FINAL LAUREL RUN WATERSHED TMDL

Somerset County

For Acid Mine Drainage Affected Segments

Prepared by:

Pennsylvania Department of Environmental Protection

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Introduction

This report presents the Total Maximum Daily Loads (TMDLs) developed for segments in the Laurel Run Watershed (Attachment 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 one segment 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.

Table 1. 303(d) Listed Segments										
State Water Plan (SWP) Subbasin: 19F Casselman River										
HUC: 05020006										
Year	Miles	Use Designation	Assessment ID	Segment ID	DEP Stream Code	Stream Name	Desig-nated Use	Data Source	Source	EPA 305(b) Cause Code
1996	0.8	*	*	4851	38967	Laurel Run	WWF	305(b) Report	RE	Metals
1998	0.86	*	*	4851	38967	Laurel Run	WWF	SWMP	AMD	Metals
2002	1.6	*	*	990102-1045-TVP	38967	Laurel Run	WWF	SWMP	AMD	Metals pH
2004	0.9 0.7	*	*	990102-1045-TVP 990102-1046-TVP	38967	Laurel Run	WWF	SWMP	AMD	Metals pH Metals pH

1 Pennsylvania's 1996, 1998, 2002 Section 303(d) lists and 2004 and 2006 Integrated Water Quality Monitoring and Assessment Reports were approved by the Environmental Protection Agency (EPA). The 1996 Section 303(d) list provides the basis for measuring progress under the 1997 lawsuit settlement of *American Littoral Society and Public Interest Group of Pennsylvania v. EPA.* See Attachment D, *Excerpts Justifying Changes Between the 1996, 1998, and 2002 Section 303(d) Lists and 2004 and 2006 Integrated Water Quality Monitoring and Assessment Reports.*
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2006	1.93	Aquatic Life	6894	*	38967	Laurel Run	WWF	SWMP	AMD	Siltation
	1.42	Aquatic Life	9187	*						Metals Other Inorganics* Suspended Solids
	0.6	Aquatic Life	10058	*						Metals pH
	1.02	Aquatic Life	10059	*						Metals pH
2006	3.14	Aquatic Life	12718	*	*	Bromm Run	WWF	SWMP	Surface Mining	Siltation
2006	1.39	Aquatic Life	12718	*	*	Dempsey Run	WWF	SWMP	Surface Mining	Siltation

Resource Extraction=RE
Warm Water Fishes = WWF
Surface Water Monitoring Program = SWMP
Abandoned Mine Drainage = AMD
The use designations for the stream segments in this TMDL can be found in PA Title 25 Chapter 93.

Directions to the Laurel Run Watershed

Laurel Run is located in Somerset County, southwest of Somerset, Pennsylvania. Laurel Run is best accessed by following SR 2031 south from US 219 to SR 3010. SR 3010 is the “Mud Pike” and it is oriented east-west with Laurel Run along the north side of the road. Heading west on SR 3010 results in an intersection with SR 3075 that lies along Coxes Creek. Traveling north on SR 3075 results in encountering the village of Murdoch at the mouth of Laurel Run.

Hydrology and Geology

Laurel Run Watershed comprises approximately 8.9 $miles^2$ in the Plateau Physiographic province of Pennsylvania. The stream is approximately 3.6 miles in length and is oriented in an east to west fashion, flowing from the east at the headwaters along the “Garrett Shortcut” (SR 2031). The stream flows into Coxes Creek at Murdoch, in Milford Township, Somerset County. Bromm Run and Dempsey Run in the north and an unnamed tributary in the south render the basin as wide along the north-south axis as along its east- west axis.

Sandstone quarrying and some underground mining are the earliest types of mining that took place in the basin. “Bare Rock Quarry” supplied sandstone along a railroad line shown on the geologic folio for the area ”Geology of Southern Somerset County, Pennsylvania”, Pennsylvania Geologic Survey, Atlas C56A, Norman K. Flint, 1965. This mapping indicates that the bedrock strike is to the northeast and dip is to the west. The Negro Mountain Anticline approximately underlies the location of the Garrett Shortcut in the east. Strata dip towards a syncline located west of Murdoch. The rate of dip is approximately 400 feet in 1800 feet to the west. The mapping by the Pennsylvania Geologic Survey in Open-File Report 2000-02, “Groundwater Resources of Somerset County”, by McElroy, Shaulis and Wegweiser, 2001, indicates structure contours that support this statement.

Watershed History

The coals of the Allegheny Group have been surface mined in the basin. Permits indicate Lower Kittanning and Middle Kittanning coal seams were mined in the west near Murdoch and the Upper Freeport and Lower Freeport seams were mined in the east.

Approximately 700 acres of previously permitted surface mining area can be plotted within the basin. No active surface mining takes place and almost all the previously permitted area is backfilled, completed and in various stages of bond release. No permitted water discharges exist in the basin.

Water quality data from 1994 on Laurel Run supports that currently collected for this report. This factor, in addition to the nature of the water quality, indicates that recent mining has had little to no impact on the stream. Sulfates are low and acidity and alkalinity are benign as compared to acid mine drainage-affected streams nearby. The depressed pH values of the upstream monitoring currently measured are natural values reflective of the setting from which the water originates. One low-volume seep (non-point) is reported on a bond forfeiture site located in the headwaters area as being out of compliance (H & H Coal Company, SMP #56783046, the James E. Long Operation). There is one seep present on the permit with a flow of 2 GPM (0.002882 MGD), pH 3.8, acidity 45 mg/L, alkalinity 0 mg/L, 0.3 mg/L iron, 13.1 mg/L manganese, and 4.5 mg/L aluminum. The discharge is currently not receiving treatment. However, the downstream monitoring point (4) has shown no affects from the seepage and the segment to which the seep drains is attaining its designated use.

Segments addressed in this TMDL

There currently are no active mining operations in the watershed; a bond forfeiture permit has a post-mining discharge but creates no impairment to the receiving stream. Impacts from mining in the area are from abandoned mines and will be treated as non-point sources. The 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.

This AMD TMDL document contains one or more future mining Waste Load Allocations (WLA). This (these) WLA(s) were requested by the (Knox, Moshannon, Greensburg, Cambria or Pottsville) District Mining Office (DMO) to accommodate one or more future mining operations. The District Mining Office determined the number of and location of the future mining WLAs. This will allow speedier approval of future mining permits without the time consuming process of amending this TMDL document. All comments and questions concerning the future mining WLAs in this TMDL are to be directed to the appropriate DMO. Future wasteload allocations are calculated using the method described for quantifying pollutant load in Attachment C.

The following are examples of what is or is not intended by the inclusion of future mining WLAs. This list is by way of example and is not intended to be exhaustive or exclusive:

1. The inclusion of one or more future mining WLAs is not intended to exclude the issuance of future non-mining NPDES permits in this watershed or any waters of the Commonwealth.
2. The inclusion of one or more future mining WLAs in specific segments of this watershed is not intended to exclude future mining in any segments of this watershed that does not have a future mining WLA.
3. The inclusion of future mining WLAs does not preclude the amending of this AMD TMDL to accommodate additional NPDES permits.

All of the remaining discharges in the watershed are from abandoned mines and will be treated as non-point sources. The distinction between non-point and point sources in this case is determined on the basis of whether or not there is a responsible party for the discharge. TMDLs will be 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 D 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 1997 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.

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

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

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

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

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.

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.

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 all 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

*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. 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.

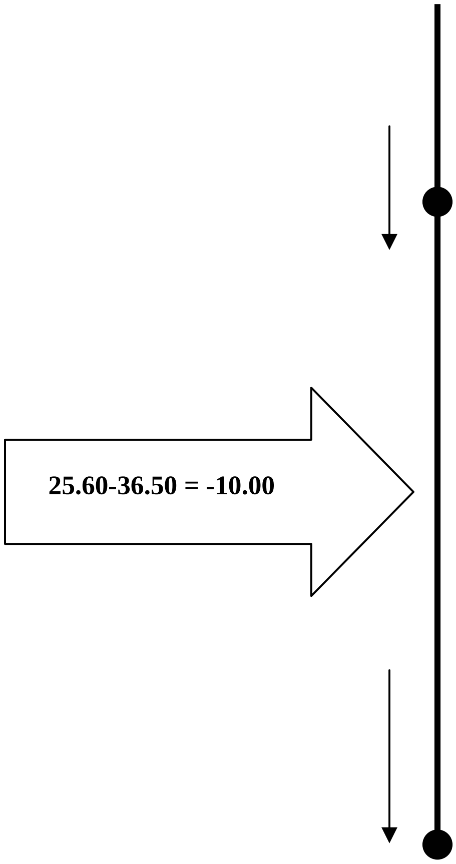
In the instance that the allowable load is equal to the existing load (e.g. iron point 2, Table 3), the simulation determined that water quality standards are being met instream 99% of the time and no TMDL is necessary for the parameter at that point. Although no TMDL is necessary, the loading at the point is considered at the next downstream point.

Table 3. TMDL Component Summary for the Laurel Run Watershed

Parameter	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	Load Reduction (lbs/day)	Percent Reduction %
4 – Unnamed tributary to Laurel Run						
Al	7.77	2.18	-	2.18	5.59	72
Fe	2.36	2.36	-	2.36	-	-
Mn	1.96	1.96	-	1.96	-	-
Acidity	81.32	0.08	-	0.08	81.24	99.9
3 – Laurel Run between unnamed tributaries						
Al	28.10	14.33	*0.56*	13.77	8.18	37*
Fe	19.34	19.34	*2.25*	17.09	-	-
Mn	7.61	7.61	*1.50*	6.11	-	-
Acidity	223.70	51.45	-	51.45	91.01	64*
2 – Bromm Run at mouth						
Al	8.40	2.10	*0.28*	1.82	6.30	75
Fe	4.11	4.11	*1.13*	2.98	-	-
Mn	1.56	1.56	*0.75*	0.81	-	-
Acidity	73.02	13.14	-	13.14	59.88	82
1 – Laurel Run at mouth						
Al	26.50	20.14	*0.56*	19.58	0	0*
Fe	16.07	16.07	*2.25*	13.81	-	-
Mn	5.25	5.25	*1.50*	3.75	-	-
Acidity	262.53	81.38	-	81.38	0	0*

* TAKES INTO ACCOUNT LOAD REDUCTIONS FROM UPSTREAM SOURCES.
Numbers in italics are set aside for future mining operations.

Following is an example of how the allocations, presented in Table 3, are calculated. For this example, aluminum allocations are shown. As demonstrated in the example, all upstream contributing loads are accounted for at each point. Attachment D 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.



2	Load (lbs/day)
Existing Load	**8.40**
Allowable Load	**2.10**
Load Reduction	6.30
% Reduction	75

1	Load (lbs/day)
Existing Load	26.50
Difference in Existing Load	**-10.00**
Load tracked from upstream	16.43
Total Load tracked between points	**11.83**
Allowable Load at 1	20.14
Load Reduction at 1	0
% Reduction required at 1	0

Recommendations

Various methods to eliminate or treat pollutant sources and to provide a reasonable assurance that the proposed TMDLs can be met exist in Pennsylvania. These methods include PADEP's primary efforts to improve water quality through reclamation of abandoned mine lands (for abandoned mining) and through the National Pollution Discharge Elimination System (NPDES) permit program (for active mining). Funding sources available that are currently being used for projects designed to achieve TMDL reductions include the Environmental Protection Agency (EPA) 319 grant program and Pennsylvania's Growing Greener Program (which has awarded almost $37 M since 1999 for watershed restoration and protection in mine-drainage impacted watersheds and abandoned mine reclamation). In 2006 alone, federal funding through the Office of Surface Mining (OSM) contributed $949 K for reclamation and mine drainage treatment through the Appalachian Clean Streams Initiative and another $298 K through Watershed Cooperative Agreements. According to the Department of the Interior, Office of Surface Mining (www.osmre.gov/annualreports/05SMCRA2AbandMineLandReclam.pdf), during 2005, Pennsylvania reclaimed 54 acres of gob piles, 73 acres of pits, 2,500 acres of spoil areas, 7,658 feet of highwall, and treated 94,465 gallons of mine drainage under their environmental (Priority 3) program only (priorities 1&2 are for reclaiming features threatening public health and safety with much larger number of features reclaimed).

OSM reports that nationally, of the $8.5 billion of high priority (defined as priority 1&2 features or those that threaten public health and safety) coal related AML problems in the AML inventory, $6.6 billion (78%)have yet to be reclaimed; $3.6 billion of this total is attributable to Pennsylvania watershed costs. Almost 83 percent of the $2.3 billion of coal related environmental problems (priority 3) in the AML inventory are not reclaimed. The Bureau of Abandoned Mine Reclamation, the Department's primary bureau in dealing with abandoned mine reclamation (AMR) issues, has established a comprehensive plan for abandoned mine reclamation throughout the Commonwealth to prioritize and guide reclamation efforts for throughout the state to make the best use of valuable funds (www.dep.state.pa.us/dep/deputate/minres/bamr/complan1.htm). In developing and implementing a comprehensive plan for abandoned mine reclamation, the resources (both human and financial) of the participants must be coordinated to insure cost-effective results. The following set of principles is intended to guide this decision making process:

- Partnerships between the DEP, watershed associations, local governments, environmental groups, other state agencies, federal agencies and other groups organized to reclaim abandoned mine lands are essential to achieving reclamation and abating acid mine drainage in an efficient and effective manner.

- Partnerships between AML interests and active mine operators are important and essential in reclaiming abandoned mine lands.

- Preferential consideration for the development of AML reclamation or AMD abatement projects will be given to watersheds or areas for which there is an approved rehabilitation plan. (guidance is given in Appendix B to the Comprehensive Plan).

- Preferential consideration for the use of designated reclamation moneys will be given to projects that have obtained other sources or means to partially fund the project or to projects that need the funds to match other sources of funds.

- Preferential consideration for the use of available moneys from federal and other sources will be given to projects where there are institutional arrangements for any necessary long-term operation and maintenance costs.

- Preferential consideration for the use of available moneys from federal and other sources will be given to projects that have the greatest worth.

- Preferential consideration for the development of AML projects will be given to AML problems that impact people over those that impact property.

- No plan is an absolute; occasional deviations are to be expected.

A detailed decision framework is included in the plan that outlines the basis for judging projects for funding, giving high priority to those projects whose cost/benefit ratios are most favorable and those in which stakeholder and landowner involvement is high and secure.

In addition to the abandoned mine reclamation program, regulatory programs also are assisting in the reclamation and restoration of Pennsylvania's land and water. PADEP has been effective in implementing the NPDES program for mining operations throughout the Commonwealth. During 2006, District Mining Offices issued 31 new remining permits with the potential for reclaiming 1,058 acres of abandoned mine lands; an additional 328 acres were reclaimed during 2006 from existing remining permits. This reclamation was done at no cost to the Commonwealth or the federal government. Long-term treatment agreements were initialized for 109 facilities/operators who need to assure treatment of post-mining discharges or discharges they degraded which will provide for long-term treatment of 211 discharges. Of the 109 agreements, 34 have been finalized with 17 conventional bonding agreements totaling $75 M and 17 with treatment trusts totaling $73 M. According to OSM, "PADEP is conducting a program where active mining sites are, with very few exceptions, in compliance with the approved regulatory program". In addition, the Commonwealth dedicates 359 full-time equivalents (staff) to its regulatory and AML programs.

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; and 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).

Pennsylvania is striving for complete reclamation of its abandoned mines and plugging of its orphaned wells. 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. 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.
The coal industry, through DEP-promoted remining efforts, can help to eliminate some sources of AMD and conduct some of the remediation identified in the above recommendations through the permitting, mining, and reclamation of abandoned and disturbed mine lands. Special consideration should be given to potential remining projects within these areas, as the environmental benefit versus cost ratio is generally very high.

The Commonwealth is exploring all options to address its abandoned mine problem. During 2000-2006, many new approaches to mine reclamation and mine drainage remediation have been explored and projects funded to address problems in innovative ways. These include:

- Project XL - The Pennsylvania Department of Environmental Protection ("PADEP"), has proposed this XL Project to explore a new approach to encourage the remining and reclamation of abandoned coal mine sites. The approach would be based on compliance with in-stream pollutant concentration limits and implementation of best management practices ("BMPs"), instead of National Pollutant Discharge Elimination System ("NPDES") numeric effluent limitations measured at individual discharge points. This XL project would provide for a test of this approach in up to eight watersheds with significant acid mine drainage ("AMD") pollution. The project will collect data to compare in-stream pollutant concentrations versus the loading from individual discharge points and provide for the evaluation of the performance of BMPs and this alternate strategy in PADEP's efforts to address AMD.

- Awards of grants for 1) proposals with economic development or industrial application as their primary goal and which rely on recycled mine water and/or a site that has been made suitable for the location of a facility through the elimination of existing Priority 1 or 2 hazards, and 2) new and innovative mine drainage treatment technologies that will provide waters of higher purity that may be needed by a particular industry at costs below conventional treatment costs as in common use today or reduce the costs of water treatment below those of conventional lime treatment plants. Eight contracts totaling $4.075 M were awarded in 2006 under this program.
- Projects using water from mine pools in an innovative fashion, such as the Shannopin Deep Mine Pool (in southwestern Pennsylvania), the Barnes & Tucker Deep Mine Pool (the Susquehanna River Basin Commission into the Upper West Branch Susquehanna River), and the Wadesville Deep Mine Pool (Excelon Generation in Schuylkill County).

There currently isn't a watershed organization interested in the Laurel Run Watershed. It is recommended that agencies work with local interests to form a watershed group that will be dedicated to the remediation and preservation of these watersheds through public education, monitoring and assessment, and improvement projects. Information on formation of a watershed group is available through websites for the PADEP (www.dep.state.pa.us), the AMR Clearinghouse (www.amrclearinghouse.com), the EPA (www.epa.gov), the Susquehanna River Basin Commission (www.srbc.net) and others. In addition, each DEP Regional Office (6) and each District Mining Office (5) have watershed managers to assist stakeholder groups interested in restoration in their watershed. Most Pennsylvania county conservation districts have a watershed specialist who can also provide assistance to stakeholders (www.pacd.org). Potential funding sources for AMR projects can be found at www.dep.state.pa.us/dep/subject/pubs/water/wc/FS2205.pdf.

Candidate or federally-listed threatened and endangered species may occur in or near the watershed. While implementation of the TMDL should result in improvements to water quality, they could inadvertently destroy habitat for candidate or federally-listed species. TMDL implementation projects should be screened through the Pennsylvania Natural Diversity Inventory (PNDI) early in their planning process, in accordance with the Department's policy titled Policy for Pennsylvania Natural Diversity Inventory (PNDI) Coordination During Permit Review and Evaluation (Document ID# 400-0200-001).

Public Participation

Public notice of the draft TMDL was published in the *Pennsylvania Bulletin* and the Daily American to foster public comment on the allowable loads calculated. The public comment period on this TMDL was open from January 9, 2008, to March 19, 2008. A public meeting was held on January 24, 2008 at the Cambria District Mining Office to discuss the proposed TMDL.

Future TMDL Modifications

In the future, the Department may adjust the load and/or wasteload allocations in this TMDL to account for new information or circumstances that are developed or discovered during the implementation of the TMDL when a review of the new information or circumstances indicate that such adjustments are appropriate. Adjustment between the load and wasteload allocation will only be made following an opportunity for public participation. A wasteload allocation adjustment will be made consistent and simultaneous with associated permit(s) revision(s)/reissuances (i.e., permits for revision/reissuance in association with a TMDL revision will be made available for public comment concurrent with the related TMDLs availability for public comment). New information generated during TMDL implementation may include, among other things, monitoring data, BMP effectiveness information, and land use information. All changes in the TMDL will be tallied and once the total changes exceed 1% of the total original TMDL allowable load, the TMDL will be revised. The adjusted TMDL, including its LAs and WLAs, will be set at a level necessary to implement the applicable WQS and any adjustment increasing a WLA will be supported by reasonable assurance demonstration that load allocations will be met. The Department will notify EPA of any adjustments to the TMDL within 30 days of its adoption and will maintain current tracking mechanisms that contain accurate loading information for TMDL waters.

Changes in TMDLs That May Require EPA Approval

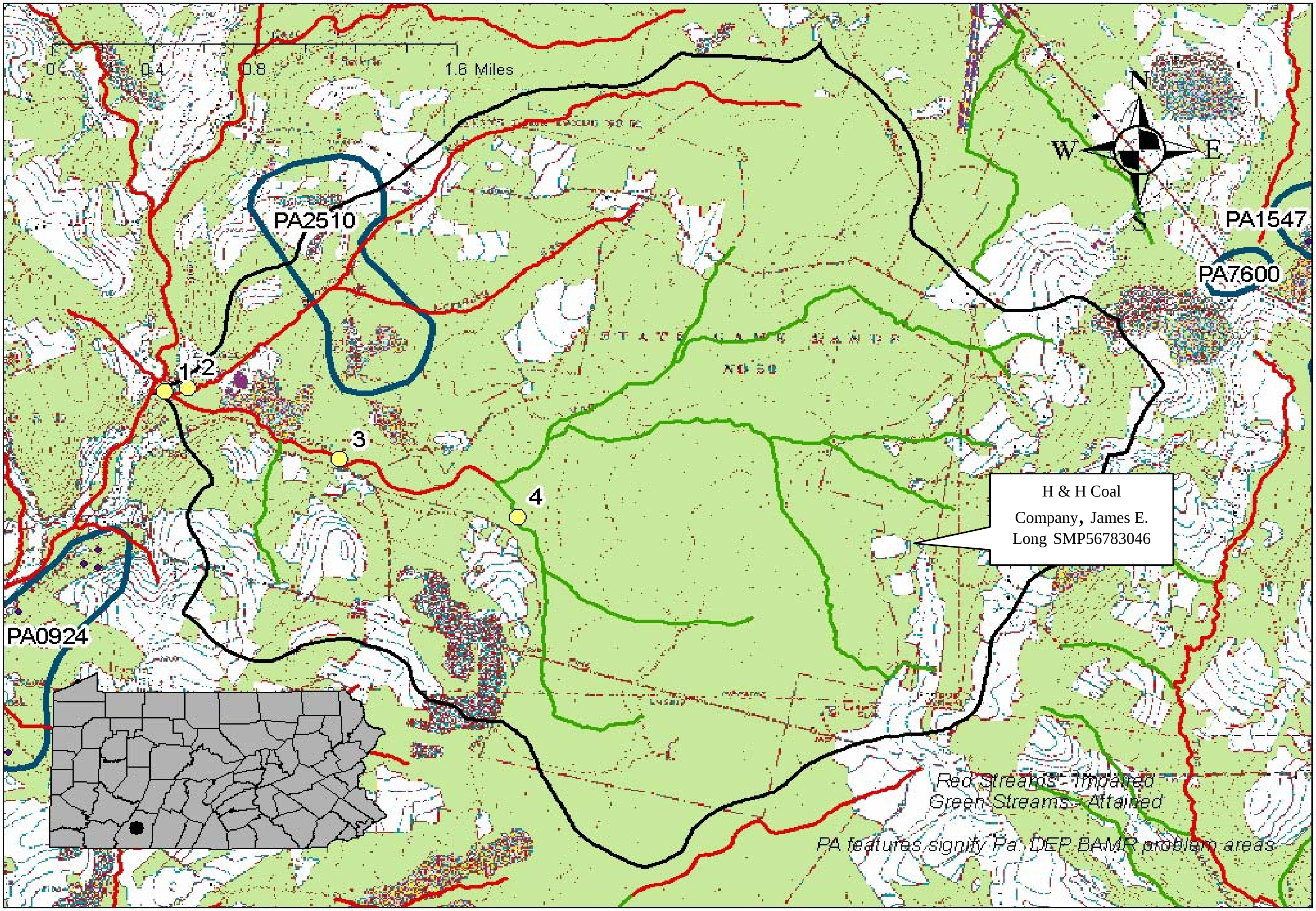
- Increase in total load capacity.
- Transfer of load between point (WLA) and nonpoint (LA) sources.
- Modification of the margin of safety (MOS).
- Change in water quality standards (WQS).
- Non-attainment of WQS with implementation of the TMDL.
- Allocations in trading programs.

Changes in TMDLs That May Not Require EPA Approval

- Total loading shift less than or equal to 1% of the total load.
- Increase of WLA results in greater LA reductions provided reasonable assurance of implementation is demonstrated (a compliance/implementation plan and schedule).
- Changes among WLAs with no other changes; TMDL public notice concurrent with permit public notice.
- Removal of a pollutant source that will not be reallocated.
- Reallocation between LAs.
- Changes in land use.

Attachment A

Laurel Run Watershed Maps


0
0.4
0.8
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PA2510
PA1547
PA7600
PA0924
1
2
3
4
H & H Coal Company, James E. Long SMP56783046
Red Streams - Impaired
Green Streams - Attained
PA features signify Pa. DEP BAMR problem areas

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.

There are several documented cases of streams in Pennsylvania having a natural background pH below six. If the natural pH of a stream on the Section 303(d) list can be established from its upper unaffected regions, then the pH standard will be expanded to include this natural range. The acceptable net alkalinity of the stream after treatment/abatement in its polluted segment will be the average net alkalinity established from the stream's upper, pristine reaches added to the acidity of the polluted portion in question. Summarized, if the pH in an unaffected portion of a stream is found to be naturally occurring below six, then the average net alkalinity for that portion (added to the acidity of the polluted portion) of the stream will become the criterion for the polluted portion. This "natural net alkalinity level" will be the criterion to which a 99 percent confidence level will be applied. The pH range will be varied only for streams in which a natural unaffected net alkalinity level can be established. This can only be done for streams that have upper segments that are not impacted by mining activity. All other streams will be required to reduce the acid load so the net alkalinity is greater than zero 99% of time.

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.*

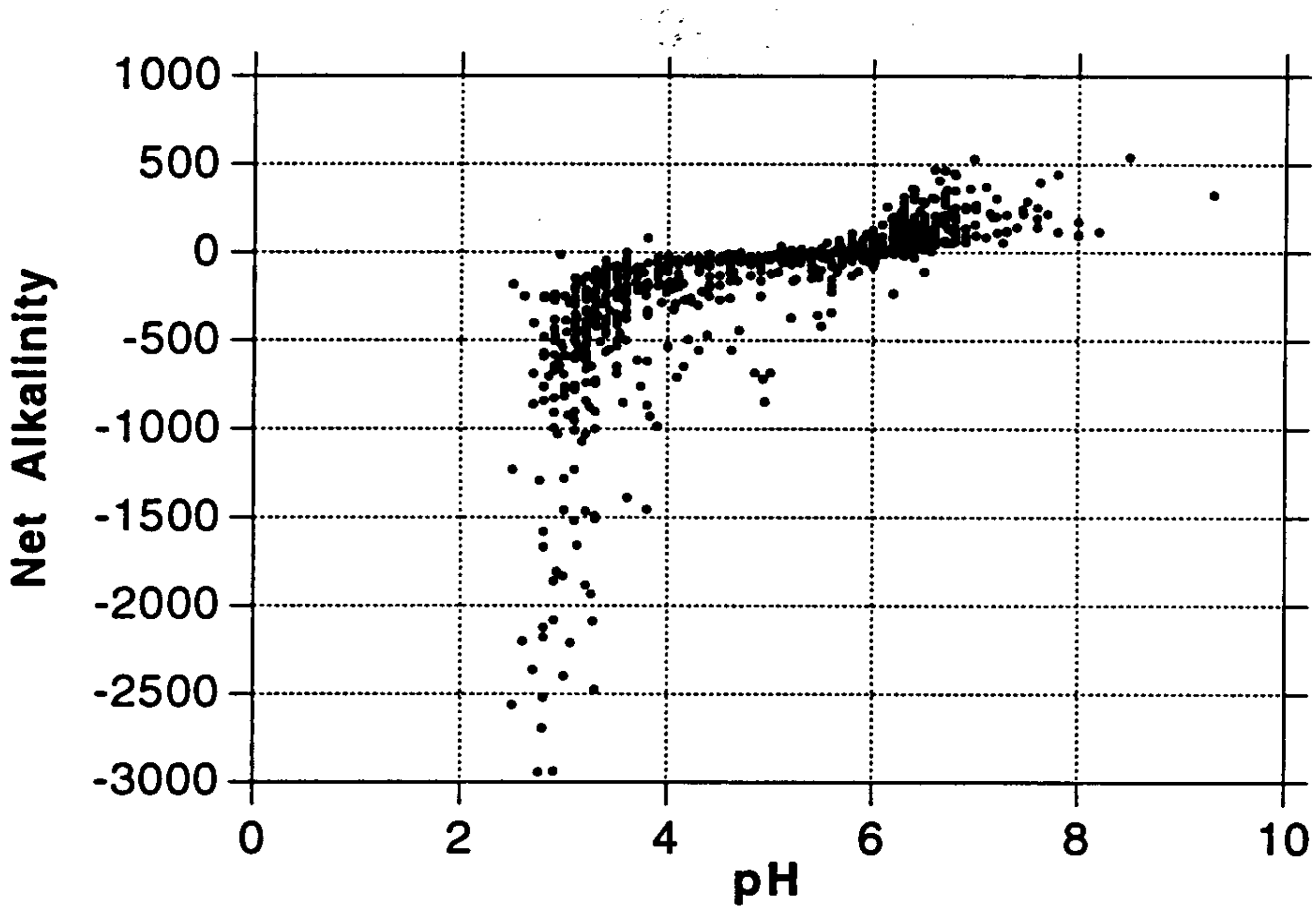


Figure 1. Net Alkalinity vs. pH. Taken from Figure 1.2 Graph C, pages 1-5, of Coal Mine Drainage Prediction and Pollution Prevention in Pennsylvania

Attachment C

Method for Calculating Loads from Mine Drainage Treatment Facilities from Surface Mines

Method to Quantify Treatment Pond Pollutant Load

Calculating Waste Load Allocations for Active Mining in the TMDL Stream Segment.

The end product of the TMDL report is to develop Waste Load Allocations (WLA) and Load Allocations (LA) that represent the amount of pollution the stream can assimilate while still achieving in-stream limits. The LA is the load from abandoned mine lands where there is no NPDES permit or responsible party. The WLA is the pollution load from active mining that is permitted through NPDES.

In preparing the TMDL, calculations are done to determine the allowable load. The actual load measured in the stream is equal to the allowable load plus the reduced load.

Total Measured Load = Allowed Load + Reduced Load

If there is active mining or anticipated mining in the near future in the watershed, the allowed load must include both a WLA and a LA component.

Allowed Load (lbs/day) = WLA (lbs/day) + LA (lbs/day)

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 coalmines 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 <= pH <= 9.0
Fe < 3.0 mg/l
Mn < 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, they can be used to quantify the WLA. 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 regarded 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 0.75 mg/l x 0.01202 = 0.3 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.

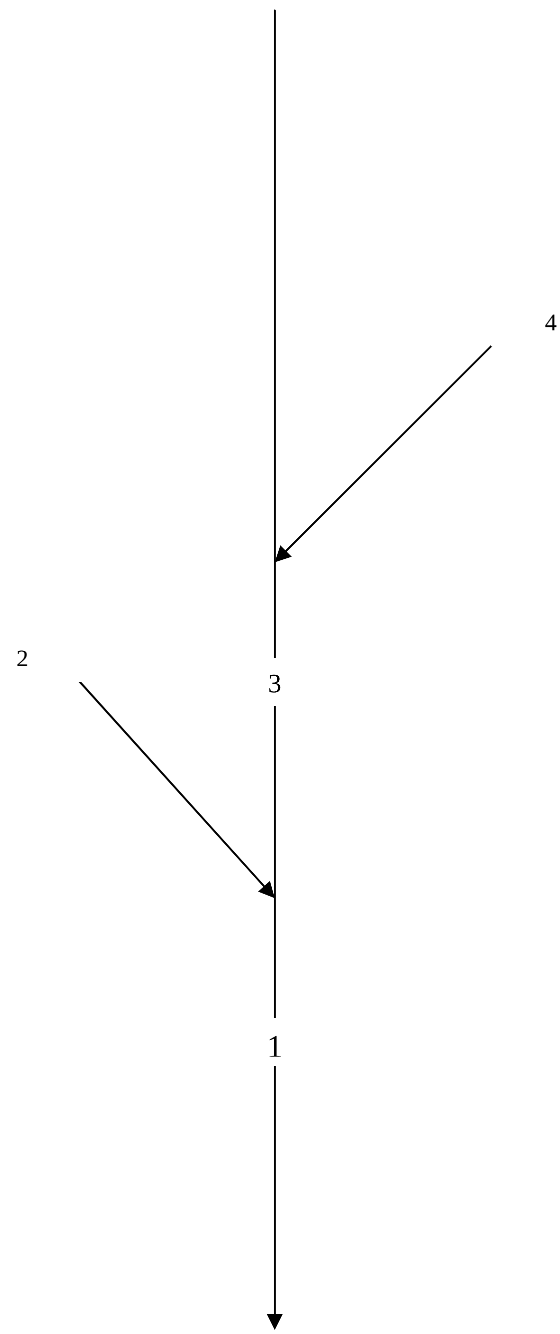
The allowable load for the stream segment is determined by modeling of flow and water quality data. The allowable load has a potential Waste Load Allocation (WLA) component if there is active mining or anticipated future mining and a Load Allocation (LA). So, the sum of the Load Allocation and the Waste Load Allocation is equal to the allowed load. The WLA is determined by the above calculations and the LA is determined by the difference between the allowed load and the WLA.

Allowed Load = Waste Load Allocation + Load Allocation
Or
Load Allocation = Allowed Load – Waste Load Allocation

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 in the allowed load to allow for future mining.

Attachment D
TMDLs By Segment

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



Laurel Run

Laurel Run is listed as impaired on the PA Section 303(d) list by metals and pH from AMD as being the cause of the degradation to the stream.

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 2). 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.

TMDL Calculations - Sample Point 4 – Unnamed tributary to Laurel Run at mouth

The TMDL for sample point 4 consists of a load allocation to all of the area upstream of this point (Attachment A). The load allocation for this segment was computed using water-quality sample data collected at point 4. The average flow of 1.1772 MGD, measured at the point, is used for these computations.

This segment was not included on the 1996 PA Section 303(d) list for pH impairment from AMD. Sample data at point 4 shows pH ranging between 4.33 and 4.58; pH is addressed as part of this TMDL.

Water quality analysis determined the existing and allowable loads for iron and manganese were equal. Because the WQS are met, a TMDL for iron and manganese is not necessary at 4. Although a TMDL is not necessary, the measured iron and manganese loads are considered at the next downstream point, 3.

Table D1. TMDL Calculations at Point 4				
Flow = 1.1772 MGD	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	0.79	7.77	0.22	2.18
Fe	0.24	2.36	0.24	2.36
Mn	0.20	1.96	0.20	1.96
Acidity	8.28	81.32	0.01	0.08
Alkalinity	0.03	0.33		

Table D2. Calculation of Load Reduction Necessary at Point 4				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	7.77	2.36	1.96	81.32
Allowable Load	2.18	2.36	1.96	0.08
Load Reduction	5.59	-	-	81.24
% Reduction required	72	0	0	99.9

TMDL Calculations - Sample Point 3 – Laurel Run between Unnamed Tributaries 4 & Bromm Run

The TMDL for sample point 3 consists of a load allocation to all of the area upstream of this point (Attachment A). The load allocation for this segment was computed using water-quality sample data collected at point 3. The average flow of 4.84752 MGD, measured at the point, is used for these computations.

This segment was not included on the 1996 PA Section 303(d) list for pH impairments from AMD. Sample data at point 3 shows pH ranging between 5.09 and 6.49; pH is addressed as part of this TMDL.

Table D3. TMDL Calculations at Point 3				
Flow = 4.84752 MGD	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	0.70	28.10	0.35	14.33
Fe	0.48	19.34	0.48	19.34
Mn	0.19	7.61	0.19	7.61
Acidity	5.53	223.70	1.27	51.45
Alkalinity	4.13	167.10		

The calculated upstream load reductions for all the loads that enter point 3 must be accounted for in the calculated reductions at the sample point shown in Table D4. A comparison of measured loads between points 3 and upstream points (4) shows that there is an increase in loading for all parameters. The total segment aluminum, iron, manganese, and acid loads are the sum of the upstream loads and the additional loads entering the segment.

Table D4. Calculation of Load Reduction Necessary at Point 3				
3	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ 3	28.10	19.34	7.61	223.70
Difference in measured loads between upstream and existing	20.33	16.98	5.65	142.38
Percent loss due calculated at 3	0	0	0	0
Additional load tracked from above samples	2.18	2.36	1.96	0.08
Percentage of upstream loads that reach 3	100	100	100	100
Total load tracked between upstream and 3	22.51	19.34	7.61	142.46
Allowable Load @ 3	14.33	19.34	7.61	51.45
Load Reduction @ 3	8.18	0	0	91.01
% Reduction required at 3	37	0	0	64

A waste load allocation for future mining was included for this segment of Laurel Run allowing for one operation with two active pits (1500' x 300') to be permitted in the future on this segment (see Attachment C for the method used to calculate mine drainage treatment facility loading).

Table D5. Waste Load Allocations for future mining operations			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50

TMDL Calculations - Sample Point 2 – Bromm Run near mouth

The TMDL for sample point 2 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 2. The average flow of 1.3824 MGD, measured at the point, is used for these computations.

This segment was not included on the 1996 PA Section 303(d) list for pH impairments from AMD. Sample data at point 2 shows pH ranging between 4.82 and 6.02; pH is addressed as part of this TMDL.

Water quality analysis determined the existing and allowable iron and manganese loads are equal. Because the WQS are met, TMDLs for these metals are not necessary at 2. Although a TMDL is not necessary, the measured metals loads are considered at the next downstream point, 1.

Table D6. TMDL Calculations at Point 2				
Flow = 1.3824 MGD	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	0.73	8.40	0.18	2.10
Fe	0.36	4.11	0.36	4.11
Mn	0.14	1.56	0.14	1.56
Acidity	6.33	73.02	1.14	13.14
Alkalinity	2.37	27.29		

Table D7. Calculation of Load Reduction Necessary at Point 2				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	8.40	4.11	1.56	73.02
Allowable Load	2.10	4.11	1.56	13.14
Load Reduction	6.30	-	-	59.88
% Reduction required	75	0	0	82

A waste load allocation for future mining was included for this segment of Laurel Run allowing for one operation with one active pits (1500’ x 300’) to be permitted in the future on this segment (see Attachment C for the method used to calculate mine drainage treatment facility loading).

Table D8. Waste Load Allocations for future mining operations			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Future Operation 1			
Al	0.75	0.045	0.28
Fe	3.0	0.045	1.13
Mn	2.0	0.045	0.75

TMDL Calculations - Sample Point 1 – Laurel Run near mouth

The TMDL for sample point 1 consists of a load allocation to all of the area between points 3 and 1 (Attachment A). The load allocation for this segment was computed using water-quality sample data collected at point 1. The average flow of 5.81136 MGD, measured at the point, is used for these computations.

This segment was included on the 1996 PA Section 303(d) list for pH impairments from AMD. Sample data at point 1 shows pH ranging between 5.32 and 6.67; pH is addressed as part of this TMDL.

Table D9. TMDL Calculations at Point 1				
Flow = 5.81136 MGD	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	0.55	26.50	0.42	20.14
Fe	0.33	16.07	0.33	16.07
Mn	0.11	5.25	0.11	5.25
Acidity	5.42	262.53	1.68	81.38
Alkalinity	4.22	204.37		

The calculated upstream load reductions for all the loads that enter point 1 must be accounted for in the calculated reductions at the sample point shown in Table D10. A comparison of measured loads between points 1 and upstream points (2,3) shows that there is a decrease in loading for all parameters, likely due to instream processes. The total segment aluminum, iron, manganese, and acid loads are the sum of the upstream loads and the additional loads entering the segment.

Table D10. Calculation of Load Reduction Necessary at Point 1				
1	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ 1	26.50	16.07	5.25	262.53
Difference in measured loads between upstream and existing	-10.00	-7.38	-3.92	-34.19
Percent loss due calculated at 1	28	32	43	12
Additional load tracked from above samples	16.43	23.45	9.17	64.59
Percentage of upstream loads that reach 1	72	68	57	88
Total load tracked between upstream and 1	11.83	15.95	5.23	56.84
Allowable Load @ 1	20.14	16.07	5.25	81.38
Load Reduction @ 1	0	0	0	0
% Reduction required at 1	0	0	0	0

A waste load allocation for future mining was included for this segment of Laurel Run allowing for one operation with two active pits (1500’ x 300’) to be permitted in the future on this segment (see Attachment C for the method used to calculate mine drainage treatment facility loading).

Table D11. Waste Load Allocations for future mining operations			
Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Future Operation 1			
Al	0.75	0.090	0.56
Fe	3.0	0.090	2.25
Mn	2.0	0.090	1.50

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.

Seasonal Variation

Seasonal variation is implicitly accounted for in these TMDLs because the data used represent 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 E

Excerpts Justifying Changes Between the 1996, 1998, and 2002 Section 303(d) Lists and Integrated Water Quality Assessment Report and List (2004, 2006)

The following are excerpts from the Pennsylvania DEP Section 303(d) narratives that justify changes in listings between the 1996, 1998, 2002, 2004 and 2006 303(d) Lists and Integrated Report/List (2006). 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).

Migration to National Hydrography Data (NHD)

New to the 2006 report is use of the 1/24,000 National Hydrography Data (NHD) streams GIS layer. Up until 2006 the Department relied upon its own internally developed stream layer. Subsequently, the United States Geologic Survey (USGS) developed 1/24,000 NHD streams layer for the Commonwealth based upon national geodatabase standards. In 2005, DEP contracted with USGS to add missing streams and correct any errors in the NHD. A GIS contractor transferred the old DEP stream assessment information to the improved NHD and the old DEP streams layer was archived. Overall, this marked an improvement in the quality of the streams layer and made the stream assessment data compatible with national standards but it necessitated a change in the Integrated Listing format. The NHD is not attributed with the old DEP five digit stream codes so segments can no longer be listed by stream code but rather only by stream name or a fixed combination of NHD fields known as reachcode and ComID. The NHD is aggregated by Hydrologic Unit Code (HUC) watersheds so HUCs rather than the old State Water Plan (SWP) watersheds are now used to group streams together. The map in

Appendix E illustrates the relationship between the old SWP and new HUC watershed delineations. A more basic change was the shift in data management philosophy from one of “dynamic segmentation” to “fixed segments”. The dynamic segmentation records were proving too difficult to mange from an historical tracking perspective. The fixed segment methods will remedy that problem. The stream assessment data management has gone through many changes over the years as system requirements and software changed. It is hoped that with the shift to the NHD and OIT’s (Office of Information Technology) fulltime staff to manage and maintain SLIMS the systems and formats will now remain stable over many Integrated Listing cycles.

Attachment F
Water Quality Data Used In TMDL Calculations

Site	Site Name	Date-time	Flow (gpm)	pH	Acidity (mg/L)	Alkalinity (mg/L)	TSS (mg/L)	Al (ppm)	Fe (ppm)	Mn (ppm)	SO4 (mg/L)
1	Laurel Run	050408-1000	8714	5.32	6.7	1.7	6.4	0.52	0.28	0.20	17
1		050423-1125	7649	6.05	7.6	3.1	14.0	0.67	0.42	0.15	17
1		050428-1100	3257	6.22	5.3	3.1	7.5	0.54	0.46	0.13	17
1		050512-1105	1790	6.42	3.7	5.0	2.5	0.32	0.21	0.02	13
1		050523-1047	1618	6.50	7.7	6.1	1.2	0.74	0.30	0.05	16
1		050602-1040	1186	6.67	1.5	6.3	6.6	0.49	0.32	0.10	14
		Average	**4035.67**	**6.20**	**5.42**	**4.22**	**6.37**	**0.55**	**0.33**	**0.11**	**15.67**
		St. Dev.	**3303.27**	**0.48**	**2.45**	**1.86**	**4.50**	**0.15**	**0.09**	**0.07**	**1.75**
2	Laurel Run	050408-1020	2167	4.82	8.1	1.1	2.3	0.53	0.27	0.11	14
2		050423-1150	1811	5.36	8.3	1.6	2.2	0.52	0.32	0.09	15
2		050428-1115	740	5.18	8.3	2.7	4.9	0.49	0.42	0.08	13
2		050512-1125	378	5.55	5.4	2.0	2.0	0.35	0.23	0.02	14
2		050523-1115	420	5.88	3.6	4.1	6.4	0.58	0.43	0.28	12
2		050602-1055	244	6.02	4.3	2.7	3.2	1.90	0.47	0.23	11
		Average	**960.00**	**5.47**	**6.33**	**2.37**	**3.50**	**0.73**	**0.36**	**0.14**	**13.17**
		St. Dev.	**821.27**	**0.45**	**2.16**	**1.05**	**1.78**	**0.58**	**0.10**	**0.10**	**1.47**
3	Laurel Run	050408-1120	6886	5.09	8.0	1.4	7.2	0.54	0.21	0.10	19
3		050423-1110	6224	5.68	7.5	2.3	15.2	1.10	0.82	0.24	16
3		050428-1040	2649	6.07	4.9	3.0	11.2	0.64	0.55	0.25	15
3		050512-1050	1421	6.27	4.0	5.8	7.0	0.44	0.27	0.02	16
3		050523-1030	1849	6.43	9.0	5.7	2.8	0.86	0.69	0.44	14
3		050602-1030	1169	6.49	-0.2	6.6	8.6	0.59	0.33	0.08	12
		Average	**3366.33**	**6.01**	**5.53**	**4.13**	**8.67**	**0.70**	**0.48**	**0.19**	**15.33**
		St. Dev.	**2529.18**	**0.54**	**3.39**	**2.16**	**4.21**	**0.24**	**0.25**	**0.15**	**2.34**
4	Laurel Run	050408-1150	1486	4.33	10.5	0.0	0.5	0.63	0.11	0.09	11
4		050423-1020	1334	4.49	10.2	0.0	5.4	0.64	0.73	0.48	10
4		050428-1020	670	4.44	9.2	0.0	2.6	0.59	0.10	0.12	10
4		050512-1040	452	4.41	2.5	0.0	0.5	0.35	0.10	0.10	10
4		050523-1010	658	4.51	9.5	0.0	3.2	0.74	0.19	0.25	11
4		050602-1010	305	4.58	7.8	0.2	3.4	1.80	0.21	0.16	9
		Average	**817.50**	**4.46**	**8.28**	**0.03**	**2.60**	**0.79**	**0.24**	**0.20**	**10.17**
		St. Dev.	**481.06**	**0.09**	**2.99**	**0.08**	**1.88**	**0.51**	**0.24**	**0.15**	**0.75**

Attachment G

TMDLs and NPDES Permitting Coordination

NPDES permitting is unavoidably linked to TMDLs through waste load allocations and their translation, through the permitting program, to effluent limits. Primary responsibility for NPDES permitting rests with the District Mining Offices (for mining NPDES permits) and the Regional Offices (for industrial NPDES permits). Therefore, the DMOs and Regions will maintain tracking mechanisms of available waste load allocations, etc. in their respective offices. The TMDL program will assist in this effort. However, the primary role of the of the TMDL program is TMDL development and revision/amendment (the necessity for which is as defined in the Future Modifications section) at the request of the respective office. All efforts will be made to coordinate public notice periods for TMDL revisions and permit renewals/reissuances.

Load Tracking Mechanisms

The Department has developed tracking mechanisms that will allow for accounting of pollution loads in TMDL watersheds. This will allow permit writers to have information on how allocations have been distributed throughout the watershed in the watershed of interest while making permitting decisions. These tracking mechanisms will allow the Department to make minor changes in WLAs without the need for EPA to review and approve a revised TMDL. Tracking will also allow for the evaluation of loads at downstream points throughout a watershed to ensure no downstream impairments will result from the addition, modification or movement of a permit.

Options for Permittees in TMDL Watersheds

The Department is working to develop options for mining permits in watersheds with approved TMDLs.

Options identified

- Build excess WLA into the TMDL for anticipated future mining. This could then be used for a new permit. Permittee must show that there has been actual load reduction in the amount of the proposed permit or must include a schedule to guarantee the reductions using current data referenced to the TMDL prior to permit issuance.
- Use WLA that is freed up from another permit in the watershed when that site is reclaimed. If no permits have been recently reclaimed, it may be necessary to delay permit issuance until additional WLA becomes available.
- Re-allocate the WLA(s) of existing permits. WLAs could be reallocated based on actual flows (as opposed to design flows) or smaller than approved pit/spoil areas (as opposed to default areas). The "freed-up" WLA could be applied to the new permit. This option would require the simultaneous amendment of the permits involved in the reallocation.
- Non-discharge alternative.

Other possible options

The following two options have also been identified for use in TMDL watersheds. However, before recommendation for use as viable implementation options, a thorough regulatory (both state and federal) review must be completed. These options should not be implemented until the completion of the regulatory review and development of any applicable administrative mechanisms.

- Issue the permit with in-stream water quality criteria values as the effluent limits. The in-stream criteria value would represent the monthly average, with the other limits adjusted accordingly (e.g., for Fe, the limits would be 1.5 mg/L monthly average, 3.0 mg/L daily average and 4.0 instantaneous max mg/L).

- The applicant would agree to treat an existing source (point or non-point) where there is no responsible party and receive a WLA based on a portion of the load reduction to be achieved. The result of using these types of offsets in permitting is a net improvement in long-term water quality through the reclamation or treatment of an abandoned source.

Attachment H
Comment and Response

No public comments were received for the Laurel Run TMDL.