00	0.25	0.05
Fe	3.57	0.72	0.54	0.11
Mn	15.55	3.13	0.47	0.09
Acidity	45.27	9.11	0.45	0.09
Alkalinity	1.55	0.3		

Table C15. Calculation of Load Reduction Necessary at Point CYLR02

	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	1.00	0.72	3.13	9.11
Allowable Load	0.05	0.11	0.09	0.09
Load Reduction	0.95	0.61	3.04	9.02
% Reduction	95	85	97	99

TMDL Calculations - Sample Point CYLR01, Mouth of Caylor Run

The TMDL for sample point CYLR01 consists of a load allocation to all of the area above the point (Attachment A). The load allocation for this tributary was computed using water-quality sample data collected at point CYLR01. The average flow of 1.02 MGD, measured at the point, is used for these computations.

This segment was included on the 1996 PA Section 303(d) list for metals impairments from AMD. Sample data at point CYLR01 shows pH ranging between 3.18 and 3.53, pH is addressed in this TMDL.

Table C16. TMDL Calculations at Point CYLR01				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	7.90	67.0	0.39	3.4
Fe	10.27	87.2	0.62	5.2
Mn	6.50	55.2	0.59	5.0
Acidity	98.00	831.9	0.00	0.0
Alkalinity	0.00	0.0		

Table C17. Calculation of Load Reduction Necessary at Point CYLR01				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	67.0	87.2	55.2	831.9
Allowable Load	3.4	5.2	5.0	0.0
Load Reduction	63.6	82.0	50.2	831.9
% Reduction	95	94	91	100

TMDL Calculation - Sampling Point PINE22, Pine Run upstream of Unnamed Tributary 47376

The TMDL for sampling point PINE22 consists of a load allocation of the area between sample points PINE22, CYLR01, CYLR02, PINE26 and PINE27. The load allocation for this stream segment was computed using water-quality sample data collected at point PINE22. The average flow of 7.91 MGD, measured at the point, is used for these computations.

This segment was included on the 1996 PA Section 303(d) list for metals and other inorganic impairments from AMD. Sample data at point PINE22 shows pH ranging between 3.81 and 5.99, pH is addressed in this TMDL.

Table C18. TMDL Calculations at Point PINE22				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	2.42	159.7	0.56	36.7
Fe	9.34	616.3	0.75	49.3
Mn	2.47	162.9	0.57	37.5
Acidity	18.57	1,224.9	1.30	85.7
Alkalinity	3.89	256.9		

The calculated load reductions for all the loads that enter point PINE22 must be accounted for in the calculated reductions at the sample point shown in Table C19. A comparison of measured loads between points PINE22, CYLR01, CYLR02, PINE26 and PINE27 shows that there is additional loading entering the segment for aluminum, manganese, and iron and a loss of acidity load. For loss of loading, the percent of load lost within the segment is calculated and applied to the upstream loads to determine the amount of load that is tracked through the segment. For increase in load, the total segment load is the sum of the upstream loads and any additional load entering the segment.

Table C19. Calculation of Load Reduction Necessary at Point PINE22				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	159.7	616.3	162.9	1,224.9
Difference in Existing Load between PINE22, CYLR01, CYLR02, PINE26 & PINE27	20.6	44.4	35.2	-364.9
Load tracked from PINE27, PINE26, CYLR02 & CYLR01	23.0	37.4	24.9	160.2
Percent load lost	-	-	-	23
Percent load tracked	-	-	-	77
Total Load tracked between points PINE22, CYLR01, CYLR02, PINE26 & PINE27	43.6	81.8	60.1	123.4
Allowable Load at PINE22	36.7	49.3	37.5	85.7
Additional Reduction at PINE22	6.9	32.5	22.6	37.7
% Reduction required at PINE22	16	40	38	31

TMDL Calculations - Sample Point PINE21, Mouth of Unnamed Tributary 47376

The TMDL for sample point PINE21 consists of a load allocation to all of the area above the point (Attachment A). The load allocation for this tributary was computed using water-quality sample data collected at point PINE21. The average flow of 0.19 MGD, measured at the point, is used for these computations.

This segment is not included on the PA Section 303(d) list for from AMD. Sample data at point PINE21 shows pH ranging between 7.41 and 7.66, pH is not addressed in this TMDL.

Water quality analysis determined that the measured metals loads are equal to the allowable loads. Because WQS are met, TMDLs for metals are not necessary. Although TMDLs are not necessary, the measured loads are considered at the next downstream point, PINE20.

Table C20. TMDL Calculations at Point PINE21				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	0.07	0.1	0.07	0.1
Fe	0.15	0.2	0.15	0.2
Mn	0.28	0.4	0.28	0.4
Acidity	0.00	0.0	0.00	0.0
Alkalinity	51.18	79.9		

Table C21. Calculation of Load Reduction Necessary at Point PINE21				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	0.1	0.2	0.4	0.0
Allowable Load	0.1	0.2	0.4	0.0
Load Reduction	0.0	0.0	0.0	0.0
% Reduction	0	0	0	0

TMDL Calculation - Sampling Point PINE20, Pine Run upstream of Eagle Run

The TMDL for sampling point PINE20 consists of a load allocation of the area between sample points PINE22, PINE21 and PINE20. The load allocation for this stream segment was computed using water-quality sample data collected at point PINE20. The average flow of 11.47 MGD, measured at the point, is used for these computations.

This segment was included on the 1996 PA Section 303(d) list for metals impairments from AMD. Sample data at point PINE20 shows pH ranging between 5.37 and 6.44, pH is addressed in this TMDL.

Table C22. TMDL Calculations at Point PINE20				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	1.84	175.5	0.44	42.1
Fe	9.94	950.7	0.89	85.6
Mn	2.45	234.3	0.61	58.6
Acidity	14.39	1,375.6	2.16	206.3
Alkalinity	6.77	647.6		

The calculated load reductions for all the loads that enter point PINE20 must be accounted for in the calculated reductions at the sample point shown in Table C23. A comparison of measured loads between points PINE20, PINE21 and PINE22 shows that there is additional loading entering the segment for all parameters. The total segment load is the sum of the upstream loads and any additional load entering the segment.

Table C23. Calculation of Load Reduction Necessary at Point PINE20				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	175.5	950.7	234.3	1,375.6
Difference in Existing Load between PINE20, PINE21 & PINE22	15.7	334.2	71.0	150.7
Load tracked from PINE21 & PINE22	36.8	49.5	37.9	85.7
Total Load tracked between points PINE20, PINE21 & PINE22	52.5	383.7	108.9	236.4
Allowable Load at PINE20	42.1	85.6	58.6	206.3
Additional Reduction at PINE20	10.4	298.2	50.3	30.1
% Reduction required at PINE20	20	78	46	13

TMDL Calculations - Sample Point EGLE01, Mouth of Eagle Run

The TMDL for sample point EGLE01 consists of a load allocation to all of the area above the point (Attachment A). The load allocation for this tributary was computed using water-quality sample data collected at point EGLE01. The average flow of 1.57 MGD, measured at the point, is used for these computations.

This segment is not included on the PA Section 303(d) list for from AMD. Sample data at point EGLE01 shows pH ranging between 6.85 and 7.22, pH is not addressed in this TMDL.

Water quality analysis determined that the measured metals loads are equal to the allowable metals loads. Because WQS are met, TMDLs for metals are not necessary. Although TMDLs are not necessary, the measured loads are considered at the next downstream point, PINE18.

Table C24. TMDL Calculations at Point EGLE01				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	0.19	2.5	0.19	2.5
Fe	0.24	3.2	0.24	3.2
Mn	0.34	4.4	0.34	4.4
Acidity	0.00	0.0	0.00	0.0
Alkalinity	20.38	266.6		

Table C25. Calculation of Load Reduction Necessary at Point EGLE01				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	2.5	3.2	4.4	0.0
Allowable Load	2.5	3.2	4.4	0.0
Load Reduction	0.0	0.0	0.0	0.0
% Reduction	0	0	0	0

TMDL Calculation - Sampling Point PINE18, Pine Run upstream of Painter Run

The TMDL for sampling point PINE18 consists of a load allocation of the area between sample points PINE18, EGLE01 and PINE20. The load allocation for this stream segment was computed using water-quality sample data collected at point PINE18. The average flow of 12.73 MGD, measured at the point, is used for these computations.

This segment was included on the 1996 PA Section 303(d) list for metals impairments from AMD. Sample data at point PINE18 shows pH ranging between 5.77 and 6.49, pH is addressed in this TMDL.

Table C26. TMDL Calculations at Point PINE18

	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	1.54	163.0	0.37	39.1
Fe	8.05	854.8	0.72	76.9
Mn	2.15	228.0	0.56	59.3
Acidity	11.22	1,191.1	2.02	214.4
Alkalinity	7.24	768.6		

The calculated load reductions for all the loads that enter point PINE18 must be accounted for in the calculated reductions at the sample point shown in Table C27. A comparison of measured loads between points PINE18, EGLE01 and PINE20 shows that there is a loss of loading within the segment for all parameters. For loss of loading, the percent of load lost within the segment is calculated and applied to the upstream loads to determine the amount of load that is tracked through the segment.

Table C27. Calculation of Load Reduction Necessary at Point PINE18

	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	163.0	854.8	228.0	1,191.1
Difference in Existing Load between PINE20, EGLE01 & PINE18	-15.0	-99.0	-10.7	-184.5
Load tracked from EGLE01 & PINE18	44.6	88.8	63.0	206.3
Percent load lost	8	10	5	13
Percent load tracked	92	90	95	87
Total Load tracked between points PINE20, EGLE01 & PINE18	40.9	79.6	60.2	178.7
Allowable Load at PINE18	39.1	76.9	59.3	214.4
Additional Reduction at PINE18	1.8	2.7	0.9	0.0
% Reduction required at PINE18	4	3	1	0

TMDL Calculations - Sample Point PNTR01, Mouth of Painter Run

The TMDL for sample point PNTR01 consists of a waste load allocation to the Schreckengost Mine treatment discharge, TP-1 and a load allocation to all of the area above the point (Attachment A). The load allocation for this tributary was computed using water-quality sample data collected at point PNTR01. The average flow of 2.31 MGD, measured at the point, is used for these computations.

This segment is not included on the PA Section 303(d) list for from AMD. Sample data at point PNTR01 shows pH ranging between 6.92 and 7.47, pH is not addressed in this TMDL.

Water quality analysis determined that the measured metals loads are equal to the allowable metals loads. Because WQS are met, TMDLs for metals are not necessary. Although TMDLs are not necessary, the measured loads are considered at the next downstream point, PINE13. Because affects from the permitted discharge are included in the TMDL data, a portion of the load is assigned to the discharge.

Table C28. TMDL Calculations at Point PNTR01

	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	0.17	3.3	0.17	3.3
Fe	0.49	9.5	0.49	9.5
Mn	0.17	3.2	0.17	3.2
Acidity	0.00	0.0	0.00	0.0
Alkalinity	25.03	482.7		

Table C29. Calculation of Load Reduction Necessary at Point PNTR01

	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	3.3	9.5	3.2	0.0
Allowable Load	3.3	9.5	3.2	0.0
Load Reduction	0.0	0.0	0.0	0.0
% Reduction Required	0	0	0	0

TMDL Calculations - Sample Point NYRN03, Headwaters of Nye Branch

The TMDL for sample point NYRN03 consists of a load allocation to all of the area above the point (Attachment A). The load allocation for this segment was computed using water-quality sample data collected at point NYRN03. The average flow of 1.18 MGD, measured at the point, is used for these computations.

This segment was included on the 1996 PA Section 303(d) list for metals impairments from AMD. Sample data at point NYRN03 shows pH ranging between 4.69 and 6.13, pH is addressed in this TMDL.

Water quality analysis determined that the measured iron load is equal to the allowable iron load. Because the WQS is met, a TMDL for iron is not necessary. Although a TMDL is not necessary, the measured load is considered at the next downstream point, NYRN02.

Table C30. TMDL Calculations at Point NYRN03				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	0.78	7.7	0.27	2.7
Fe	0.35	3.4	0.35	3.4
Mn	1.05	10.4	0.49	4.9
Acidity	5.71	56.3	0.68	6.8
Alkalinity	2.67	26.4		

Table C31. Calculation of Load Reduction Necessary at Point NYRN03				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	7.7	3.4	10.4	56.3
Allowable Load	2.7	3.4	4.9	6.8
Load Reduction	5.0	0.0	5.5	49.6
% Reduction	65	0	53	88

TMDL Calculation - Sampling Point NYRN02, Nye Branch

The TMDL for sampling point NYRN02 consists of a load allocation of the area between sample points NYRN02 and NYRN03. The load allocation for this stream segment was computed using water-quality sample data collected at point NYRN02. The average flow of 3.50 MGD, measured at the point, is used for these computations.

This segment was included on the 1996 PA Section 303(d) list for metals impairments from AMD. Sample data at point NYRN02 shows pH ranging between 5.28 and 6.45, pH is addressed in this TMDL.

Water quality analysis determined that the measured aluminum and iron loads are equal to the allowable iron and aluminum loads. Because WQS are met, TMDLs for iron and aluminum are not necessary. Although TMDLs are not necessary, the measured loads are considered at the next downstream point, NYRN01.

Table C32. TMDL Calculations at Point NYRN02				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	0.20	5.8	0.20	5.8
Fe	0.43	12.5	0.43	12.5
Mn	0.96	27.9	0.50	14.5
Acidity	3.42	100.0	0.68	20.0
Alkalinity	3.11	90.7		

The calculated load reductions for all the loads that enter point NYRN02 must be accounted for in the calculated reductions at the sample point shown in Table C33. A comparison of measured loads between points NYRN02 and NYRN03 shows that there is a loss of aluminum loading within the segment and an increase in loading for iron, manganese, and acidity. For loss of loading, the percent of load lost within the segment is calculated and applied to the upstream loads to determine the amount of load that is tracked through the segment. For increase in loading the total segment load is the sum of the upstream loads and any additional loading entering the segment.

Table C33. Calculation of Load Reduction Necessary at Point NYRN02				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	5.8	12.5	27.9	100.0
Difference in Existing Load between NYRN03 & NYRN02	-1.9	9.0	17.5	43.7
Load tracked from NYRN03	2.7	3.4	4.9	6.8
Percent load lost	25	-	-	-
Percent load tracked	75	-	-	-
Total Load tracked between points NYRN03 & NYRN02	2.0	12.5	22.4	50.5
Allowable Load at NYRN02	5.8	12.5	14.5	20.0
Additional Reduction at NYRN02	0.0	0.0	7.9	30.5
% Reduction required at NYRN02	0	0	35	60

TMDL Calculation - Sampling Point NYRN01, Mouth of Nye Branch

The TMDL for sampling point NYRN01 consists of a load allocation of the area between sample points NYRN01 and NYRN02. The load allocation for this stream segment was computed using water-quality sample data collected at point NYRN01. The average flow of 4.67 MGD, measured at the point, is used for these computations.

This segment is not included on the PA Section 303(d) list for impairments from AMD. Sample data at point NYRN01 shows pH ranging between 6.04 and 6.62, pH is addressed in this TMDL because water quality analysis determined that the WQS is not met.

Water quality analysis determined that the measured iron and aluminum loads are equal to the allowable iron and aluminum loads. Because WQS are met, TMDLs for aluminum and iron are not necessary. Although TMDLs are not necessary, the measured loads are considered at the next downstream point, PINE13.

Table C34. TMDL Calculations at Point NYRN01				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	0.17	6.5	0.17	6.5
Fe	0.36	14.1	0.36	14.1
Mn	0.75	29.3	0.61	23.8
Acidity	1.89	73.6	0.87	33.9
Alkalinity	4.74	184.4		

The calculated load reductions for all the loads that enter point NYRN01 must be accounted for in the calculated reductions at the sample point shown in Table C35. A comparison of measured loads between points NYRN01 and NYRN02 shows that there is a loss of acidity loading within the segment and an increase in loading for iron, manganese, and aluminum. For loss of loading, the percent of load lost within the segment is calculated and applied to the upstream loads to determine the amount of load that is tracked through the segment. For increase in loading the total segment load is the sum of the upstream loads and any additional loading entering the segment.

Table C35. Calculation of Load Reduction Necessary at Point NYRN01				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	6.5	14.1	29.3	73.6
Difference in Existing Load between NYRN01 & NYRN02	0.7	1.6	1.4	-26.4
Load tracked from NYRN02	2.0	12.5	14.5	20.0
Percent load lost	-	-	-	26
Percent load tracked	-	-	-	74
Total Load tracked between points NYRN01 & NYRN02	2.7	14.1	15.9	14.7
Allowable Load at NYRN01	6.5	14.1	23.8	33.9
Additional Reduction at NYRN01	0.0	0.0	0.0	0.0
% Reduction required at NYRN01	0	0	0	0

TMDL Calculation - Sampling Point PINE13, Pine Run downstream of Nye Branch

The TMDL for sampling point PINE13 consists of a load allocation of the area between sample points PINE13, NYRN01, PNTR01 and PINE18. The load allocation for this stream segment was computed using water-quality sample data collected at point PINE13. The average flow of 20.87 MGD, measured at the point, is used for these computations.

This segment was included on the 1996 PA Section 303(d) list for metals and other inorganic impairments from AMD. Sample data at point PINE13 shows pH ranging between 5.81 and 6.51, pH is addressed in this TMDL.

Table C36. TMDL Calculations at Point PINE13				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	0.76	132.0	0.35	60.7
Fe	4.24	737.3	0.68	118.0
Mn	1.39	241.6	0.51	89.4
Acidity	5.28	918.3	1.42	248.0
Alkalinity	7.61	1,323.6		

The calculated load reductions for all the loads that enter point PINE13 must be accounted for in the calculated reductions at the sample point shown in Table C37. A comparison of measured loads between points PINE13, NYRN01, PNTR01 and PINE18 shows that there is a loss of loading for all parameters within the segment. For loss of loading, the percent of load lost within the segment is calculated and applied to the upstream loads to determine the amount of load that is tracked through the segment.

Table C37. Calculation of Load Reduction Necessary at Point PINE13				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	132.0	737.3	241.6	918.3
Difference in Existing Load between PINE13, PNTR01, NYRN01, PINE18	-40.8	-141.1	-18.9	-346.4
Load tracked from PNTR01, NYRN01, PINE18	45.1	100.5	78.4	193.4
Percent load lost	24	16	7	27
Percent load tracked	76	84	93	73
Total Load tracked between points PINE13, PNTR01, NYRN01, PINE18	34.5	84.4	72.7	140.4
Allowable Load at PINE13	60.7	118.0	89.4	248.0
Additional Reduction at PINE13	0.0	0.0	0.0	0.0
% Reduction required at PINE13	0	0	0	0

TMDL Calculations - Sample Point PINE12, Mouth of Unnamed Tributary 47350

The TMDL for sample point PINE12 consists of a load allocation to all of the area above the point (Attachment A). The load allocation for this tributary was computed using water-quality sample data collected at point PINE12. The average flow of 0.37 MGD, measured at the point, is used for these computations.

This segment is not included on the PA Section 303(d) list for impairments from AMD. Sample data at point PINE12 shows pH ranging between 6.67 and 7.04, pH is not addressed in this TMDL.

Water quality analysis determined that the measured aluminum, iron, and manganese loads are equal to the allowable aluminum, iron, and manganese loads. Because WQS are met, TMDLs for aluminum, iron, and manganese are not necessary. Although TMDLs are not necessary, the measured loads are considered at the next downstream point, PINE10.

Table C38. TMDL Calculations at Point PINE12				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	0.34	1.1	0.34	1.1
Fe	0.34	1.1	0.34	1.1
Mn	0.17	0.5	0.17	0.5
Acidity	0.00	0.0	0.00	0.0
Alkalinity	9.14	28.5		

Table C39. Calculation of Load Reduction Necessary at Point PINE12				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	1.1	1.1	0.5	0.0
Allowable Load	1.1	1.1	0.5	0.0
Load Reduction	0.0	0.0	0.0	0.0
% Reduction	0	0	0	0

TMDL Calculations - Sample Point PINE11, Mouth of Unnamed Tributary 47349

The TMDL for sample point PINE11 consists of a load allocation to all of the area above the point (Attachment A). The load allocation for this tributary was computed using water-quality sample data collected at point PINE11. The average flow of 0.45 MGD, measured at the point, is used for these computations.

This segment is not included on the PA Section 303(d) list for impairments from AMD. Sample data at point PINE11 shows pH ranging between 3.58 and 3.94, pH is addressed in this TMDL.

Table C40. TMDL Calculations at Point PINE11				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	6.68	24.8	0.47	1.7
Fe	4.61	17.1	0.65	2.4
Mn	4.67	17.4	0.65	2.4
Acidity	58.37	216.8	0.00	0.0
Alkalinity	0.00	0.0		

Table C41. Calculation of Load Reduction Necessary at Point PINE11				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	24.8	17.1	17.4	216.8
Allowable Load	1.7	2.4	2.4	0.0
Load Reduction	23.1	14.7	15.0	216.8
% Reduction	93	86	86	100

TMDL Calculation - Sampling Point PINE10, Pine Run upstream of Sugarcamp Run

The TMDL for sampling point PINE10 consists of a load allocation of the area between sample points PINE10, PINE11, PINE12 and PINE13. The load allocation for this stream segment was computed using water-quality sample data collected at point PINE10. The average flow of 23.13 MGD, measured at the point, is used for these computations.

This segment was included on the 1996 PA Section 303(d) list for metals and other inorganic impairments from AMD. Sample data at point PINE10 shows pH ranging between 5.58 and 6.31, pH is addressed in this TMDL.

Table C42. TMDL Calculations at Point PINE10				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	0.92	176.8	0.42	81.3
Fe	4.88	941.4	0.83	160.0
Mn	1.50	289.4	0.53	101.3
Acidity	8.45	1,630.7	1.44	277.2
Alkalinity	5.40	1,040.7		

The calculated load reductions for all the loads that enter point PINE10 must be accounted for in the calculated reductions at the sample point shown in Table C43. A comparison of measured loads between points PINE10, PINE11, PINE12 and PINE13 shows that there is an increase in loading for all parameters. The total segment load is the sum of the upstream loads plus the additional loading entering the segment.

Table C43. Calculation of Load Reduction Necessary at Point PINE10				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	176.8	941.4	289.4	1,630.7
Difference in Existing Load between PINE13, PINE12, PINE11 & PINE10	19.0	185.8	29.9	495.5
Load tracked from PINE13, PINE12 & PINE11	37.3	87.8	75.7	140.4
Total Load tracked between points PINE13, PINE12, PINE11 & PINE10	56.3	273.6	105.6	635.9
Allowable Load at PINE10	81.3	160.0	101.3	277.2
Additional Reduction at PINE10	0.0	113.6	4.3	358.7
% Reduction required at PINE10	0	42	4	56

TMDL Calculations - Sample Point SUGR01, Mouth of Sugarcamp Run

The TMDL for sample point SUGR01 consists of a load allocation to all of the area above the point (Attachment A). The load allocation for this tributary was computed using water-quality sample data collected at point SUGR01. The average flow of 1.21 MGD, measured at the point, is used for these computations.

This segment is not included on the PA Section 303(d) list for impairments from AMD. Sample data at point SUGR01 shows pH ranging between 5.43 and 6.67, pH is addressed in this TMDL.

Water quality analysis determined that the measured iron and aluminum loads are equal to the allowable aluminum and iron loads. Because WQS are met, TMDLs for aluminum and iron are not necessary. Although TMDLs are not necessary, the measured loads are considered at the next downstream point, PINE08.

Table C44. TMDL Calculations at Point SUGR01				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	0.43	4.3	0.43	4.3
Fe	0.22	2.2	0.22	2.2
Mn	1.15	11.5	0.54	5.4
Acidity	2.52	25.5	0.96	9.7
Alkalinity	5.38	54.2		

Table C45. Calculation of Load Reduction Necessary at Point SUGR01				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	4.3	2.2	11.5	25.5
Allowable Load	4.3	2.2	5.4	9.7
Load Reduction	0.0	0.0	6.1	15.8
% Reduction	0	0	53	62

TMDL Calculation - Sampling Point PINE08, Pine Run upstream of Mudlick Creek

The TMDL for sampling point PINE08 consists of a load allocation of the area between sample points PINE08, SUGR01 and PINE10. The load allocation for this stream segment was computed using water-quality sample data collected at point PINE08. The average flow of 24.09 MGD, measured at the point, is used for these computations.

This segment was included on the 1996 PA Section 303(d) list for metals and other inorganic impairments from AMD. Sample data at point PINE08 shows pH ranging between 5.54 and 6.52, pH is addressed in this TMDL.

Table C46. TMDL Calculations at Point PINE08				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	1.00	200.5	0.32	64.2
Fe	4.88	979.6	0.68	137.1
Mn	1.56	313.4	0.51	103.4
Acidity	9.15	1,838.3	1.46	294.1
Alkalinity	4.69	941.4		

The calculated load reductions for all the loads that enter point PINE08 must be accounted for in the calculated reductions at the sample point shown in Table C47. A comparison of measured loads between points PINE08, SUGR01 and PINE10 shows that there is an increase in loading for all parameters. The total segment load is the sum of the upstream loads plus the additional loading entering the segment.

Table C47. Calculation of Load Reduction Necessary at Point PINE08				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	200.5	979.6	313.4	1,838.3
Difference in Existing Load between PINE08, SUGR01 & PINE10	19.4	36.0	12.5	182.1
Load tracked from PINE10 & SUGR01	60.6	162.2	106.7	286.9
Total Load tracked between points PINE08, PINE10 & SUGR01	80.0	198.2	119.2	469.0
Allowable Load at PINE08	64.2	137.1	103.4	294.1
Additional Reduction at PINE08	15.8	61.1	15.8	174.9
% Reduction required at PINE08	20	31	13	37

TMDL Calculations - Sample Point MDLK01, Mouth of Mudlick Creek

The TMDL for sample point MDLK01 consists of a load allocation to all of the area above the point (Attachment A). The load allocation for this tributary was computed using water-quality sample data collected at point MDLK01. The average flow of 3.31 MGD, measured at the point, is used for these computations.

This segment is not included on the PA Section 303(d) list for impairments from AMD. Sample data at point MDLK01 shows pH ranging between 7.12 and 7.59, pH is not addressed in this TMDL.

Water quality analysis determined that the measured metals loads are equal to the allowable metals loads. Because WQS are met, TMDLs for metals are not necessary. Although TMDLs are not necessary, the measured loads are considered at the next downstream point, PINE05.

Table C48. TMDL Calculations at Point MDLK01

	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	0.15	4.0	0.15	4.0
Fe	0.28	7.7	0.28	7.7
Mn	0.48	13.3	0.48	13.3
Acidity	0.00	0.0	0.00	0.0
Alkalinity	29.30	808.9		

Table C49. Calculation of Load Reduction Necessary at Point MDLK01

	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	4.0	7.7	13.3	0.0
Allowable Load	4.0	7.7	13.3	0.0
Load Reduction	0.0	0.0	0.0	0.0
% Reduction	0	0	0	0

TMDL Calculations - Sample Point PINE06, Mouth of Unnamed Tributary 47337

The TMDL for sample point PINE06 consists of a load allocation to all of the area above the point (Attachment A). The load allocation for this tributary was computed using water-quality sample data collected at point PINE06. The average flow of 0.62 MGD, measured at the point, is used for these computations.

This segment is not included on the PA Section 303(d) list for impairments from AMD. Sample data at point PINE06 shows pH ranging between 7.45 and 7.80, pH is not addressed in this TMDL.

Water quality analysis determined that the measured metals loads are equal to the allowable metals loads. Because WQS are met, TMDLs for metals are not necessary. Although TMDLs are not necessary, the measured loads are considered at the next downstream point, PINE05.

Table C50. TMDL Calculations at Point PINE06				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	0.19	1.0	0.19	1.0
Fe	0.35	1.8	0.35	1.8
Mn	0.08	0.4	0.08	0.4
Acidity	0.00	0.0	0.00	0.0
Alkalinity	52.40	272.2		

Table C51. Calculation of Load Reduction Necessary at Point PINE06				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	1.0	1.8	0.4	0.0
Allowable Load	1.0	1.8	0.4	0.0
Load Reduction	0.0	0.0	0.0	0.0
% Reduction	0	0	0	0

TMDL Calculation - Sampling Point PINE05, Pine Run downstream of Unnamed Tributary 47337

The TMDL for sampling point PINE05 consists of a load allocation of the area between sample points PINE05, PINE06, MDLK01 and PINE08. The load allocation for this stream segment was computed using water-quality sample data collected at point PINE05. The average flow of 30.86 MGD, measured at the point, is used for these computations.

This segment was included on the 1996 PA Section 303(d) list for metals and other inorganic impairments from AMD. Sample data at point PINE05 shows pH ranging between 6.11 and 6.72, pH is addressed in this TMDL.

Table C52. TMDL Calculations at Point PINE05				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	0.85	219.6	0.32	83.5
Fe	3.92	1,007.6	0.67	171.3
Mn	1.37	352.6	0.56	144.6
Acidity	3.86	993.5	1.35	347.7
Alkalinity	7.68	1,976.6		

The calculated load reductions for all the loads that enter point PINE05 must be accounted for in the calculated reductions at the sample point shown in Table C53. A comparison of measured loads between points PINE05, PINE06, MDLK01 and PINE08 shows that there is an increase in loading for all metals and a decrease in acidity loading. For increase in load, the total segment load is the sum of the upstream loads plus the additional loading entering the segment. For loss of loading, the percent of load lost within the segment is calculated and applied to the upstream loads to determine the amount of load that is tracked through the segment.

Table C53. Calculation of Load Reduction Necessary at Point PINE05				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	219.6	1,007.6	352.6	993.5
Difference in Existing Load between PINE08, MLDK01, PINE06 & PINE05	14.1	18.5	25.5	-844.8
Load tracked from PINE08, MLDK01 & PINE06	69.2	146.7	117.1	294.1
Percent load lost	-	-	-	46
Percent load tracked	-	-	-	54
Total Load tracked between points PINE08, MLDK01, PINE06 & PINE05	83.3	165.2	142.6	159.0
Allowable Load at PINE05	83.5	171.3	144.6	347.7
Additional Reduction at PINE05	0.0	0.0	0.0	0.0
% Reduction required at PINE05	0	0	0	0

TMDL Calculations - Sample Point PINE02, Mouth of Unnamed Tributary 47335

The TMDL for sample point PINE02 consists of a load allocation to all of the area above the point (Attachment A). The load allocation for this tributary was computed using water-quality sample data collected at point PINE02. The average flow of 0.23 MGD, measured at the point, is used for these computations.

This segment is not included on the PA Section 303(d) list for impairments from AMD. Sample data at point PINE02 shows pH ranging between 7.00 and 7.28, pH is not addressed in this TMDL.

Water quality analysis determined that the measured metals loads are equal to the allowable metals loads. Because WQS are met, TMDLs for metals are not necessary. Although TMDLs are not necessary, the measured loads are considered at the next downstream point, PINE01.

Table C54. TMDL Calculations at Point PINE01				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	0.12	0.2	0.12	0.2
Fe	0.31	0.6	0.31	0.6
Mn	0.11	0.2	0.11	0.2
Acidity	0.00	0.0	0.00	0.0
Alkalinity	26.33	51.0		

Table C55. Calculation of Load Reduction Necessary at Point PINE02				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	0.2	0.6	0.2	0.0
Allowable Load	0.2	0.6	0.2	0.0
Load Reduction	0.0	0.0	0.0	0.0
% Reduction	0	0	0	0

TMDL Calculations - Sample Point PINE03, Mouth of Unnamed Tributary 47329

The TMDL for sample point PINE03 consists of a load allocation to all of the area above the point (Attachment A). The load allocation for this tributary was computed using water-quality sample data collected at point PINE03. The average flow of 3.00 MGD, measured at the point, is used for these computations.

This segment is not included on the PA Section 303(d) list for impairments from AMD. Sample data at point PINE03 shows pH ranging between 6.77 and 7.15, pH is not addressed in this TMDL.

Water quality analysis determined that the measured metals loads are equal to the allowable metals loads. Because WQS are met, TMDLs for metals are not necessary. Although TMDLs are not necessary, the measured loads are considered at the next downstream point, PINE01.

Table C56. TMDL Calculations at Point PINE03				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	0.23	5.8	0.23	5.8
Fe	0.29	7.2	0.29	7.2
Mn	0.22	5.4	0.22	5.4
Acidity	0.00	0.0	0.00	0.0
Alkalinity	15.45	387.1		

Table C57. Calculation of Load Reduction Necessary at Point PINE03				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	0.2	0.6	0.2	0.0
Allowable Load	0.2	0.6	0.2	0.0
Load Reduction	0.0	0.0	0.0	0.0
% Reduction	0	0	0	0

TMDL Calculation - Sampling Point PINE01, Mouth of Pine Run

The TMDL for sampling point PINE01 consists of a load allocation of the area between sample points PINE01, PINE02, PINE03 and PINE05. The load allocation for this stream segment was computed using water-quality sample data collected at point PINE01. The average flow of 34.59 MGD, measured at the point, is used for these computations.

This segment was included on the 1996 PA Section 303(d) list for metals and other inorganic impairments from AMD. Sample data at point PINE01 shows pH ranging between 6.29 and 7.00, pH is addressed in this TMDL.

Table C58. TMDL Calculations at Point PINE01

	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	0.64	185.1	0.43	124.0
Fe	2.90	837.7	0.70	201.0
Mn	1.19	344.3	0.68	196.3
Acidity	2.36	680.4	1.67	483.1
Alkalinity	9.24	2,665.0		

The calculated load reductions for all the loads that enter point PINE01 must be accounted for in the calculated reductions at the sample point shown in Table C59. A comparison of measured loads between points PINE01, PINE02, PINE03 and PINE05 shows that there is loss in loading for all parameters. For loss of loading, the percent of load lost within the segment is calculated and applied to the upstream loads to determine the amount of load that is tracked through the segment.

Table C59. Calculation of Load Reduction Necessary at Point PINE01

	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	185.1	837.7	344.3	680.4
Difference in Existing Load between PINE01, PINE02, PINE03 & PINE05	-40.5	-177.8	-14.0	-313.0
Load tracked from PINE02, PINE03 & PINE05	89.3	173.0	148.3	159.0
Percent load lost	20	18	4	17
Percent load tracked	80	82	96	83
Total Load tracked between points PINE01, PINE02, PINE03 & PINE05	71.8	141.8	141.8	131.9
Allowable Load at PINE01	124.0	201.0	196.3	483.1
Additional Reduction at PINE01	0.0	0.0	0.0	0.0
% Reduction required at PINE01	0	0	0	0

Margin of Safety

For this study the margin of safety is applied implicitly. A MOS is implicit because the allowable concentrations and loadings were simulated using Monte Carlo techniques and employing the @Risk software. Other margins of safety used for this TMDL analysis include the following:

- Effluent variability plays a major role in determining the average value that will meet water-quality criteria over the long-term. The value that provides this variability in our analysis is the standard deviation of the dataset. The simulation results are based on this variability and the existing stream conditions (an uncontrolled system). The general assumption can be made that a controlled system (one that is controlling and stabilizing the pollution load) would be less variable than an uncontrolled system. This implicitly builds in a margin of safety.
- An additional MOS is provided because that the calculations were done with a daily Fe average instead of the 30-day average

Seasonal Variation

Seasonal variation is implicitly accounted for in these TMDLs because the data used represents all seasons.

Critical Conditions

The reductions specified in this TMDL apply at all flow conditions. A critical flow condition could not be identified from the data used for this analysis.

Attachment D

Excerpts Justifying Changes Between the 1996, 1998, and 2002 Section 303(d) Lists

The following are excerpts from the Pennsylvania DEP Section 303(d) narratives that justify changes in listings between the 1996, 1998, and 2002 list. The Section 303(d) listing process has undergone an evolution in Pennsylvania since the development of the 1996 list.

In the 1996 Section 303(d) narrative, strategies were outlined for changes to the listing process. Suggestions included, but were not limited to, a migration to a Global Information System (GIS), improved monitoring and assessment, and greater public input.

The migration to a GIS was implemented prior to the development of the 1998 Section 303(d) list. As a result of additional sampling and the migration to the GIS some of the information appearing on the 1996 list differed from the 1998 list. Most common changes included:

1. mileage differences due to recalculation of segment length by the GIS;
2. slight changes in source(s)/cause(s) due to new EPA codes;
3. changes to source(s)/cause(s), and/or miles due to revised assessments;
4. corrections of misnamed streams or streams placed in inappropriate SWP subbasins; and
5. unnamed tributaries no longer identified as such and placed under the named watershed listing.

Prior to 1998, segment lengths were computed using a map wheel and calculator. The segment lengths listed on the 1998 Section 303(d) list were calculated automatically by the GIS (ArcInfo) using a constant projection and map units (meters) for each watershed. Segment lengths originally calculated by using a map wheel and those calculated by the GIS did not always match closely. This was the case even when physical identifiers (e.g., tributary confluence and road crossings) matching the original segment descriptions were used to define segments on digital quad maps. This occurred to some extent with all segments, but was most noticeable in segments with the greatest potential for human errors using a map wheel for calculating the original segment lengths (e.g., long stream segments or entire basins).

Attachment E
Water Quality Data Used In TMDL Calculations

STATION	Date	Flow (gpm)	pH	Alk (mg/L)	Acidity (mg/L)	Al (mg/l)	Fe (mg/l)	Mn (mg/l)	SO4 (mg/l)
PINE01	4/6/2003	44071	6.32	3.11	6.3	0.43	3.2	1	162
	5/14/2003	22453	6.73	0	9.62	0.64	2.7	1	132
Latitude:	7/8/2003	10121	7.00	0.0	12.5	0.53	1.8	1.4	186
40 56' 49"	8/7/2003	20809	6.87	0.0	12.4	0.6	1.8	1.1	164
Longitude:	2/14/2004	17668	6.43	5.7	8.6	0.9	4.7	1.5	204
79 16' 36"	3/28/2004	29022	6.29	5.4	6.0	0.75	3.22	1.16	167
	Average	24024.00000	6.60667	2.35833	9.23667	0.64167	2.90333	1.19333	169.16667
	St Dev	11604.81472	0.30098	2.73131	2.83931	0.16582	1.08557	0.21040	24.33447
PINE02	4/6/2003	292	7.00	0	13.8	<.02	0.21	0.07	
Trib	5/14/2003	155	7.28	0	22.8	0.04	0.14	0.05	
Latitude:	7/8/2003	73	7.27	0.0	38.5	0.2	0.58	0.19	
40 56' 58"	8/7/2003	125	7.18	0.0	30.2	0.11	0.32	0.13	
Longitude:									
79 16' 05"									
	Average	161.25000	7.18250	0.00000	26.32500	0.11667	0.31250	0.11000	
	St Dev	93.51782361	0.12971	0.00000	10.52849	0.08021	0.19311	0.06325	
PINE03	4/6/2003	3671	6.77	0	8.7	<.02	0.13	0.33	
Trib	5/14/2003	1690	7.15	0	13.2	0.07	0.22	0.21	
Latitude:	7/8/2003	824	7.36	0.0	24.9	0.28	0.39	0.1	
40 56' 56"	8/7/2003	2159	6.94	0.0	15.0	0.34	0.41	0.23	
Longitude:									
79 16' 03"									
	Average	2086.00000	7.05500	0.00000	15.45000	0.23000	0.28750	0.21750	
	St Dev	1192.618128	0.25593	0.00000	6.83447	0.14177	0.13525	0.09430	

STATION	Date	Flow (gpm)	pH	Alk (mg/L)	Acidity (mg/L)	Al (mg/l)	Fe (mg/l)	Mn (mg/l)	SO4 (mg/l)
PINE05	4/6/2003	38689	6.11	4.98	5.1	0.9	4.6	1.2	
	5/14/2003	20151	6.66	0	9.34	0.65	2.4	0.83	
Latitude:	7/8/2003	9548	6.72	0.0	9.25	0.48	3.3	1.8	
40 57' 36"	8/7/2003	16692	6.62	0.0	11.0	0.87	2.8	1.3	
Longitude:	2/14/2004	17364	6.38	9.8	6.3	1.5	6.5	1.8	
79 15' 23"	3/28/2004	26141	6.15	8.4	5.1	0.72	3.89	1.29	
	Average	21430.83333	6.44000	3.86000	7.68000	0.85333	3.91500	1.37000	
	St Dev	10018.63626	0.26676	4.50622	2.50855	0.35189	1.48787	0.37459	
PINE06	4/6/2003	769	7.45	0	35.8	<.02	0.18	0.05	
Trib	5/14/2003	398	7.70	0	49.5	0.04	0.25	0.06	
Latitude:	7/8/2003	196	7.80	0.0	70.2	0.32	0.59	0.12	
40 57' 45"	8/7/2003	367	7.59	0.0	54.1	0.21	0.38	0.07	
Longitude:									
79 15' 28"									
	Average	432.50000	7.63500	0.00000	52.40000	0.19000	0.35000	0.07500	
	St Dev	241.2778481	0.15022	0.00000	14.18567	0.14107	0.18019	0.03109	
MDLK01	4/6/2003	4179	7.12	0	19.5	<.02	0.16	0.61	
Trib	5/14/2003	2060	7.50	0	26.3	0.09	0.18	0.32	
Latitude:	7/8/2003	874	7.59	0.0	39.4	0.23	0.47	0.43	
40 57' 48"	8/7/2003	2082	7.45	0.0	32.0	0.12	0.31	0.57	
Longitude:									
79 15' 09"									
	Average	2298.75000	7.41500	0.00000	29.30000	0.14667	0.28000	0.48250	
	St Dev	1374.679932	0.20502	0.00000	8.45261	0.07371	0.14306	0.13301	

STATION	Date	Flow (gpm)	pH	Alk (mg/L)	Acidity (mg/L)	Al (mg/l)	Fe (mg/l)	Mn (mg/l)	SO4 (mg/l)
PINE08	4/6/2003	30844	6.04	13.6	3.9	0.7	5	1.3	
	5/14/2003	13847	6.30	5.17	5.72	0.71	2.8	0.86	
Latitude:	7/8/2003	7412	6.52	7.0	5.02	0.52	4.3	2.1	
40 57' 45"	8/7/2003	13288	6.31	0.6	6.8	1.1	3.9	1.5	
Longitude:	2/14/2004	12127	5.76	15.4	4.2	1.6	8.1	2.1	
79 15' 09"	3/28/2004	22837	5.54	13.2	2.6	1.36	5.16	1.5	
	Average	16725.83333	6.07833	9.15167	4.68667	0.99833	4.87667	1.56000	
	St Dev	8540.165418	0.37161	5.82043	1.47493	0.42523	1.79356	0.47917	
SUGR01	4/6/2003	1365	5.91	3.57	2.9	0.31	0.1	1.2	
Trib	5/14/2003	705	6.55	0	6.32	0.32	0.15	0.69	
Latitude:	7/8/2003	306	6.56	0.0	6.63	0.51	0.21	1.2	
40 57' 44"	8/7/2003	739	6.67	0.0	9.5	0.43	0.22	0.82	
Longitude:	2/14/2004	578	5.61	5.3	4.8	0.4	0.4	1.4	
79 14' 13"	3/28/2004	1346	5.43	6.3	2.1	0.59	0.22	1.56	
	Average	839.83333	6.12167	2.52333	5.37833	0.42667	0.21667	1.14500	
	St Dev	427.5246971	0.54061	2.89915	2.71908	0.10893	0.10172	0.33345	
PINE10	4/6/2003	29126	5.93	7.69	4.2	0.87	5	1.2	
Latitude:	5/14/2003	14689	6.31	3.97	6.86	0.8	3.1	0.91	
40 57' 43"	7/8/2003	6943	6.26	7.5	5.55	0.55	4.9	2.2	
Longitude:	8/7/2003	12992	6.23	0.5	7.9	1	4.1	1.5	
79 14' 12"	2/14/2004	12696	5.70	18.4	4.6	1.3	7	1.8	
	3/28/2004	19930	5.58	12.7	3.3	0.98	5.18	1.39	
	Average	16062.66667	6.00167	8.45333	5.39500	0.91667	4.88000	1.50000	
	St Dev	7634.470032	0.31237	6.34140	1.72814	0.24825	1.29430	0.45392	

STATION	Date	Flow (gpm)	pH	Alk (mg/L)	Acidity (mg/L)	Al (mg/l)	Fe (mg/l)	Mn (mg/l)	SO4 (mg/l)
PINE11	4/6/2003	543	3.93	47.8	0	6.1	4.7	4.6	
Trib	5/14/2003	259	3.85	49.4	0	5.2	3.4	3.7	
Latitude:	7/8/2003	104	3.58	63.7	0	6.9	2.9	5.9	
40 57' 47"	8/7/2003	285	3.94	41.8	0.0	5.3	4.7	3.9	
Longitude:	2/14/2004	275	3.62	78.3	0.0	9	8.1	5.3	
79 13' 48"	3/28/2004	390	3.62	69.2	0.0	7.59	3.88	4.64	
	Average	309.33333	3.75667	58.36500	0.00000	6.68167	4.61333	4.67333	
	St Dev	146.6787874	0.16789	14.20999	0.00000	1.46220	1.85026	0.83058	
PINE12	4/6/2003	548	6.67	0	6.6	0.18	0.18	0.16	
Trib	5/14/2003	177	6.81	0	6.97	0.32	0.22	0.14	
Latitude:	7/8/2003	61	6.89	0.0	9.08	0.49	0.62	0.19	
40 57' 48"	8/7/2003	254	7.04	0.0	13.9	0.36	0.35	0.17	
Longitude:	Average	260.00000	6.85250	0.00000	9.13750	0.33750	0.34250	0.16500	
79 13' 26"	St Dev	207.741827	0.15457	0.00000	3.35766	0.12764	0.19873	0.02082	
PINE13	4/6/2003	27278	6.16	6.15	5.9	0.62	4.6	1.1	
Latitude:	5/14/2003	12971	6.48	0.08	9.08	0.69	2.5	0.83	
40 57' 46"	7/8/2003	6621	6.45	2.7	7.97	0.36	3.7	2	
Longitude:	8/7/2003	10636	6.51	0.0	11.4	0.79	2.7	1.3	
79 13' 25"	2/14/2004	10593	5.96	15.1	7.0	1.2	7.1	1.8	
	3/28/2004	18850	5.81	7.7	4.3	0.89	4.82	1.3	
	Average	14491.50000	6.22833	5.27667	7.60500	0.75833	4.23667	1.38833	
	St Dev	7440.577632	0.29782	5.72091	2.49818	0.28138	1.69330	0.43683	

STATION	Date	Flow (gpm)	pH	Alk (mg/L)	Acidity (mg/L)	Al (mg/l)	Fe (mg/l)	Mn (mg/l)	SO4 (mg/l)
PNTR01	4/6/2003	2864	6.92	0	13.1	<.02	0.25	0.13	
Latitude:	5/14/2003	1639	7.22	0	20.1	0.18	0.36	0.12	
40 58' 01"	7/8/2003	397	7.47	0.0	41.3	0.13	0.8	0.2	
Longitude:	8/7/2003	1525	7.31	0.0	25.6	0.2	0.56	0.21	
79 12' 38"	Average	1606.25000	7.23000	0.00000	25.02500	0.17000	0.49250	0.16500	
	St Dev	1008.612041	0.23108	0.00000	11.99538	0.03606	0.24185	0.04655	
NYRN01	4/6/2003	6693	6.06	3.08	3.1	0.09	0.26	0.63	
	5/14/2003	2886	6.51	0	4.46	0.18	0.18	0.52	
Latitude:	7/8/2003	1184	6.62	0.0	5.78	0.1	0.38	0.99	
40 57' 32"	8/7/2003	2387	6.62	0.0	6.4	0.14	0.24	0.72	
Longitude:	2/14/2004	1980	6.10	4.8	5.8	0.2	0.6	0.9	
79 13' 22"	3/28/2004	4323	6.04	3.5	2.9	0.29	0.51	0.76	
	Average	3242.16667	6.32500	1.89000	4.73500	0.16667	0.36167	0.75333	
	St Dev	1988.151445	0.28648	2.14179	1.47651	0.07421	0.16570	0.17224	
NYRN02	4/6/2003	5073	5.28	6.15	1.6	0.18	0.47	0.72	
Latitude:	5/14/2003	1782	6.10	1.51	3.11	0.12	0.17	0.52	
40 57' 06"	7/8/2003	985	6.45	0.2	4.52	0.03	0.19	1.4	
Longitude:	8/7/2003	1972	6.39	0.2	4.6	0.18	0.27	0.99	
79 12' 35"	2/14/2004	1381	5.70	7.3	3.1	0.3	0.8	1.2	
	3/28/2004	3401	5.50	5.3	1.8	0.38	0.66	0.9	
	Average	2432.33333	5.90333	3.42333	3.10667	0.19833	0.42667	0.95500	
	St Dev	1532.73294	0.48310	3.19251	1.27370	0.12529	0.26158	0.31836	

STATION	Date	Flow (gpm)	pH	Alk (mg/L)	Acidity (mg/L)	Al (mg/l)	Fe (mg/l)	Mn (mg/l)	SO4 (mg/l)
NYRN03	4/6/2003	1887	6.13	1.54	3.7	0.32	0.28	0.67	
	5/14/2003	583	5.12	6.63	1.95	0.87	0.18	0.81	
Latitude:	7/8/2003	391	5.46	4.7	2.38	0.8	0.28	1.5	
40 56' 26"	8/7/2003	605	5.90	2.6	3.7	0.93	0.4	1.3	
Longitude:	2/14/2004	438	4.69	14.0	1.9	1.4	0.7	1.3	
79 10' 48"	3/28/2004	1027	5.67	4.7	2.5	0.37	0.25	0.72	
	Average	821.83333	5.49500	5.70500	2.67333	0.78167	0.34833	1.05000	
	St Dev	568.0980256	0.52683	4.45507	0.82510	0.39877	0.18638	0.35732	
PINE18	4/6/2003	15778	6.02	15.4	5.8	1.3	8	1.5	
Latitude:	5/14/2003	7043	6.46	3.23	9.12	1.7	6.8	2	
40 57' 59"	7/8/2003	3889	6.01	13.1	5	1.1	8	2.9	
Longitude:	8/7/2003	6305	6.49	0.0	12.5	1.3	4.9	1.9	
79 12' 36"	2/14/2004	6814	5.94	20.1	6.4	2.5	12.5	2.8	
	3/28/2004	13224	5.77	15.5	4.6	1.31	8.1	1.78	
	Average	8842.16667	6.11500	11.21667	7.23833	1.53500	8.05000	2.14667	
	St Dev	4596.254624	0.29304	7.84650	3.03397	0.51162	2.50180	0.57085	
EGLE01	4/6/2003	2397	6.85	0	12.1	<.02	0.19	0.37	
Latitude:	5/14/2003	774	7.22	0	18	0.15	0.3	0.33	
40 57' 55"	7/8/2003	334	7.08	0.0	29	0.19	0.24	0.34	
Longitude:	8/7/2003	853	7.10	0.0	22.4	0.24	0.24	0.31	
79 12' 02"									
	Average	1089.50000	7.06250	0.00000	20.37500	0.19333	0.24250	0.33750	
	St Dev	901.0750986	0.15457	0.00000	7.13226	0.04509	0.04500	0.02500	

STATION	Date	Flow (gpm)	pH	Alk (mg/L)	Acidity (mg/L)	Al (mg/l)	Fe (mg/l)	Mn (mg/l)	SO4 (mg/l)
PINE20	4/6/2003	15382	5.88	18.5	4.9	1.6	10	1.8	
Latitude:	5/14/2003	6598	6.42	7.58	8.98	1.8	8.8	2.3	
40 57' 54"	7/8/2003	3645	5.37	18.4	2.38	1.5	10	3.3	
Longitude:	8/7/2003	5869	6.44	0.0	12.8	1.6	6.6	2.3	
79 12' 02"	2/14/2004	6437	5.81	22.9	6.8	2.7	14.2	2.9	
	3/28/2004	9844	5.74	19.0	4.8	1.81	10.05	2.1	
	Average	7962.50000	5.94333	14.38500	6.77167	1.83500	9.94167	2.45000	
	St Dev	4142.501213	0.41611	8.70790	3.68822	0.44108	2.47476	0.55045	
PINE21	4/6/2003	202	7.41	0	50.8	<.02	0.25	0.5	
Trib	5/14/2003	70	7.66	0	47.4	0.1	0.13	0.16	
Latitude:	7/8/2003	84	7.58	0.0	43	0	0.16	0.18	
40 58' 06"	8/7/2003	164	7.48	0.0	63.5	0.11	0.07	0.29	
Longitude:	Average	130.00000	7.53250	0.00000	51.17500	0.07000	0.15250	0.28250	
79 10' 27"	St Dev	63.39295439	0.10996	0.00000	8.81528	0.06083	0.07500	0.15586	
PINE22	4/6/2003	10880	5.41	23.1	3.2	2	11	1.8	
	5/14/2003	4403	5.58	11.5	4.22	2.68	8.6	2.5	
Latitude:	7/8/2003	1851	3.81	29.1	0	2.3	7.5	3.7	
40 58' 05"	8/7/2003	3342	5.99	0.0	9.5	2.2	4.8	2.1	
Longitude:	2/14/2004	3582	5.46	21.9	3.4	2.9	13.6	2.6	
79 10' 26"	3/28/2004	8906	5.22	25.8	3.1	2.44	10.54	2.11	
	Average	5494.00000	5.24500	18.56500	3.89333	2.42000	9.34000	2.46833	
	St Dev	3560.87961	0.74840	10.85699	3.11887	0.32790	3.06229	0.67024	

STATION	Date	Flow (gpm)	pH	Alk (mg/L)	Acidity (mg/L)	Al (mg/l)	Fe (mg/l)	Mn (mg/l)	SO4 (mg/l)
CYLR01	4/6/2003	1050	3.32	102	0	8.7	11	6.1	
Latitude:	5/14/2003	562	3.43	94	0	5.04	6.7	4.4	
40 58' 13"	7/8/2003	375	3.38	79.0	0	6.8	7.2	7	
Longitude:	8/7/2003	401	3.18	121.0	0.0	10	11	7.9	
79 10' 10"	2/14/2004	673	3.36	114.0	0.0	9.5	17.3	8.1	
	3/28/2004	1180	3.53	78.0	0.0	7.33	8.42	5.52	
	Average	706.83333	3.36667	98.00000	0.00000	7.89500	10.27000	6.50333	
	St Dev	336.8735173	0.11656	17.76513	0.00000	1.86142	3.90074	1.43529	
CYLR02	4/6/2003	31	4.89	31.4	1.3	3.6	4.5	9.5	
Latitude:	5/14/2003	7.3	4.79	39.4	1.78	5.01	3.4	14	
40 58' 02"	7/8/2003	7.5	5.56	33.9	3.6	1.1	0.67	23	
Longitude:	8/7/2003	18.3	4.70	41.5	1.3	4.8	2.1	18	
79 09' 46"	2/14/2004	18.2	4.94	46.3	1.3	6.8	6	14.2	
	3/28/2004	18.3	4.49	79.1	0.0	8.5	4.75	14.58	
	Average	16.76667	4.89500	45.26667	1.54500	4.96833	3.57000	15.54667	
	St Dev	8.773064839	0.36259	17.41180	1.17053	2.55711	1.93711	4.54474	
PINE26	4/6/2003	1142	3.68	43.1	0	4	2.6	1.7	
Trib	5/14/2003	399	3.73	35.3	0	1.93	0.72	1.1	
Latitude:	7/8/2003	169	3.59	44.3	0	4	1.1	2.7	
40 57' 52"	8/7/2003	410	3.60	40.9	0.0	3.9	1.8	2	
Longitude:	2/14/2004	435	3.64	51.2	0.0	5.1	3.3	2.5	
79 09' 43"	3/28/2004	824	3.42	55.0	0.0	4.44	2.56	2.11	
	Average	563.16667	3.61000	44.96333	0.00000	3.89500	2.01333	2.01833	
	St Dev	353.63451	0.10658	7.11382	0.00000	1.06135	0.98498	0.57447	

STATION	Date	Flow (gpm)	pH	Alk (mg/L)	Acidity (mg/L)	Al (mg/l)	Fe (mg/l)	Mn (mg/l)	SO4 (mg/l)
PINE27	4/6/2003	7632	6.06	10.8	9.6	0.97	12	1.1	
Latitude:	5/14/2003	2808	6.66	0	19.8	0.51	4.3	0.55	
40 57' 53"	7/8/2003	1235	5.26	19.3	2.74	1.4	14	2.5	
Longitude:	8/7/2003	2009	6.82	0.0	32.4	0.9	5.7	1	
79 09' 42"	2/14/2004	2351	6.58	18.7	19.4	1.1	14.6	1.2	
	3/28/2004	5604	5.88	12.8	9.9	1.31	14.55	1.36	
	Average	3606.50000	6.21000	10.26833	15.63833	1.03167	10.85833	1.28500	
	St Dev	2473.239071	0.59083	8.60290	10.46639	0.31971	4.65665	0.65494	
MBCH01	4/6/2003	2966	6.79	0	20.5	2.3	0.69	0.32	
Latitude:	5/14/2003	1050	7.40	0	34.9	1.93	0.46	0.36	
40 57' 53"	7/8/2003	376	7.73	0.0	60.6	0.7	0.43	0.33	
Longitude:	8/7/2003	661	7.52	0.0	63.2	1.5	1.3	0.39	
79 08' 58"	2/14/2004	920	7.22	0.0	45.0	1.3	0.6	0.3	
	3/28/2004	1542	7.04	0.0	30.3	2.34	1.11	0.36	
	Average	1252.50000	7.28333	0.00000	42.42000	1.67833	0.76500	0.34333	
	St Dev	926.2374965	0.33933	0.00000	17.04706	0.63556	0.35871	0.03266	
PINE29	4/6/2003	5150	5.94	21.3	8.7	0.1	16	1.2	
Latitude:	5/14/2003	1640	6.42	2.48	17.3	0.27	16	1.4	
40 57' 54"	7/8/2003	641	6.10	6.2	11.4	0.23	16	2.3	
Longitude:	8/7/2003	1162	6.46	0.0	24.6	0.36	10.4	1.1	
79 08' 58"	2/14/2004	1369	6.25	20.5	17.4	<.02	18.9	1.4	
	3/28/2004	3390	6.05	16.6	13.9	0.14	18.92	1.57	
	Average	2225.33333	6.20333	11.17833	15.55500	0.22000	16.03667	1.49500	
	St Dev	1710.370447	0.20906	9.42948	5.57435	0.10368	3.10768	0.42773	

STATION	Date	Flow (gpm)	pH	Alk (mg/L)	Acidity (mg/L)	Al (mg/l)	Fe (mg/l)	Mn (mg/l)	SO4 (mg/l)
PINE30	4/6/2003	4166	5.86	23.6	10.3	0.1	21	1.4	
Latitude:	5/14/2003	1523	6.18	0	18.7	0.27	23	1.6	
40 58' 16"	7/8/2003	578	5.95	11.7	22	0.59	34	2.3	
Longitude:	8/7/2003	1138	6.46	0.0	33.3	0.37	13	0.93	
79 08' 35"	2/14/2004	1210	6.13	13.1	22.2	0.1	25.4	1.5	
	3/28/2004	2893	6.03	18.9	17.4	0.41	27.13	1.76	
	Average	1918.00000	6.10167	11.21167	20.65000	0.30667	23.92167	1.58167	
	St Dev	1346.507928	0.21066	9.66538	7.55956	0.19065	6.96735	0.45000	
PINE31	4/6/2003	3323	7.16	0	30	<.02	0.16	0.05	
Latitude:	5/14/2003	1691	7.64	0	44.8	0.06	0.2	0.03	
40 58' 17"	7/8/2003	464	7.89	0.0	80.4	0.13	0.49	0.07	
Longitude:	8/7/2003	1082	7.68	0.0	61.0	0.15	0.31	0.05	
79 08' 34"	2/14/2004	1004	7.40	0.0	50.2	<.02	<.02	<.02	
	3/28/2004	2294	7.53	0.0	47.5	<.02	0.13	0.03	
	Average	1643.00000	7.55000	0.00000	52.31667	0.11333	0.25800	0.04600	
	St Dev	1035.527692	0.25124	0.00000	17.00758	0.04726	0.14653	0.01673	

Attachment F
Comment and Response

No comments received.