FINAL BEAR RUN WATERSHED TMDL

Clearfield, Indiana, and Jefferson Counties

Prepared for:

Pennsylvania Department of Environmental Protection

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INTRODUCTION

This Total Maximum Daily Load (TMDL) calculation has been prepared for segments in the Bear Run Watershed (Attachment A). It was done to address the impairments noted on the 1996, 1998, 2002, and draft 2004 Pennsylvania Section 303(d) lists required under the Clean Water Act. The TMDL covers 10 segments on these lists (Table 1). High levels of metals, and in some areas depressed pH, caused these impairments. All impairments are a result of acid mine drainage from abandoned coal mines. The TMDL addresses the three primary metals (iron, manganese, and aluminum) associated with abandoned mine drainage (AMD) and pH.

Table 1. Bear Run Segments Addressed

State Water Plan (SWP) Subbasin: 08-B West Branch Susquehanna River								
Year	***Miles***	***Segment ID***	***PADEP Stream Code***	***Stream Name***	***Designated Use***	***Data Source***	***Source***	***USEPA 305(b) Cause Code***
1996	2.9	4125	27032	Bear Run	CWF	305(b) Report	RE	Metals
1998	8.30	4125, 4126	27032	Bear Run Watershed	CWF	Surface Water Monitoring Program	AMD	Metals, pH
2002	3	4125	27032	Bear Run	CWF	Surface Water Monitoring Program	AMD	Metals
2002	5.2	4126	27032, 27038	Bear Run and South Branch Bear Run	CWF	Surface Water Monitoring Program	AMD	Metals, pH
2004	3.2	4126	27032	Bear Run	CWF	Statewide Surface Water Monitoring Program	AMD	Metals
2004	3.1	4125	27032	Bear Run	CWF	Statewide Surface Water Monitoring Program	AMD	Metals
1996	5.3	4126	27038	South Branch Bear Run	CWF	305(b) Report	RE	Metals, pH
2004	2	4126	27038	South Branch Bear Run	CWF	Statewide Surface Water Monitoring Program	AMD	Metals, pH
2004	3.2	20030929-1930-JCO	27038	South Branch Bear Run	CWF	Statewide Surface Water Monitoring Program	AMD	Metals, pH

[1] Pennsylvania's 1996, 1998, and 2002 Section 303(d) lists were approved by the U.S. Environmental Protection Agency. The draft 2004 Section 303(d) list had not yet been approved at the time this document was written. 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.*

State Water Plan (SWP) Subbasin: 08-B West Branch Susquehanna River								
Year	**Miles**	**Segment ID**	**PADEP Stream Code**	**Stream Name**	**Designated Use**	**Data Source**	**Source**	**USEPA 305(b) Cause Code**
2004	2	20030929-1932-JCO	27039	UNT 27039 to South Branch Bear Run	CWF	Statewide Surface Water Monitoring Program	AMD	Metals, pH
2004	1	20030929-1929-JCO	27040	UNT 27040 to South Branch Bear Run	CWF	Statewide Surface Water Monitoring Program	AMD	Metals, pH
2004	0.5	20030929-1929-JCO	27041	UNT 27041 to South Branch Bear Run	CWF	Statewide Surface Water Monitoring Program	AMD	Metals, pH
2004	0.6	20030929-1929-JCO	27045	UNT 27045 to South Branch Bear Run	CWF	Statewide Surface Water Monitoring Program	AMD	Metals, pH
2004	0.8	20030929-1929-JCO	27046	UNT 27046 to South Branch Bear Run	CWF	Statewide Surface Water Monitoring Program	AMD	Metals, pH
2004	0.7	20030929-1929-JCO	27047	UNT 27047 to South Branch Bear Run	CWF	Statewide Surface Water Monitoring Program	AMD	Metals, pH
2004	1.2	20030929-1929-JCO	27049	UNT 27049 to South Branch Bear Run	CWF	Statewide Surface Water Monitoring Program	AMD	Metals, pH
2004	0.9	20030929-1929-JCO	27051	UNT 27051 to South Branch Bear Run	CWF	Statewide Surface Water Monitoring Program	AMD	Metals, pH

Attachment B includes a justification of differences between the 1996, 1998, 2002, and draft 2004 Section 303(d) Lists

CWF = Cold Water Fishes
RE = Resource Extraction
AMD = Abandoned Mine Drainage

LOCATION

The Bear Run Watershed is approximately 19.3 square miles in area. The watershed can be located on U. S. Geological Service (USGS) 7.5 minute quadrangles of Burnside, McGees Mills, Punxsutawney, and Rochester Mills, Pennsylvania. A large portion of the Bear Run Watershed lies in State Game Lands 174; private parcels account for the remaining land ownership. Bear Run flows southeast from its origin near Hillman, Indiana County until its confluence with South

Branch Bear Run. The origin of South Branch Bear Run is near Flora, Indiana County. It flows southeast until it joins Bear Run. The stream then flows northeast and drains into the West Branch Susquehanna River along State Route 219 between Mahaffey and Burnside at the village of McGees Mills, Clearfield County, Pennsylvania. The only major named tributary to Bear Run is South Branch Bear Run. The watershed is sparsely populated; hunting cabins are the main dwellings found in the watershed. The village of Hillman, Pennsylvania, is located in the headwaters of Bear Run and the village of McGees Mills is at the mouth of the stream. The long-abandoned mining towns of Keal Run, Sidney, and Lochvale are also found in the watershed.

Bear Run can be accessed from State Route 219 at its mouth and from Township Road 974 near the confluence of South Branch Bear Run. A gated State Game Land road gives access to the headwaters of the stream but ends shortly after the stream is reached. The middle portion of the watershed is accessible only by foot. South Branch Bear Run can be accessed from State Route 1053 near the village of Lochvale and from Township Road 701 that parallels the stream until it confluences with Bear Run. Several other State Game Land roads exist in the watershed; these roads may or may not be gated at points along their path.

SEGMENTS ADDRESSED IN THIS TMDL

The Bear Run Watershed is affected by pollution from AMD. This pollution has caused high levels of metals and low pH in the mainstem of Bear Run, South Branch Bear Run, and eight unnamed tributaries to South Branch Bear Run. The sources of the AMD are deep mine discharges and seeps from areas disturbed by surface mining. Most of the discharges originate from mining on the Lower Kittanning, Clarion, and Brookville coal seams or refuse piles associated with them. All but two of the discharges are considered to be nonpoint sources of pollution because they are from abandoned Pre-Act mining operations or from coal companies that have settled their bond forfeitures with the Pennsylvania Department of Environmental Protection (PADEP).

The P & N Coal Company operates a coal processing and tipple site in the headwaters of Bear Run MP#32851601; PA0095966. The Hillman Tipple site is active and requires a WLA for a surface water runoff treatment pond that flows in response to precipitation events. Two other permits in the Bear Run Watershed are actively treating post-mining discharges. Since liability exists for these discharges, they are considered to be point source discharges and are assigned a WLA. The A & T Coal Company operated MP# 32803053; PA0124770, the Fisher Strip, from 1984 to 1994. The mine site was completely backfilled and revegetated by 1994; however, a post-mining discharge occurred from A & T Coal Company's operation. All bonds remain intact on the permit and the discharge is being treated to effluent standards. The Paul F. Becker Coal Company Buchanan Job, MP# 32860115; PA0597864, operated from 1987 to 1992. The mine site was completely backfilled and revegetated by 1992; however, the mined area was in the recharge zone of three preexisting deep mine discharges. The company placed a limestone channel to treat the discharges and bonds remain intact for that treatment system. Several permits are in Stage 2 or 3 bond release including: the Urey Coal Company Neely Strip MP# 32880107 and P & N Coal Company Urey Mine MP# 32930105. These permits are valid for reclamation only; the mine sites are regraded and no water treatment facilities remain on site. Also, the permitted area for these mines barely extend into the Bear Run Watershed and all water treatment facilities discharged into other watersheds. Therefore, the permits do not require a waste load allocation (WLA).

A fourth WLA, for a future mining operation, was calculated and incorporated into the allocations at BEAR1.0. It is possible that there will be mining in the Bear Run Watershed in the future based on available coal reserves, mining operator interests, and other factors. A WLA that is representative of one future surface mining operation has been included to accommodate this possibility.

Any preexisting discharges listed on permitted sites are treated as nonpoint sources for the purposes of doing the TMDLs, unless otherwise noted. The reduction necessary to meet applicable water quality standards from preexisting conditions (including discharges from areas coextensive with areas permitted under the remining program Subchapter F or G) are expressed in the load allocation (LA) portion of the TMDL. The WLAs express the basis for applicable effluent limitations on point sources. Except for any expressed assumptions, any WLA allocated to a remining permittee does not require the permittee to necessarily implement the reductions from preexisting conditions set forth in the LA. Additional requirements for the permittee to address the preexisting conditions are set forth in the applicable National Pollutant Discharge Elimination System (NPDES)/mining permit. The individual discharges are not assigned LAs, however; discharge affects on the stream are taken into account at the closest downstream sampling point, and it is noted that the discharge is a contributing pollutant source to the segment.

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 U.S. Environmental Protection Agency’s (USEPA) implementing regulations (40 CFR 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 USEPA 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

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

Despite these requirements, states, territories, authorized tribes, and USEPA have not developed many TMDLs since 1972. Beginning in 1986, organizations in many states filed lawsuits against the USEPA for failing to meet the TMDL requirements contained in the federal Clean Water Act and its implementing regulations. While USEPA has entered into consent agreements with the plaintiffs in several states, many lawsuits still are pending across the country.

In the cases that have been settled to date, the consent agreements require USEPA 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, 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 USEPA, the states have developed methods for assessing the waters within their respective jurisdictions.

The primary method adopted by the PADEP 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. PADEP is now using the Statewide Surface Water Assessment Program (SSWAP), a modification of the USEPA Rapid Bioassessment Protocol II (RPB-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 stream segment can vary between sites. All the biological surveys include kick-screen sampling of benthic macroinvertebrates, habitat surveys, and measurements of pH, temperature, conductivity, dissolved oxygen, and alkalinity. Benthic macroinvertebrates are identified to the family level in the field.

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

After the survey is completed, the biologist determines the status of the stream segment. The decision is based on the performance of the segment using a series of biological metrics. 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 documented source and cause. A TMDL must be developed for the stream segment. A TMDL is for only one pollutant. If a stream segment is impaired by two pollutants, two TMDLs must be developed for that stream segment. 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 preexisting data (watershed characterization, inventory contaminant sources, determination of pollutant loads, etc.);
2. Calculate TMDL for the waterbody using USEPA approved methods and computer models;
3. Allocate pollutant loads to various sources;
4. Determine critical and seasonal conditions;
5. Submit draft report for public review and comments; and
6. USEPA approval of the TMDL.

This document will present the information used to develop the Bear Run Watershed TMDL.

WATERSHED BACKGROUND

The Bear Run Watershed contains approximately 19.3 square miles within the Appalachian Plateaus Province. The headwaters of both Bear Run and South Branch Bear Run and the length of the streams until their confluence lie in the Mountainous High Plateau Section. The area from the confluence of the streams until the mouth of Bear Run lies in the Pittsburgh Low Plateau Section. There is a vertical drop in the watershed of 860 feet from its headwaters to its mouth. The headwaters of Bear Run begin in the southeast corner of Jefferson County and flow southeast into Banks Township, Indiana County and State Game Lands 174. South Branch Bear Run begins in northcental Indiana County near the village of Flora, Banks Township, and flows southeast until its confluence with Bear Run in State Game Lands 174. After the confluence of South Branch Bear Run, the stream flows east into Bell Township, Clearfield County and joins the West Branch Susquehanna River at the village of McGees Mills. The southern portion of the watershed has been highly disturbed by past coal mining operations. Numerous deep and surface mines have operated in the South Branch Bear Run subwatershed. Soils throughout the Bear Run Watershed are moderately to very deep, well drained, and strongly acidic (USDA, 2004). The surficial geology is a mixture of interbedded sedimentary (94.75 percent) and sandstone (5.25 percent).

Bear Run and all its tributaries are classified as cold-water fishery (CWF) (Title 25, Chapter 93, Pennsylvania Code). The Pennsylvania Fish and Boat Commission (PFBC) surveyed Bear Run and South Branch Bear Run in 1931 and noted that they were both badly polluted by AMD at their mouths (PFBC, 1931). The PFBC did not survey the rest of the stream length.

The Indiana County Conservation District (ICCD) received a Growing Greener Grant in 2002 to write a preliminary restoration plan for the Bear Run Watershed. The field work for the plan began in fall 2002, and the final report will be completed by early 2005. The ICCD electroshocked Bear Run above the confluence with South Branch Bear Run for approximately 200 meters of stream in 2004. Approximately 24 brook trout that were two to nine inches in length were captured. Four to five age classes were present, which indicates a naturally reproducing population. The ICCD is interested in petitioning the PFBC to study Bear Run for the possibility of increasing its designated use from CWF to a high-quality CWF or possibly a Class A Wild Brook Trout stream (Clark, 2004). The Western Pennsylvania Conservancy Watershed Assistance Center is applying for a Coldwater Heritage Conservation Plan grant for the Bear Run Watershed (Bright, 2004).

Coal mining has been the primary industry in the watershed from the 1880s to the present. Large tracts of land in the southwestern portion of the watershed have been disturbed by deep and strip mining operations. Disturbed land (abandoned coal mines, quarries, etc.) make up approximately 5.6 percent of the watershed. Forested land makes up 79 percent of the watershed, though evidence of disturbed lands can still be found with tree cover now growing over top. Agriculture and grasslands makes up 15.2 percent of the land use. The watershed is thinly populated, with a negligible percent of developed lands.

Bear Run has water quality typical of a highland infertile stream, until its confluence with South Branch Bear Run (Mayers and others, 1980). The water quality of South Branch Bear Run above Lochvale is good, before the stream enters the abandoned Johnstown Coal and Coke Complex. The first of many sources of AMD enter South Branch Bear Run from the abandoned treatment facilities of the coal operation. The stream is completely degraded after these discharges (Proch, 1982).

There are five current mining permits in the Bear Run Watershed (Table 2).

Table 2. Mining Permits in the Bear Run Watershed

Permit No.	NPDES No.	Effective Dates	Company Name	Status
32930105	PA0212652	7/1994 - 7/2009	P & N Coal Company, Inc. Urey Mine	Stage 2 Bond Release
32880107	PA0598304	5/1999 - 5/2009	Urey Coal Company Neely Strip	Stage 3 Bond Release
32851601	PA0095966	1985 - 2009	P & N Coal Company, Inc. Hillman Tipple	Active
32803053	PA0124770	11/1984 – 11/2004	A & T Coal Company Fisher Strip	Post-Mining Discharge
32860115	PA0597864	11/1987 – 11/2007	Paul F Becker Coal Comp. Buchanan Job	Post-Mining Discharge

The mine drainage treatment facilities for the active permitted areas are assigned a WLA. Discharge rate and frequency vary as a function of precipitation and runoff. The method to quantify the treatment facility discharges is explained in the "Method to Quantify Treatment Pond Pollution Load" section of this report.

It has been determined that effects from sedimentation ponds are negligible because their potential discharges are based on infrequent and temporary events and the ponds should rarely discharge if reclamation and revegetation is concurrent. In addition, sediment ponds are designed in accordance with PA Code Title 25 Chapter 87.108(h) to, at a minimum, contain runoff from a 10-year, 24-hour precipitation event.

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 nonpoint sources, as well as those where there are both point and nonpoint sources. The following defines what are considered point sources and nonpoint sources for the purposes of our evaluation; point sources are defined as permitted discharges or a discharge that has a responsible party, nonpoint sources are then any pollution sources that are not point sources. For situations where all of the impact is due to nonpoint sources, the equations shown below are applied using data for a point in the stream. The LA 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 nonpoint 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:

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

$$PR = \text{maximum } \{0, (1 - Cc/Cd)\} \text{ where} \quad (1)$$

PR = required percent reduction for the current iteration

Cc = criterion in milligrams per liter (mg/l)

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

$$Cd = \text{RiskLognorm}(\text{Mean, Standard Deviation}) \text{ where} \quad (1a)$$

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:

$$LTA = \text{Mean} * (1 - PR99) \text{ where} \quad (2)$$

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.

For pH TMDLs, acidity is compared to alkalinity. 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 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.

ACCOUNTING FOR UPSTREAM REDUCTIONS IN AMD TMDLS

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.

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 are 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 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 instream 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, it is used along with the Best Available Technology (BAT) limits to quantify the WLA for one or more of the following: iron and manganese. The limits for aluminum are based on a 2.0 mg/l concentration and the average flow value. The following formula is used:

Flow (MGD) X BAT limit (mg/l) X 8.34 = lbs/day

The following is an approach that can be used to determine a WLA 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 WLA 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, ttp://www.dep.state.pa.us/dep/subject/hotopics/drought/PrecipNorm.htm). A maximum pit dimension without special permit approval is 1,500 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 1,500'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 also can 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. The PADEP 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. PADEP 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 instream 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 1,500'x300'/pit x 7.48 gal/ft^3 x 1yr/365days x 1day/24hr x 1hr/60 min x 15 in. runoff/100 in. precip =

= 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 WLA:
30.9 gal/min x 3 mg/l x 0.01202 = 1.1 lbs/day

Allowable Manganese WLA:
30.9 gal/min x 2 mg/l x 0.01202 = 0.7 lbs/day

Allowable Aluminum WLA:
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 (MOS) in the methodology. County specific precipitation rates can be used in place of the long-term state average rate, although the MOS 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 PADEP'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, 1,500 ft x 300 ft 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 WLA is very generous and likely high compared to actual conditions that are generally encountered. A large MOS 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 instream 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 is 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 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 of the nature of the pollution sources in the watershed, the TMDLs component makeup will be LAs that are specified above a point in the stream segment. All allocations will be specified as LTA daily concentrations. These LTA daily concentrations are expected to meet water quality criteria 99 percent of the time. Pennsylvania Title 25 Chapter 96.3(c) specifies that the water quality standards must be met 99 percent of the time. The iron TMDLs are expressed as total recoverable as the iron data used for this analysis was reported as total recoverable. Table 3 shows the water quality criteria for the selected parameters.

Table 3. Applicable Water Quality Criteria

Parameter	Criterion Value (mg/l)	Total Recoverable/Dissolved
Aluminum (Al)	0.75	Total Recoverable
Iron (Fe)	1.50 0.3	30-Day Average Total Recoverable Dissolved
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. These values are typically as low as 5.4 (Pennsylvania Fish and Boat Commission).

TMDL ELEMENTS (WLA, LA, MOS)

A TMDL equation consists of a WLA, LA, and a MOS. The WLA is the portion of the load assigned to point sources. The LA is the portion of the load assigned to nonpoint sources. The MOS is applied to account for uncertainties in the computational process. The MOS may be expressed implicitly (documenting conservative processes in the computations) or explicitly (setting aside a portion of the allowable load).

TMDL ALLOCATIONS SUMMARY

Methodology for dealing with metal and pH impairments is discussed in Attachment C. Information for the TMDL analysis using the methodology described above is contained in the “TMDLs by Segment” section in Attachment D.

This TMDL will focus remediation efforts on the identified numerical reduction targets for each watershed. As changes occur in the watershed, the TMDL may be reevaluated to reflect current conditions. Table 4 presents the estimated reductions identified for all points in the watershed. Attachment D gives detailed TMDLs by segment analysis for each allocation point.

WLAs are being assigned to the permitted operations (A & T Coal Company Fisher Site; ATFS, Paul F. Becker Coal Company Buchanan Job; BCBJ, and P & N Coal Company Hillman Tipple; PNHT) and a future mining operation for iron, manganese, and aluminum. Acidity is narratively addressed to be exceeded by the alkalinity at all times, because a numeric standard was not included in the permit, no WLA is assigned for this parameter. All WLAs were calculated using the methodology explained previously in the “Method to Quantify Treatment Pond Pollutant Load” section of the report. The future WLA is calculated using the pit area method to calculate flow and is assigned to the mouth of Bear Run; BEAR1.0. The ATFS and BCBJ WLAs are calculated with the measured discharge average flow and are assigned to SBBR6.0. The PNHT WLAs are calculated with the average discharge rate in the permit and are assigned to BEAR3.0.

Table 4. Summary Table–Bear 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 %
BEAR3.0	*Bear Run Headwaters*						
	Fe	2.9	2.0	0.03	1.97	0.93	32
	Mn	1.6	1.6	0.02	1.58	0.02	1
	Al	ND	*	0.02	*	*	*
	Acidity	282.2	31.1	*	31.1	251.1	89
BEAR2.0	*Bear Run above South Branch Bear Run confluence*						
	Fe	ND	*	*	*	*	*
	Mn	28.8	5.4	*	5.4	23.4	81
	Al	ND	*	*	*	*	*
	Acidity	497.5	119.3	*	119.3	127.1	52
SBBR6.0	*South Brach Bear Run after abandoned Johnstown Coal and Coke site*						
	Fe	50.2	20.1	3.4	16.7	33.5	68
	Mn	21.6	13.9	2.3	11.6	7.4	39
	Al	31.2	9.6	2.6	7.0	24.2	78
	Acidity	794.8	79.4	*	79.4	715.4	90
SBBR5.0	*South Branch Bear Run after abandoned drift discharge*						
	Fe	118.1	20.0	*	20.0	68.0	77
	Mn	45.8	14.5	*	14.5	23.6	62
	Al	46.2	12.6	*	12.6	12.0	51
	Acidity	1,362.0	0.0	*	0.0	646.6	100
SBBR4.0	*South Branch Bear Run before UNTs 27045 and 27046 to South Branch Bear Run*						
	Fe	158.1	23.7	*	23.7	36.3	61
	Mn	65.7	16.6	*	16.6	17.8	52
	Al	51.8	13.5	*	13.5	4.7	26
	Acidity	1,661.5	149.7	*	149.7	149.8	50
SBBR3.0	*South Brach Bear Run before UNT 27042 to South Branch Bear Run at Keal Run*						
	Fe	198.0	27.9	*	27.9	35.7	56
	Mn	101.2	19.2	*	19.2	32.9	63
	Al	73.3	17.0	*	17.0	18.0	51
	Acidity	2,125.5	148.7	*	148.7	465.0	76
SBTR2.0	*UNT 27042 to South Branch Bear Run*						
	Fe	ND	*	*	*	*	*
	Mn	2.1	2.1	*	2.1	0.0	0
	Al	ND	*	*	*	*	*
	Acidity	206.4	35.1	*	35.1	171.3	83
SBBR2.0	*South Branch Bear Run above UNT 27039 to South Branch Bear Run*						
	Fe	222.6	42.1	*	42.1	10.4	20
	Mn	152.4	32.3	*	32.3	38.1	54
	Al	96.2	28.1	*	28.1	11.8	30
	Acidity	2,937.4	205.8	*	205.8	583.5	74
SBTR1.0	*UNT 27039 to South Branch Bear Run*						
	Fe	11.2	8.4	*	8.4	2.8	25
	Mn	15.9	6.1	*	6.1	9.8	62
	Al	36.6	3.7	*	3.7	32.9	90
	Acidity	561.0	3.9	*	3.9	557.1	99
SBBR1.0	*South Branch Bear Run at mouth*						
	Fe	224.2	36.0	*	36.0	12.5	26
	Mn	161.9	36.0	*	36.0	0.9	2
	Al	135.7	27.0	*	27.0	7.7	22
	Acidity	3,666.4	256.4	*	256.4	121.3	32
BRTR2.0	*UNT 27036 to Bear Run*						
	Fe	ND	*	*	*	*	*
	Mn	1.3	1.3	*	1.3	0.0	0
	Al	ND	*	*	*	*	*

Station	Parameter	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	Load Reduction (lbs/day)	Percent Reduction %
	Acidity	3.2	3.2	*	3.2	0.0	0
BRTR1.0	*UNT 27033 to Bear Run*						
	Fe	ND	*	*	*	*	*
	Mn	ND	*	*	*	*	*
	Al	ND	*	*	*	*	*
	Acidity	0.0	*	*	*	*	*
BEAR1.0	*Bear Run at mouth*						
	Fe	244.2	64.0	1.1	62.9	0.0	0
	Mn	209.0	56.2	0.7	55.5	4.2	7
	Al	141.1	48.3	0.7	47.6	0.0	0
	Acidity	5,677.4	510.7	*	510.7	1,378.5	73

ND = Non Detect; * = Not Applicable

No required reduction of these permits is necessary at this time because there are nonpoint contributions upstream and downstream of discharges that when reduced will satisfy the TMDL. All necessary reductions are assigned to the nonpoint sources. Table 5 contains the WLAs for the permitted operations.

Table 5. Waste load Allocation of Permitted Operations

Parameter	Allowable Average Monthly Conc. (mg/l)	Average Flow (MGD)	Allowable Load (lbs/day)
FUTURE			
Fe	3.0	0.0446	1.1
Mn	2.0	0.0446	0.7
Al	2.0	0.0446	0.7
BCBJ			
Fe	3.0	0.0411	1.0
Mn	2.0	0.0411	0.7
Al	3.0	0.0411	1.0
ATFS			
Fe	3.0	0.0964	2.4
Mn	2.0	0.0964	1.6
Al	2.0	0.0964	1.6
PNHT			
Fe	3.0	0.0011	0.03
Mn	2.0	0.0011	0.02
Al	2.0	0.0011	0.02

In the instance that the allowable load is equal to the measured load and the simulation determines that water quality standards are being met instream 99 percent of the time, 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. In addition, when all measured values are below the method detection limit, denoted by ND, no TMDL is necessary. In this case the accounting for upstream loads is not carried through to the next downstream point. Rather, there is a disconnect noted and the allowable load is considered to start over because the water quality standard is satisfied.

RECOMMENDATIONS

Two primary programs in Pennsylvania that provide reasonable assurance for maintenance and improvements of water quality in the watershed are in effect. The PADEP'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 PADEP's Bureau of Abandoned Mine Reclamation (BAMR) (which administers and oversees the Abandoned Mine Reclamation Program in Pennsylvania), the U. S. Office of Surface Mining, the National Mine Land Reclamation Center, the National Environmental Training Laboratory, and many other agencies and individuals. Funding from USEPA's 319 Grant program and Pennsylvania's Growing Greener program has been used extensively to remedy mine drainage impacts. These activities are expected to continue and result in water quality improvement.

The PADEP BAMR administers an environmental regulatory program for all mining activities, including mine subsidence regulation, mine subsidence insurance, and coal refuse disposal. PADEP BAMR also conducts a program to ensure safe underground bituminous mining and protect certain structures from subsidence; administers a mining license and permit program; administers a regulatory program for the use, storage, and handling of explosives; and provides for training, examination, and certification of applicant's blaster's licenses. In addition, PADEP BAMR administers a loan program for bonding anthracite underground mines and for mine subsidence, administers the USEPA Watershed Assessment Grant Program, the Small Operator's Assistance Program (SOAP), and the Remining Operator's Assistance Program (ROAP).

Reclaim PA is PADEP's initiative designed to maximize reclamation of the state's quarter million acres of abandoned mineral extraction lands. Abandoned mineral extraction lands in Pennsylvania constitute a significant public liability—more than 250,000 acres of abandoned surface mines, 2,400 miles of stream polluted with AMD, 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.

Since the 1960s, Pennsylvania has been a national leader in establishing laws and regulations to ensure mine reclamation and well plugging after operations cease. 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 PADEP's Brownfields Program. Pennsylvania is striving for complete reclamation of its abandoned mines and plugging of its orphan wells. Realizing this task is no small order, PADEP has developed Reclaim PA, a collection of concepts to make abandoned mine reclamation easier. These concepts include legislative, policy, and land management initiatives designed to enhance mine operator/volunteer/PADEP 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.

The ICCD received a Growing Greener Grant in 2002 to write a preliminary restoration plan for the Bear Run Watershed. The field work for the plan began in fall 2002, and the final report will be completed by early 2005. Preliminary results suggest that South Branch Bear Run and Bear Run can be restored by treating the major AMD discharges that enter South Branch Bear Run in the area of Lochvale. Six discharges occur on private lands that were formerly the Johnstown Coal and Coke complex. The property contains the abandoned treatment ponds of the Johnstown Coal and Coke operation and other acreage suitable for construction of AMD treatment systems. The landowner has expressed interest in selling the property to the ICCD or other interested parties. Four other major discharges occur on Pennsylvania Game Commission property in State Game Lands 174. The Pennsylvania Game Commission has been a willing participant in restoration projects in other watersheds, and it is likely they would cooperate in restoration activities for Bear Run. The discharges are relatively low in metals but high in acidity; allowing them to be treated by anoxic or oxic limestone drains and wetlands to precipitate the metals. Land reclamation of abandoned refuse piles is also a likely activity in the Bear Run Watershed since the opening of the Seward co-generation plant in Indiana County (Clark, 2004).

The ICCD electroshocked Bear Run above the confluence with South Branch Bear Run for approximately 200 meters of stream in 2004. Approximately 24 brook trout that were two to nine inches in length were captured. Four to five age classes were present, which indicates a naturally reproducing population. The ICCD is interested in petitioning the PFBC to study Bear Run for the possibility of increasing its designated use from CWF to a high-quality CWF or possibly a Class A Wild Brook Trout stream (Clark, 2004). The Western Pennsylvania Conservancy Watershed Assistance Center is applying for a Coldwater Heritage Conservation Plan grant for the Bear Run Watershed (Bright, 2004).

PUBLIC PARTICIPATION

Public notice of the draft TMDL was published in the *Pennsylvania Bulletin* on January 8, 2005, and the Punxsutawney Spirit on February 5, 2005, to foster public comment on the allowable loads calculated. A public meeting was held on February 7, 2005, at the Banks Township Municipal Building, Rossiter, PA, to discuss the proposed TMDL.

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Pennsylvania Fish and Boat Commission. 1931. Stream Survey Report: Bear Run. Commonwealth of Pennsylvania, Board of Fish Commissioners.

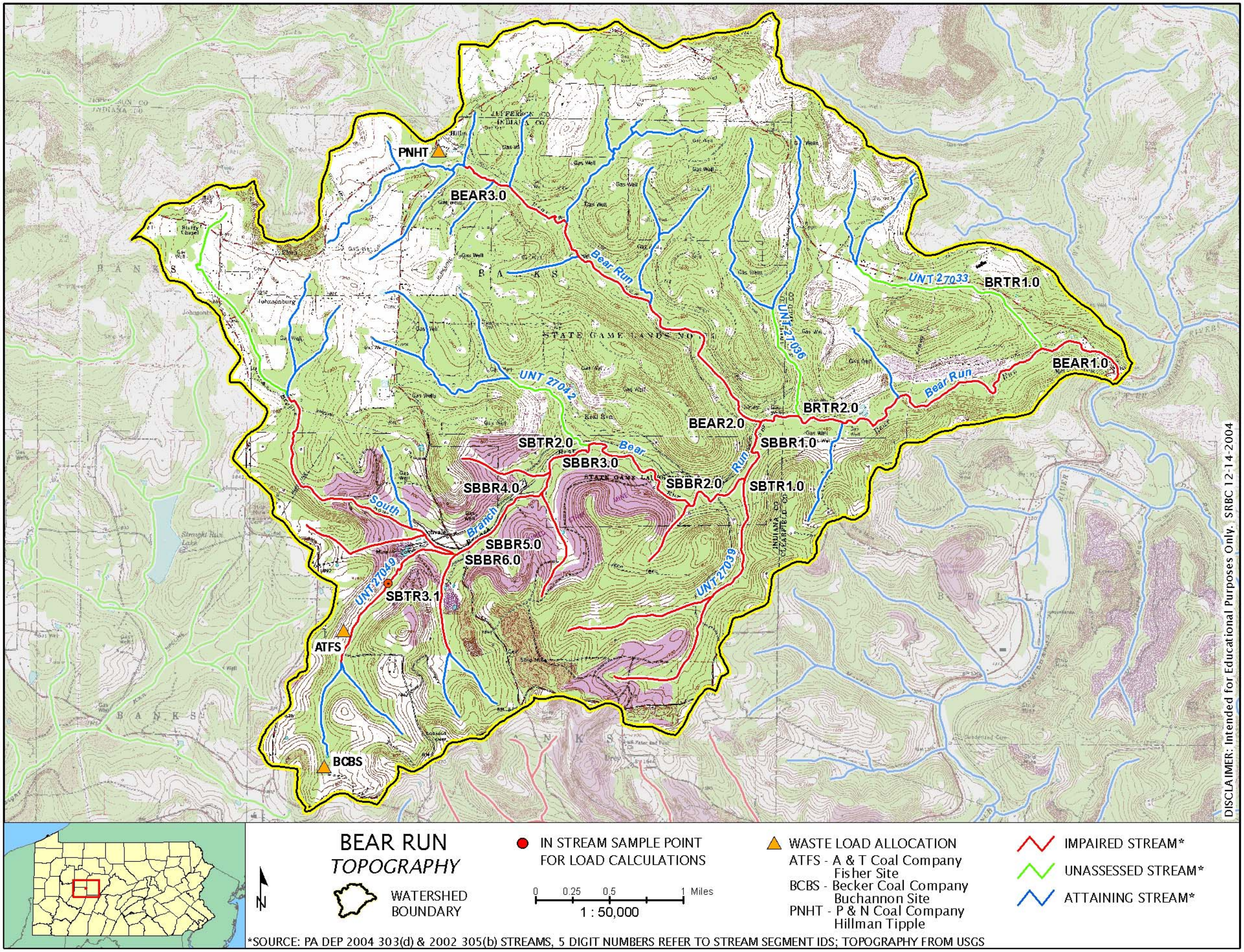
Proch, Tom. 1982. Water Quality of South Branch Bear Run, Johnstown Coal and Coke, Indiana County. Letter to Hugh Archer, Pa. DER, Southwest Regional Office, Planning Section.

U. S. Department of Agriculture. 2004. National Resources Conservation Service: Official Soil Series Descriptions. http://soils.usda.gov/technical/classification/osd/index.html

Watershed Restoration Action Strategy (Draft). 2001. State Water Plan 08B: Chest Creek and Anderson Creek Watersheds (West Branch Susquehanna River), Clearfield and Cambria Counties.

Attachment A

Bear Run Watershed Map



PNHT
BEAR3.0
Bear Run
UNT 27033
BRTR1.0
UNT 27036
BEAR1.0
Bear Run
UNT 27042
BRTR2.0
BEAR2.0
SBBR1.0
SBTR2.0
Bear
SBBR3.0
Run
SBBR4.0
SBBR2.0
SBTR1.0
South
Branch
SBBR5.0
SBBR6.0
UNT 27049
UNT 27039
SBTR3.1
ATFS
BCBS
STATE GAME LANDS NO
DISCLAIMER: Intended for Educational Purposes Only. SRBC 12-14-2004
BEAR RUN
TOPOGRAPHY
WATERSHED BOUNDARY
IN STREAM SAMPLE POINT FOR LOAD CALCULATIONS
0 0.25 0.5 1 Miles
1 : 50,000
WASTE LOAD ALLOCATION
ATFS - A & T Coal Company Fisher Site
BCBS - Becker Coal Company Buchannon Site
PNHT - P & N Coal Company Hillman Tipple
IMPAIRED STREAM*
UNASSESSED STREAM*
ATTAINING STREAM*
*SOURCE: PA DEP 2004 303(d) & 2002 305(b) STREAMS, 5 DIGIT NUMBERS REFER TO STREAM SEGMENT IDS; TOPOGRAPHY FROM USGS

Attachment B

Excerpts Justifying Changes Between the 1996, 1998, Draft 2000, and 2002 Section 303(d) Lists and the Draft 2004 Integrated List

The following are excerpts from the Pennsylvania DEP 303(d) narratives that justify changes in listings between the 1996, 1998, draft 2000, 2002, and 2004 lists. The 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 USEPA 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).

The most notable difference between the 1998 and Draft 2000 Section 303(d) lists are the listing of unnamed tributaries in 2000. In 1998, the GIS stream layer was coded to the named stream level so there was no way to identify the unnamed tributary records. As a result, the unnamed tributaries were listed as part of the first downstream named stream. The GIS stream coverage used to generate the 2000 list had the unnamed tributaries coded with the PADEP's five-digit stream code. As a result, the unnamed tributary records are now split out as separate records on the 2000 Section 303(d) list. This is the reason for the change in the appearance of the list and the noticeable increase in the number of pages. After due consideration of comments from USEPA and PADEP on the Draft 2000 Section 303(d) list, the 2002 Pa. Section 303(d) list was written in a manner similar to the 1998 Section 303(d) list.

In 2004, Pennsylvania developed the Draft Integrated List of All Waters. The water quality status of Pennsylvania's waters is summarized using a five-part categorization of waters according to their water quality standard (WQS) attainment status. The categories represent varying levels of WQS attainment, ranging from Category 1, where all designated water uses are met, to Category 5, where impairment by pollutants requires a TMDL to correct. These category determinations are based on consideration of data and information consistent with the methods outlined by the Statewide Surface Water Assessment Program. Each PADEP five-digit waterbody segment is placed in one of the WQS attainment categories. Different segments of the same stream may appear on more than one list if the attainment status changes as the water flows downstream. The listing categories are as follows:

Category 1: Waters attaining all designated uses.

Category 2: Waters where some, but not all, designated uses are met. Attainment status of the remaining designated uses is unknown because data are insufficient to categorize a water consistent with the state's listing methodology.

Category 3: Waters for which there are insufficient or no data and information to determine, consistent with the state's listing methodology, if designated uses are met.

Category 4: Waters impaired for one or more designated use but not needing a TMDL. States may place these waters in one of the following three subcategories:

- TMDL has been completed.
- Expected to meet all designated uses within a reasonable timeframe.
- Not impaired by a pollutant.

Category 5: Waters impaired for one or more designated uses by any pollutant. Category 5 includes waters shown to be impaired as the result of biological assessments used to evaluate aquatic life use even if the specific pollutant is not known unless the state can demonstrate that nonpollutant stressors cause the impairment or that no pollutant(s) causes or contribute to the impairment. Category 5 constitutes the Section 303(d) list that USEPA will approve or disapprove under the Clean Water Act. Where more than one pollutant is causing the impairment, the water remains in Category 5 until all pollutants are addressed in a completed USEPA-approved TMDL or one of the delisting factors is satisfied.

Attachment C

Method for Addressing 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 Pa. 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 USEPA's acceptable range of six to nine and meets Pennsylvania water quality criteria in Pa. Code, 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 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 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. 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 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 meet a minimum net alkalinity of zero.

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.*

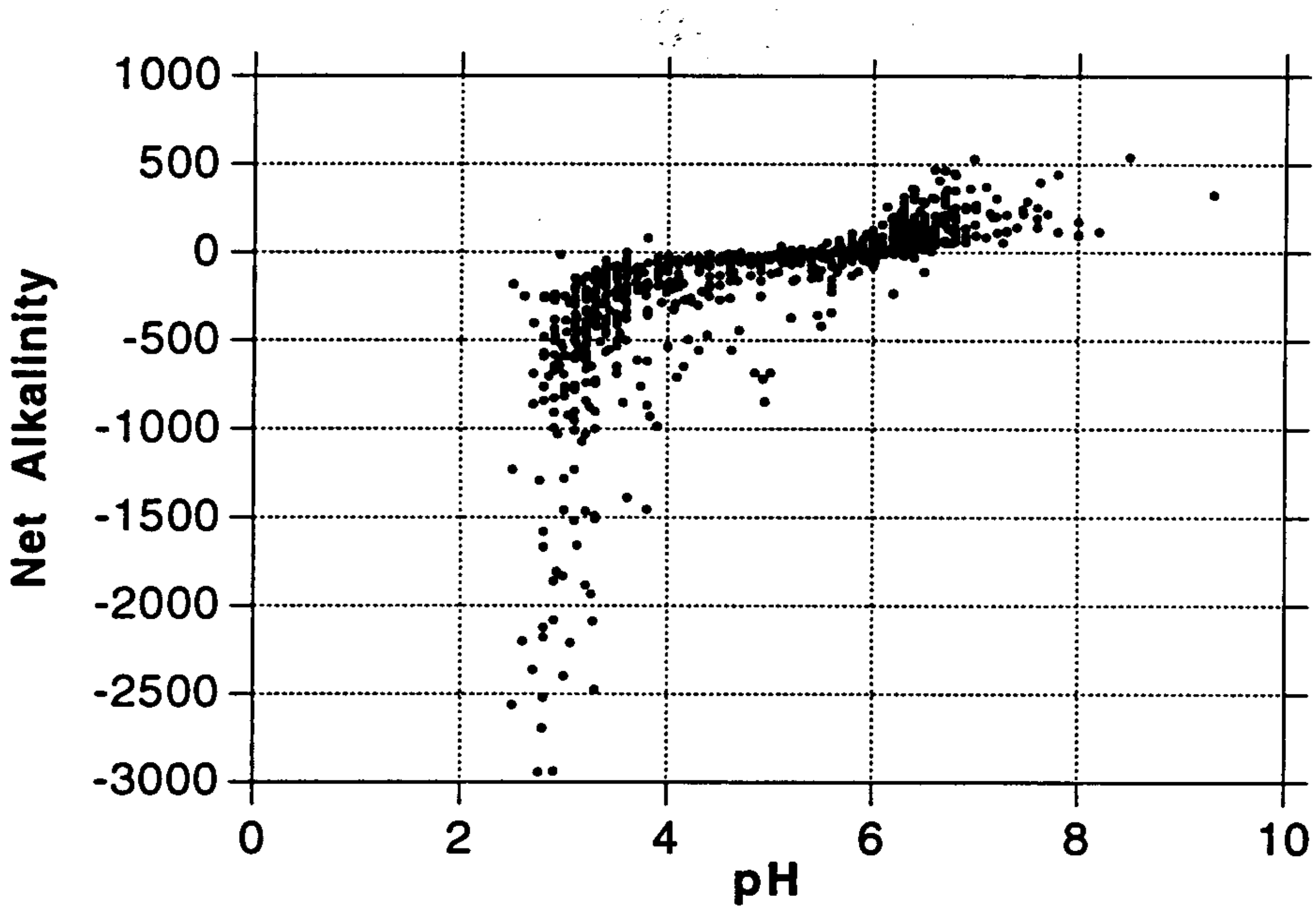


Figure 1. Net Alkalinity vs. pH. Taken from Figure 1.2 Graph C, pages 1-5, of Coal Mine Drainage Prediction and Pollution Prevention in Pennsylvania.

Attachment D

TMDLs By Segment

Bear Run

The Total Maximum Daily Load (TMDL) for the Bear Run Watershed consists of load allocations to six tributaries, including South Branch Bear Run, three unnamed tributaries to South Branch Bear Run, and two unnamed tributaries to Bear Run, and three sampling sites along the stream. WLAs (WLAs) are assigned to three mining operations in the watershed that still have liability for discharge treatment sites and for a future mining operation.

The Bear Run Watershed is listed as impaired on the Section 303(d) list by both high metals and low pH from abandoned mine drainage (AMD) as 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 C.

An allowable long-term average instream concentration for iron, manganese, aluminum, and acidity was determined at each sample point. The analysis is designed to produce a long-term average value that, when met, will be protective of the water quality criterion for that parameter 99 percent 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 percent of the time. The simulation was run assuming the data set was lognormally distributed. Using the mean and the standard deviation of the data set, 5,000 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 percent of the time. The mean value from this data set represents that long-term daily average concentration that needs to be met to achieve water quality standards.

PNHT: P & N Coal Company, Inc. Hillman Tipple

The P & N Coal Company, Inc., MP#3285160l; PA0095966 operates a coal processing area and tipple site along the western bank of the headwaters of Bear Run. Treatment ponds on the Hillman Tipple site flow only in response to precipitation events by capturing and treating surface runoff from the site. Any discharge from the operations treatment pond is treated to the Best Available Technology (BAT) limits, assigned in the mining permit, before entering Bear Run.

PNHT is considered to be a point source discharge in the watershed; therefore, the allocation made at this point is a WLA. The WLAs for iron and manganese were calculated using the methodology explained in the “Method to Quantify Treatment Pond Pollutant Load” section of this report. The P & N processing site does not have a BAT limit for aluminum; therefore, a WLA based on the standard 2.0 mg/L was assigned for this site. Table D1 shows the WLAs for the discharge.

Table D1. Waste load Allocations at PNHT			
Parameter	***Monthly Avg. Allowable Conc. (mg/l)***	***Average Flow (MGD)***	***Allowable Load (lbs/day)***
PNHT			
Fe	3.0	0.0011	0.03
Mn	2.0	0.0011	0.02
Al	2.0	0.0011	0.02

BEAR3.0: Bear Run Headwaters

The headwaters of Bear Run begin in Banks Township, Indiana County, near the village of Hillman. The stream soon flows into State Game Lands 174. Allocation point BEAR3.0 represents the stream after the P & N Coal Hillman Tipple that occasionally discharges into the stream.

There were fewer total aluminum data above the detection limit than necessary for this allocation point to conduct Monte Carlo analysis; therefore, this parameter was not evaluated for this TMDL. However, the observations for total aluminum shown in Attachment E, indicate that the stream is meeting water quality standards for aluminum at this site.

The TMDL for this section of Bear Run consists of a load allocation to the watershed area above BEAR3.0. Addressing the mining impacts above this point addresses the impairment for the stream segment. An average instream flow measurement was available for point BEAR3.0 (0.98 mgd). The load allocations made at point BEAR3.0 for this stream segment are presented in Table D2.

Table D2. TMDL Calculations at Point BEAR3.0				
Flow = 0.98 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	0.35	2.9	0.25	2.0
Mn	0.19	1.6	0.19	1.6
Al	ND	*	*	*
Acidity	34.53	282.2	3.80	31.1
Alkalinity	11.27	92.1		

Table D3. Calculation of Load Reduction Necessary at Point BEAR3.0				
	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load	2.9	1.6	ND	282.2
Existing load from upstream points (none)	0.0	0.0	0.0	0.0
Difference of existing load and upstream existing load	2.9	1.6	*	282.2
Allowable loads from upstream points	*	*	*	*
Total load at BEAR3.0	2.9	1.6	*	282.2
Allowable load at BEAR3.0	2.0	1.6	*	31.1
Waste load allocation (PNHT)	0.03	0.02	0.02	*
Remaining load at BEAR3.0	1.97	1.58	*	31.1
Load Reduction at BEAR3.0 (Total load at BEAR3.0 - Remaining load at BEAR3.0)	0.93	0.02	*	251.1
Percent reduction required at BEAR3.0	32	1	*	89

The TMDL for point BEAR3.0 requires a load allocation for total iron, total manganese, and acidity. There is no load reduction for total aluminum because the data set, found in Attachment E, shows that the average concentrations for these parameters are below detection limits and thus are meeting water quality standards.

BEAR2.0: Bear Run above confluence of South Branch Bear Run

Bear Run at point BEAR2.0 represents the stream before the confluence of South Branch Bear Run. This area of the watershed has been deep mined in the late 1880s; however, there are no records as to the extent or location of the mining activities.

There were fewer total iron and total aluminum data above the detection limit than necessary for this allocation point to conduct Monte Carlo analysis; therefore, these parameters were not evaluated for this TMDL. However, the observations for total iron and total aluminum, shown in Attachment E, indicate that the stream is meeting water quality standards for iron and aluminum at this site.

The TMDL for this section of Bear Run consists of a load allocation to the watershed area between BEAR3.0 and BEAR2.0. Addressing the mining impacts between these points addresses the impairment for the stream segment. An average instream flow measurement was available for point BEAR2.0 (4.66 mgd). The load allocations made at point BEAR2.0 for this stream segment are presented in Table D4.

Table D4. TMDL Calculations at Point BEAR2.0				
Flow = 4.66 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	ND	*	*	*
Mn	0.74	28.8	0.14	5.4
Al	ND	*	*	*
Acidity	12.80	497.5	3.07	119.3
Alkalinity	9.07	352.5		

The calculated load reductions for all the loads that enter point BEAR2.0 must be accounted for in the calculated reductions at sample point BEAR2.0, shown in Table D5. A comparison of measured loads between points BEAR3.0 and BEAR2.0 show that there is additional loading entering the segment for total manganese and acidity.

Table D5. Calculation of Load Reduction Necessary at Point BEAR2.0				
	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load	ND	28.8	ND	497.5
Existing load from upstream points (BEAR3.0)	2.9	1.6	*	282.2
Difference of existing load and upstream existing load	*	27.2	*	215.3
Allowable loads from upstream points	2.0	1.6	*	31.1
Total load at BEAR2.0	*	28.8	*	246.4
Allowable load at BEAR2.0	*	5.4	*	119.3
Waste load allocation	*	*	*	*
Remaining load at BEAR2.0	*	5.4	*	119.3
Load Reduction at BEAR2.0 (Total load at BEAR2.0 - Remaining load at BEAR2.0)	*	23.4	*	127.1
Percent reduction required at BEAR2.0	*	81	*	52

The TMDL for point BEAR2.0 requires a load allocation for total manganese and acidity. There is no load reduction for total iron and total aluminum because the data set, found in Attachment E, shows that the average concentrations for these parameters are below detection limits and thus are meeting water quality standards.

BCBJ: Paul F. Becker Coal Company Buchanan Job

The Paul F. Becker Coal Company operated a surface mine in the headwaters of the UNT 27049 to South Branch Bear Run. The Buchanan Job, MP# 32860115; PA0597864, operated from 1987 to 1992. The mine site was completely backfilled and revegetated by 1992; however, the mined area was in the recharge zone of three preexisting deep mine discharges. The company placed a limestone channel to treat the discharges and bonds remain intact for that treatment system. Any discharge from the operations treatment system is treated to the BAT limits, assigned in the mining permit, before entering the UNT 27049 to South Branch Bear Run.

BCBJ is considered to be a point source discharge in the watershed because the Paul F. Becker Coal Company still holds liability for the treatment of the discharges; therefore, the allocation made at this point is a WLA. The WLAs for iron, manganese, and aluminum were calculated using the methodology explained in the "Method to Quantify Treatment Pond Pollutant Load" section of this report. The permit for the Buchanan Job contains a BAT limit of 3.0 mg/L for aluminum; a WLA corresponding to this limit has been assigned for the site. The average flow in the treatment system is the sum of the average flows of the deep mine discharges. Table D6 shows the WLAs for the treatment system.

Table D6. Waste load Allocations at BCBJ			
Parameter	***Monthly Avg. Allowable Conc. (mg/l)***	***Average Flow (MGD)***	***Allowable Load (lbs/day)***
BCBJ			
Fe	3.0	0.0411	1.0
Mn	2.0	0.0411	0.7
Al	3.0	0.0411	1.0

ATFS: A & T Coal Company Fisher Strip

The A & T Coal Company operated a surface mine along the western bank of the UNT 27049 to South Branch Bear Run. The Fisher Strip, MP# 32803053; PA0124770, was active from 1984 to 1994. The mine site was completely backfilled and revegetated by 1994; however, a post-mining discharge occurred from A & T Coal Company's operation. All bonds remain intact on the permit and the discharge is being treated to effluent standards. Any discharge from the operations treatment pond is treated to the BAT limits, assigned in the mining permit, before entering the UNT # South Branch Bear Run.

ATFS is considered to be a point source discharge in the watershed because the A & T Coal Company still holds liability for treating the post-mining discharge; therefore, the allocation made at this point is a WLA. The WLAs for iron and manganese were calculated using the methodology explained in the "Method to Quantify Treatment Pond Pollutant Load" section of this report. The flow used in the calculations of the WLA is the average flow from data collected in the field by the PADEP mining inspector. The permit does not have a BAT limit for aluminum; therefore, a WLA based on the standard 2.0 mg/L was assigned for this site. Table D7 shows the WLAs for the discharge.

Table D7. Waste load Allocations at ATFS			
Parameter	***Monthly Avg. Allowable Conc. (mg/l)***	***Average Flow (MGD)***	***Allowable Load (lbs/day)***
ATFS			
Fe	3.0	0.0964	2.4
Mn	2.0	0.0964	1.6
Al	2.0	0.0964	1.6

SBTR3.1: Unnamed Tributary (UNT) 27049 to South Branch Bear Run

The UNT 27049 to South Branch Bear Run at point SBTR3.1 is an unnamed tributary that enters South Branch Bear Run near the ghost town of Lochvale. TMDLs are not necessary at SBTR3.1 because water quality standards are being met for iron, aluminum, manganese, and acidity (Attachment E).

SBBR6.0: South Branch Bear Run after Lochvale AMD additions

South Branch Bear Run from its origin to Lochvale maintains good water quality until it enters the abandoned Johnstown Coal and Coke complex. In the area above Lochvale, six alkaline discharges that are high in metals enter the stream. The stream maintains acceptable pH levels but the substrate becomes covered in iron precipitate when the AMD mixes with the stream.

The TMDL for South Branch Bear Run consists of a load allocation to all of the watershed area above point SBBR6.0. Addressing the mining impacts above this point addresses the impairment for the segment. An instream flow measurement was available for point SBBR6.0 (3.40 mgd). The load allocations made at point SBBR6.0 for this stream segment are presented in Table D8.

Table D8. TMDL Calculations at Point SBBR6.0

Flow = 3.40 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	1.77	50.2	0.71	20.1
Mn	0.76	21.6	0.49	13.9
Al	1.10	31.2	0.34	9.6
Acidity	28.03	794.8	2.80	79.4
Alkalinity	12.83	363.8		

The calculated load reductions for all the loads that enter point SBBR6.0 must be accounted for in the calculated reductions at sample point SBBR6.0, shown in Table D9. A comparison of measured loads between points SBBR6.0 and SBTR3.0 show that there is additional loading entering the segment of all parameters.

Table D9. Calculation of Load Reduction Necessary at Point SBBR6.0				
	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load	50.2	21.6	31.2	794.8
Existing load from upstream points	*	*	*	*
Difference of existing load and upstream existing load	50.2	21.6	31.2	794.8
Allowable loads from upstream points	*	*	*	*
Total load at SBBR6.0	50.2	19.0	31.2	794.8
Allowable load at SBBR6.0	20.1	13.9	9.6	79.4
Waste load allocation	3.4	2.3	2.6	*
Remaining load at SBBR6.0	16.7	11.6	7.0	79.4
Load Reduction at SBBR6.0 (Total load at SBBR6.0 - Remaining load at SBBR6.0)	33.5	7.4	24.2	678.2
Percent reduction required at SBBR6.0	68	39	78	90

The TMDL for point SBBR6.0 requires that a load reduction be applied to all areas of South Branch Bear Run above SBBR6.0 for total iron, total manganese, total aluminum, and acidity.

SBBR5.0: South Branch Bear Run after the drift discharge

South Branch Bear Run at point SBBR5.0 represents the stream after two additional AMD discharges have entered. SBBR5.0 is approximately one-quarter of a mile downstream from SBBR6.0.

The TMDL for South Branch Bear Run at SBBR5.0 consists of a load allocation to all of the watershed area between points SBBR6.0 and SBBR5.0. Addressing the mining impacts between these points addresses the impairment for the segment. An average instream flow measurement was available for point SBBR5.0 (3.87 mgd). The load allocations made at point SBBR5.0 for this stream segment are presented in Table D10.

Table D10. TMDL Calculations at Point SBBR5.0				
Flow = 3.87 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	3.66	118.1	0.62	20.0
Mn	1.42	45.8	0.45	14.5
Al	1.43	46.2	0.39	12.6
Acidity	42.20	1,362.0	5.91	0.0
Alkalinity	9.57	308.9		

The calculated load reductions for all the loads that enter point SBBR5.0 must be accounted for in the calculated reductions at sample point SBBR5.0, shown in Table D11. A comparison of measured loads between points SBBR6.0 and SBBR5.0 show that there is additional loading entering the segment of all parameters.

Table D11. Calculation of Load Reduction Necessary at Point SBBR5.0				
	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load	118.1	45.8	46.2	1,362.0
Existing load from upstream points (SBBR6.0)	50.2	21.6	31.2	794.8
Difference of existing load and upstream existing load	67.9	24.2	15.0	567.2
Allowable loads from upstream points	20.1	13.9	9.6	79.4
Total load at SBBR5.0	88.0	38.1	24.6	646.6
Allowable load at SBBR5.0	20.0	14.5	12.6	0.0
Waste load allocation	*	*	*	*
Remaining load at SBBR5.0	20.0	14.5	12.6	0.0
Load Reduction at SBBR5.0 (Total load at SBBR5.0 - Remaining load at SBBR5.0)	68.0	23.6	12.0	646.6
Percent reduction required at SBBR5.0	77	62	51	100

The TMDL for South Branch Bear Run at SBBR5.0 requires a load reduction for total iron, total manganese, total aluminum, and acidity.

SBBR4.0: South Branch Bear Run above the UNTs 27045 and 27046

South Branch Bear Run at site SBBR4.0 represents the stream before the addition of UNTs 27045 and 27046 to South Branch Bear Run. Both of the UNTs are impaired by AMD. Several small seeps and discharges enter South Branch Bear Run between SBBR5.0 and SBBR4.0.

The TMDL for South Branch Bear Run at point SBBR4.0 consists of a load allocation to all of the watershed area between points SBBR4.0 and SBBR5.0. Addressing the mining impacts between these points addresses the impairment for the segment. An instream flow measurement was available for point SBBR4.0 (4.06 mgd). The load allocations made at point SBBR4.0 for this stream segment are presented in Table D12.

Table D12. TMDL Calculations at Point SBBR4.0				
Flow = 4.06 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	4.67	158.1	0.70	23.7
Mn	1.94	65.7	0.49	16.6
Al	1.53	51.8	0.40	13.5
Acidity	49.07	1,661.5	4.42	149.7
Alkalinity	7.67	259.7		

The calculated load reductions for all the loads that enter point SBBR4.0 must be accounted for in the calculated reductions at sample point SBBR4.0, shown in Table D13. A comparison of measured loads between points SBBR4.0 and SBBR5.0 show that there is additional loading entering the segment of all parameters.

Table D13. Calculation of Load Reduction Necessary at Point SBBR4.0				
	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load	158.1	65.7	51.8	1,661.5
Existing load from upstream points (SBBR5.0)	118.1	45.8	46.2	1,362.0
Difference of existing load and upstream existing load	40.0	19.9	5.6	299.5
Allowable loads from upstream points	20.0	14.5	12.6	0.0
Total load at SBBR4.0	60.0	34.4	18.2	299.5
Allowable load at SBBR4.0	23.7	16.6	13.5	149.7
Waste load allocation	*	*	*	*
Remaining load at SBBR4.0	23.7	16.6	13.5	149.7
Load Reduction at SBBR4.0 (Total load at SBBR4.0 - Remaining load at SBBR4.0)	36.3	17.8	4.7	149.8
Percent reduction required at SBBR4.0	61	52	26	50

The TMDL for South Branch Bear Run at point SBBR4.0 requires a load reduction for total iron, total manganese, total aluminum, and acidity.

SBBR3.0: South Branch Bear Run before UNT 27042 at Keal Run

South Branch Bear Run at point SBBR3.0 represents the stream before the confluence of UNT 27042 to South Branch Bear Run near the ghost town of Keal Run. Several more discharges have entered into South Branch Bear Run between SBBR4.0 and SBBR3.0.

The TMDL for South Branch Bear Run at SBBR3.0 consists of a load allocation to all of the watershed area between points SBBR4.0 and SBBR3.0. Addressing the mining impacts between these points addresses the impairment for the segment. An instream flow measurement was available for point SBBR3.0 (5.23 mgd). The load allocations made at point SBBR3.0 for this stream segment are presented in Table D14.

Table D14. TMDL Calculations at Point SBBR3.0				
Flow = 5.23 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	4.54	198.0	0.64	27.9
Mn	2.32	101.2	0.44	19.2
Al	1.68	73.3	0.39	17.0
Acidity	48.73	2,125.5	3.41	148.7
Alkalinity	6.10	266.1		

The calculated load reductions for all the loads that enter point SBBR3.0 must be accounted for in the calculated reductions at sample point SBBR3.0, shown in Table D15. A comparison of measured loads between points SBBR4.0 and SBBR3.0 show that there is additional loading entering the segment of all parameters.

Table D15. Calculation of Load Reduction Necessary at Point SBBR3.0				
	***Fe* (lbs/day)**	***Mn* (lbs/day)**	***Al* (lbs/day)**	***Acidity* (lbs/day)**
Existing load	198.0	101.2	73.3	2,125.5
Existing load from upstream points (SBBR4.0)	158.1	65.7	51.8	1,661.5
Difference of existing load and upstream existing load	39.9	35.5	21.5	464.0
Allowable loads from upstream points	23.7	16.6	13.5	149.7
Total load at SBBR3.0	63.6	52.1	35.0	613.7
Allowable load at SBBR3.0	27.9	19.2	17.0	148.7
Waste load allocation	*	*	*	*
Remaining load at SBBR3.0	27.9	19.2	17.0	148.7
Load Reduction at SBBR3.0 (Total load at SBBR3.0 - Remaining load at SBBR3.0)	35.7	32.9	18.0	465.0
Percent reduction required at SBBR3.0	56	63	51	76

The TMDL for South Branch Bear Run at point SBBR3.0 requires a load reduction for total iron, total manganese, total aluminum, and acidity.

SBTR2.0: UNT 27042 to South Branch Bear Run

The UNT 27042 to South Branch Bear Run flows through the strip mined areas that were abandoned by the Benjamin Coal Company in the 1980s. The watershed was also deep mined in the late 1800's although the extent of mining is unknown. The ghost town of Keal Run lies in the watershed of the UNT 27042 to South Branch Bear Run.

There were fewer total iron and total aluminum data above the detection limit than necessary for this allocation point to conduct Monte Carlo analysis; therefore, these parameters were not evaluated for this TMDL. However, the observations for total iron and total aluminum, shown in Attachment E, indicate that the stream is meeting water quality standards for iron and aluminum at this site.

The TMDL for the UNT 27042 to South Branch Bear Run consists of a load allocation to all of the watershed area above point SBTR2.0. Addressing the mining impacts above this point addresses the impairment for the segment. An instream flow measurement was available for point SBTR2.0 (1.07 mgd). The load allocations made at point SBTR2.0 for this stream segment are presented in Table D16.

Table D16. TMDL Calculations at Point SBTR2.0				
Flow = 1.07 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	ND	*	*	*
Mn	0.24	2.1	0.24	2.1
Al	ND	*	*	*
Acidity	23.13	206.4	3.93	35.1
Alkalinity	7.53	67.2		

Table D17. Calculation of Load Reduction Necessary at Point SBTR2.0				
	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load	ND	2.1	ND	206.4
Existing load from upstream points (none)	0.0	0.0	0.0	0.0
Difference of existing load and upstream existing load	*	2.1	*	206.4
Allowable loads from upstream points	*	*	*	*
Total load at SBTR2.0	*	2.1	*	206.4
Allowable load at SBTR2.0	*	2.1	*	35.1
Waste load allocation	*	*	*	*
Remaining load at SBTR2.0	*	2.1	*	35.1
Load Reduction at SBTR2.0 (Total load at SBTR2.0 - Remaining load at SBTR2.0)	*	0.0	*	171.3
Percent reduction required at SBTR2.0	*	0	*	83

The TMDL for the UNT 27042 to South Branch Bear Run at point SBTR2.0 requires a load reduction for acidity. A load reduction is not necessary for total manganese. Also, there is no load reduction for total iron and total aluminum because the data set, found in Attachment E, shows that the average concentrations for these parameters are below detection limits, and thus are meeting water quality standards.

SBBR2.0: South Branch Bear Run above UNT 27039 to South Branch Bear Run

South Branch Bear Run at point SBBR2.0 represents the stream before the addition of UNT 27039 to South Branch Bear Run. Several more discharges and the UNT 27041 to South Branch Bear Run have entered the stream between points SBBR3.0 and SBBR2.0.

The TMDL for South Branch Bear Run at point SBBR2.0 consists of a load allocation to all of the watershed area between points SBBR3.0 and SBBR2.0. Addressing the mining impacts between these points addresses the impairment for the segment. An instream flow measurement was available for point SBBR2.0 (8.42 mgd). The load allocations made at point SBBR2.0 for this stream segment are presented in Table D18.

Table D18. TMDL Calculations at Point SBBR2.0				
Flow = 8.42 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	3.17	222.6	0.60	42.1
Mn	2.17	152.4	0.46	32.3
Al	1.37	96.2	0.40	28.1
Acidity	41.83	2,937.4	2.93	205.8
Alkalinity	5.50	386.2		

The calculated load reductions for all the loads that enter point SBBR2.0 must be accounted for in the calculated reductions at sample point SBBR2.0, shown in Table D19. A comparison of measured loads between points SBBR2.0, SBTR2.0, and SBBR3.0 shows that there is additional loading entering the segment of all parameters.

Table D19. Calculation of Load Reduction Necessary at Point SBBR2.0				
	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load	222.6	152.4	96.2	2,937.4
Existing load from upstream points (SBBR3.0 and SBTR2.0)	198.0	103.3	73.3	2,331.9
Difference of existing load and upstream existing load	24.6	49.1	22.9	605.5
Allowable loads from upstream points	27.9	21.3	17.0	183.8
Total load at SBBR2.0	52.5	70.4	39.9	789.3
Allowable load at SBBR2.0	42.1	32.3	28.1	205.8
Waste load allocation	*	*	*	*
Remaining load at SBBR2.0	42.1	32.3	28.1	205.8
Load Reduction at SBBR2.0 (Total load at SBBR2.0 - Remaining load at SBBR2.0)	10.4	38.1	11.8	583.5
Percent reduction required at SBBR2.0	20	54	30	74

The TMDL for South Branch Bear Run at point SBBR2.0 requires a load reduction for total iron, total manganese, total aluminum, and acidity.

SBTR1.0: UNT 27039 to South Branch Bear Run

The UNT 27039 to South Branch Bear Run is highly polluted by AMD. The UNT begins in the strip mined areas north of the village of Urey. Two major discharges are in the headwaters of the stream.

The TMDL for the UNT 27039 to South Branch Bear Run consists of a load allocation to all of the watershed area above point SBTR1.0. Addressing the mining impacts above this point addresses the impairment for the segment. An instream flow measurement was available for point SBTR1.0 (1.27 mgd). The load allocations made at point SBTR1.0 for this stream segment are presented in Table D20.

Table D20. TMDL Calculations at Point SBTR1.0				
Flow = 1.27 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	1.06	11.2	0.79	8.4
Mn	1.50	15.9	0.58	6.1
Al	3.46	36.6	0.35	3.7
Acidity	52.97	561.0	0.37	3.9
Alkalinity	0.67	7.1		

Table D21. Calculation of Load Reduction Necessary at Point SBTR1.0				
	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load	11.2	15.9	36.6	561.0
Existing load from upstream points (none)	0.0	0.0	0.0	0.0
Difference of existing load and upstream existing load	11.2	15.9	36.6	561.0
Allowable loads from upstream points	*	*	*	*
Total load at SBTR1.0	11.2	15.9	36.6	561.0
Allowable load at SBTR1.0	8.4	6.1	3.7	3.9
Waste load allocation	*	*	*	*
Remaining load at SBTR1.0	8.4	6.1	3.7	3.9
Load Reduction at SBTR1.0 (Total load at SBTR1.0 - Remaining load at SBTR1.0)	2.8	9.8	32.9	557.1
Percent reduction required at SBTR1.0	25	62	90	99

The TMDL for the UNT 27039 to South Branch Bear Run at SBTR1.0 requires a load reduction for total iron, total manganese, total aluminum, and acidity.

SBBR1.0: South Branch Bear Run at the mouth

South Branch Bear Run at point SBBR1.0 represents the conditions at the mouth of the stream. There are no known discharges that enter the stream between point SBBR2.0 and SBBR1.0.

The TMDL for this section of South Branch Bear Run consists of a load allocation to all of the watershed area between points SBBR2.0 and SBBR1.0. Addressing the mining between these points addresses the impairment for the segment. An instream flow measurement was available for point SBBR1.0 (8.99 mgd). The load allocations made at point SBBR1.0 for this stream segment are presented in Table D22.

Table D22. TMDL Calculations at Point SBBR1.0				
Flow = 8.99 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	2.99	224.2	0.48	36.0
Mn	2.16	161.9	0.48	36.0
Al	1.81	135.7	0.36	27.0
Acidity	48.90	3,666.4	3.42	256.4
Alkalinity	4.80	359.9		

The calculated load reductions for all the loads that enter point SBBR1.0 must be accounted for in the calculated reductions at sample point SBBR1.0, shown in Table D23. A comparison of measured loads between points SBBR2.0, SBTR1.0, and SBBR1.0 shows that there is additional loading entering the segment for total aluminum and acidity. The loadings have decreased for total iron and total manganese.

Table D23. Calculation of Load Reduction Necessary at Point SBBR1.0				
	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load	224.2	161.9	135.7	3,666.4
Existing load from upstream points (SBBR2.0 and SBTR1.0)	233.8	168.3	132.8	3,498.4
Difference of existing load and upstream existing load	-9.6	-6.4	2.9	168.0
Allowable loads from upstream points	50.5	38.4	31.8	209.7
Percent load loss from instream processes	4	4	0	0
Percent load remaining at SBBR1.0	96	96	100	100
Total load at SBBR1.0	48.5	36.9	34.7	377.7
Allowable load at SBBR1.0	36.0	36.0	27.0	256.4
Waste load allocation	*	*	*	*
Remaining load at SBBR1.0	36.0	36.0	27.0	256.4
Load Reduction at SBBR1.0 (Total load at SBBR1.0 - Remaining load at SBBR1.0)	12.5	0.9	7.7	121.3
Percent reduction required at SBBR1.0	26	2	22	32

The TMDL for South Branch Bear Run at point SBBR1.0 requires a load reduction for total iron, total manganese, total aluminum, and acidity.

BRTR2.0: UNT 27036 to Bear Run

The UNT 27036 to Bear Run begins around the border of Indiana and Clearfield Counties. There are several gas wells in the watershed but no recent coal mining operations. AMD enters the stream near its confluence with Bear Run.

There were fewer total iron and total aluminum data above the detection limit than necessary for this allocation point to conduct Monte Carlo analysis; therefore, these parameters were not evaluated for this TMDL. However, the observations for total iron and total aluminum, shown in

Attachment E, indicate that the stream is meeting water quality standards for iron and aluminum at this site.

The TMDL for the UNT 27036 to Bear Run consists of a load allocation to all of the watershed area above point BRTR2.0. Addressing the mining impacts above this point addresses the impairment for the segment. An instream flow measurement was available for point BRTR2.0 (1.42 mgd). The load allocations made at point BRTR2.0 for this stream segment are presented in Table D24.

Table D24. TMDL Calculations at Point BRTR2.0				
Flow = 1.42 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	ND	*	*	*
Mn	0.11	1.3	0.11	1.3
Al	ND	*	*	*
Acidity	0.27	3.2	0.27	3.2
Alkalinity	19.87	235.3		

Table D25. Calculation of Load Reduction Necessary at Point BRTR2.0				
	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load	ND	1.3	ND	3.2
Existing load from upstream points (none)	0.0	0.0	0.0	0.0
Difference of existing load and upstream existing load	*	1.3	*	3.2
Allowable loads from upstream points	*	*	*	*
Total load at BRTR2.0	*	1.3	*	3.2
Allowable load at BRTR2.0	*	1.3	*	3.2
Waste load allocation	*	*	*	*
Remaining load at BRTR2.0	*	1.3	*	3.2
Load Reduction at BRTR2.0 (Total load at BRTR2.0 - Remaining load at BRTR2.0)	*	0	*	0
Percent reduction required at BRTR2.0	*	0	*	0

The TMDL for the UNT 27036 to Bear Run at point BRTR2.0 does not require a load reduction for total manganese and acidity. Also, there is no load reduction for total iron and total aluminum because the data set, found in Attachment E, shows that the average concentrations for these parameters are below detection limits, and thus are meeting water quality standards.

BRTR1.0: The UNT 27033 to Bear Run

The UNT 27033 to Bear Run begins in Clearfield County near the border of Indiana and Jefferson Counties. There are several gas wells in the watershed but no recent coal mining operations.

There were fewer total iron, total manganese, and total aluminum data above the detection limit than necessary for this allocation point to conduct Monte Carlo analysis; therefore, these parameters were not evaluated for this TMDL. However, the observations for total iron, total manganese, and total aluminum, shown in Attachment E, indicate that the stream is meeting water quality standards for iron, manganese, and aluminum at this site.

The TMDL for the UNT 27033 to Bear Run consists of a load allocation to all of the watershed area above point BRTR1.0. Addressing the mining impacts above this point addresses the impairment for the segment. An instream flow measurement was available for point BRTR1.0 (0.98 mgd). The load allocations made at point BRTR1.0 for this stream segment are presented in Table D26.

Table D26. TMDL Calculations at Point BRTR1.0				
Flow = 0.98 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	ND	*	*	*
Mn	ND	*	*	*
Al	ND	*	*	*
Acidity	0.00	0.0	*	*
Alkalinity	33.17	271.1		

Table D27. Calculation of Load Reduction Necessary at Point BRTR1.0				
	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load	ND	ND	ND	0.00
Existing load from upstream points (none)	0.0	0.0	0.0	0.0
Difference of existing load and upstream existing load	*	*	*	0.0
Allowable loads from upstream points	*	*	*	*
Total load at BRTR1.0	*	*	*	0.0
Allowable load at BRTR1.0	*	*	*	*
Waste load allocation	*	*	*	*
Remaining load at BRTR1.0	*	*	*	*
Load Reduction at BRTR1.0 (Total load at BRTR1.0 - Remaining load at BRTR1.0)	*	*	*	*
Percent reduction required at BRTR1.0	*	*	*	*

The TMDL for the UNT 27033 to Bear Run at BRTR1.0 does not require a load reduction for total iron, total manganese, total aluminum, and acidity because the data set, found in Attachment E, shows that the average concentrations for these parameters are below detection limits, and thus are meeting water quality standards.

Future Waste Load Allocation

A future waste load allocation is being included in the Bear Run TMDL to allow for possible future coal mining permits in the watershed. Any discharge from the operations treatment system will be treated to the BAT limits, assigned in the mining permit, before entering Bear Run.

The future WLA is considered to be a point source discharge in the watershed; therefore, the allocation made at this point is a WLA. The WLAs for iron, manganese, and aluminum were calculated using the methodology explained in the "Method to Quantify Treatment Pond Pollutant Load" section of this report. Table D28 shows the WLAs for a future permitted operation.

Table D28. Waste load Allocations For Future Mining Permit			
Parameter	***Monthly Avg. Allowable Conc. (mg/l)***	***Average Flow (MGD)***	***Allowable Load (lbs/day)***
FUTURE			
Fe	3.0	0.0446	1.1
Mn	2.0	0.0446	0.7
Al	2.0	0.0446	0.7

BEAR1.0: Bear Run at its mouth

Bear Run drains into the West Branch Susquehanna River at the village of McGees Mills, Clearfield County, Pennsylvania. Point BEAR1.0 represents Bear Run at its mouth. Several discharges and South Branch Bear Run enter Bear Run between BEAR2.0 and BEAR1.0.

The TMDL for this section of Bear Run consists of a load allocation to all of the watershed area between points BEAR1.0 and BEAR2.0. Addressing the mining impacts between these points addresses the impairment for the segment. An instream flow measurement was available for point BEAR1.0 (15.66 mgd). The load allocations made at point BEAR1.0 for this stream segment are presented in Table D29.

Table D29. TMDL Calculations at Point BEAR1.0				
Flow = 15.66 MGD	***Measured Sample Data***		***Allowable***	
Parameter	***Conc. (mg/l)***	***Load (lbs/day)***	***LTA Conc. (mg/l)***	***Load (lbs/day)***
Fe	1.87	244.2	0.49	64.0
Mn	1.60	209.0	0.43	56.2
Al	1.08	141.1	0.37	48.3
Acidity	43.47	5,677.4	3.91	510.7
Alkalinity	7.20	940.4		

The calculated load reductions for all the loads that enter point BEAR1.0 must be accounted for in the calculated reductions at sample point BEAR1.0, shown in Table D30. A comparison of measured loads between points BEAR1.0, BEAR2.0, SBBR1.0, BRTR2.0, and BRTR1.0 shows that the loading for the parameters has increased in the segment.

Table D30. Calculation of Load Reduction Necessary at Point BEAR1.0				
	Fe (lbs/day)	***Mn (lbs/day)***	***Al (lbs/day)***	***Acidity (lbs/day)***
Existing load	244.2	209.0	141.1	5,677.4
Existing load from upstream points (SBBR1.0 and BEAR2.0)	224.2	192.0	135.7	4,167.1
Difference of existing load and upstream existing load	20.0	17.0	5.4	1,510.3
Allowable loads from upstream points	36.0	42.7	27.6	378.9
Total load at BEAR1.0	56.0	59.7	33.0	1,889.2
Allowable load at BEAR1.0	64.0	56.2	48.3	510.7
Waste load allocation (FUTURE)	1.1	0.7	0.7	*
Remaining load at BEAR1.0	62.9	55.5	47.6	510.7
Load Reduction at BEAR1.0 (Total load at BEAR1.0 - Remaining load at BEAR1.0)	0	4.2	0	1,378.5
Percent reduction required at BEAR1.0	0	7	0	73

The TMDL for Bear Run at BEAR1.0 requires a load reduction for total manganese and acidity. A load reduction is not necessary for total iron and total aluminum. All necessary reductions have been made upstream of this point.

Margin of Safety (MOS)

An implicit MOS was used in these TMDLs derived from the Monte Carlo statistical analysis employing the @Risk software. Pennsylvania Title 25 Chapter 96.3(c) states that water quality criteria must be met at least 99 percent of the time. All of the @Risk analyses results surpass the minimum 99 percent level of protection. Other MOS used for this TMDL analyses are:

- 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 MOS.

- An additional MOS is that the calculations were performed using a daily iron average, instead of the 30-day average.

- The method used to calculate a flow for a WLA using the area of the pit and ungraded portions of an active mine is conservative and an implicit MOS.

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 E

Water Quality Data Used In TMDL Calculations

Data Source	Site	Date	Flow mgd	pH (lab)	TFe mg/L	TMn mg/L	TAl mg/L	Acid mg/L	Alk mg/L	TSO4 mg/L
	BEAR3.0									
SRBC	BEAR3.0	12/11/02	0.68	5.7	0.352	0.205	< 0.5	48.4	11.4	38.8
SRBC	BEAR3.0	1/21/03	0.6	5.9	0.309	0.222	< 0.5	48	9	24.6
SRBC	BEAR3.0	4/1/03	1.05	6	0.369	0.172	< 0.5	42.6	8.8	31.9
SRBC	BEAR3.0	5/27/03	1.09	6.4	< 0.3	0.154	< 0.5	34	9.8	61.2
SRBC	BEAR3.0	6/30/03	0.35	6.4	< 0.3	0.244	< 0.5	34.2	9.2	45.4
SRBC	BEAR3.0	7/28/03	2.13	6.6	0.47	0.133	< 0.5	0	19.4	43
		Avg	**0.98**	**6.17**	**0.38**	**0.19**	**<0.5**	**34.53**	**11.27**	**40.82**
		St Dev	**0.63**	**0.35**	**0.07**	**0.04**		**18.06**	**4.09**	**12.55**
	BEAR2.0									
SRBC	BEAR2.0	12/11/02	2.14	5.6	< 0.3	00.075	< 0.5	17.8	9.6	36.1
SRBC	BEAR2.0	1/21/03	2.74	5.8	< 0.3	0.088	< 0.5	19.8	8.4	30.3
SRBC	BEAR2.0	4/1/03	6.15	5.7	< 0.3	0.115	< 0.5	11.8	6.8	32.4
SRBC	BEAR2.0	5/27/03	5.27	6.3	1.19	1.1	1.65	13.6	7.6	21.9
SRBC	BEAR2.0	6/30/03	1.22	6.3	< 0.3	0.072	< 0.5	13.8	9.4	49.7
SRBC	BEAR2.0	7/28/03	10.45	6.5	< 0.3	0.086	< 0.5	0	12.6	28.2
		Avg	**4.66**	**6.03**	**1.19**	**0.26**	**1.65**	**12.80**	**9.07**	**33.10**
		St Dev	**3.41**	**0.38**		**0.41**		**6.94**	**2.03**	**9.41**
	SBTR3.1									
A&T Coal Co.	SP-1	01/11/2002	0.72	6.8	0.31	0.19	*	4.1	16.4	39.8
A&T Coal Co.	SP-1	04/01/2002	*	6.41	0.08	0.04	*	2.3	17.5	50.5
A&T Coal Co.	SP-1	07/11/2002	*	7.69	0.33	0.12	*	2.5	56.8	71.5
A&T Coal Co.	SP-1	10/14/2002	0.04	7.35	0.42	0.1	*	3.7	58.8	74
A&T Coal Co.	SP-1	01/16/2003	0.22	7.22	0.83	0.67	*	4.8	29.6	89.7
A&T Coal Co.	SP-1	04/04/2003	0.01	7.19	0.34	0.5	*	1.3	20.8	77.6
A&T Coal Co.	SP-1	07/02/2003	0.29	7.52	1.21	0.48	*	2	47.1	93.8
A&T Coal Co.	SP-1	10/21/2003	0.19	7.01	0.2	0.39	*	2.5	30.3	67
Ebens DMO	SP-1	01/10/2002	*	7	0.521	0.461	0	0	36	85.5
Ebens DMO	SP-1	11/13/2002	*	7	0	0.159	0	0	26	126.2
Ebens DMO	SP-1	04/01/2003	*	6.9	0.527	0.73	0	0	27.6	83.8
Ebens DMO	SP-1	10/16/2003	*	6.8	2.49	0.542	0.667	0	28.6	44.2
Ebens DMO	SP-1	03/10/2004	*	7.1	1.17	0.672	0	27.8	23.6	78.2
		Avg	**0.25**	**7.08**	**0.65**	**0.39**	**0.13**	**3.92**	**32.24**	**75.52**
		St Dev	**0.26**	**0.33**	**0.67**	**0.24**	**0.30**	**7.36**	**13.85**	**22.84**

Data Source	Site	Date	Flow mgd	pH (lab)	TFe mg/L	TMn mg/L	TAl mg/L	Acid mg/L	Alk mg/L	TSO4 mg/L
	SBBR6.0									
SRBC	SBBR6.0	12/12/02	3.3	5.8	2	0.661	1.22	39.8	14.2	64.5
SRBC	SBBR6.0	1/22/03	2.66	6	2.87	1.06	1.73	49.2	11.4	91.1
SRBC	SBBR6.0	4/3/03	5.2	5	1.68	0.623	1.32	47.8	7.6	53.7
SRBC	SBBR6.0	5/28/03	3.09	6.4	1.37	0.622	0.79	31.4	11.6	47.8
SRBC	SBBR6.0	7/1/03	1.19	6.5	1.52	1.09	0.88	0	18.6	103.2
SRBC	SBBR6.0	7/29/03	4.98	6.6	1.16	0.485	0.643	0	13.6	40.5
		Avg	**3.40**	**6.05**	**1.77**	**0.76**	**1.10**	**28.03**	**12.83**	**66.80**
		St Dev	**1.50**	**0.60**	**0.61**	**0.25**	**0.40**	**22.63**	**3.65**	**25.08**
	SBBR5.0									
SRBC	SBBR5.0	12/12/02	3.7	5.6	2.8	1.1	1.51	32.2	10.8	88.7
SRBC	SBBR5.0	1/22/03	2.95	5.4	6.18	2.03	2.15	51.4	8.8	151.4
SRBC	SBBR5.0	4/3/03	5.85	5	3.27	1.14	1.49	48	7.8	82.4
SRBC	SBBR5.0	5/28/03	3.87	5.7	2.78	1.24	1.11	35.6	8.2	87.4
SRBC	SBBR5.0	7/1/03	1.79	5.9	4.63	2.1	1.42	46.6	11.2	178.8
SRBC	SBBR5.0	7/29/03	5.07	6	2.31	0.904	0.902	39.4	10.6	61.1
		Avg	**3.87**	**5.60**	**3.66**	**1.42**	**1.43**	**42.20**	**9.57**	**108.30**
		St Dev	**1.45**	**0.36**	**1.47**	**0.51**	**0.43**	**7.60**	**1.47**	**45.93**
	SBBR4.0									
SRBC	SBBR4.0	12/12/02	3.91	4.9	4.29	1.78	1.82	52.8	8.2	111.9
SRBC	SBBR4.0	1/22/03	2.47	5	7.07	2.56	2.18	55.4	8.6	177.4
SRBC	SBBR4.0	4/3/03	6.52	4.8	3.75	1.42	1.55	49.6	7.6	88.8
SRBC	SBBR4.0	5/28/03	3.49	5	3.88	1.74	1.26	42.6	6.4	111.3
SRBC	SBBR4.0	7/1/03	2.14	4.9	6.03	2.81	1.4	59.8	7.2	209.8
SRBC	SBBR4.0	7/29/03	5.85	5.3	3	1.31	0.944	34.2	8	74.5
		Avg	**4.06**	**4.98**	**4.67**	**1.94**	**1.53**	**49.07**	**7.67**	**128.95**
		St Dev	**1.78**	**0.17**	**1.55**	**0.61**	**0.43**	**9.30**	**0.79**	**53.03**
	SBBR3.0									
SRBC	SBBR3.0	12/12/02	4.89	4.8	4.79	2.23	1.86	51	8	117
SRBC	SBBR3.0	1/22/03	4.45	4.8	7.33	3.06	2.51	60	7.4	178.9
SRBC	SBBR3.0	4/2/03	9.85	4.4	2.64	1.26	1.33	33.2	5.2	85
SRBC	SBBR3.0	5/28/03	4.23	4.7	3.98	2.2	1.52	50.4	5.8	117.6

Data Source	Site	Date	Flow mgd	pH (lab)	TFe mg/L	TMn mg/L	TAl mg/L	Acid mg/L	Alk mg/L	TSO4 mg/L
SRBC	SBBR3.0	7/1/03	2.03	4.1	5.24	3.45	1.76	60.2	3.2	209
SRBC	SBBR3.0	7/29/03	5.92	4.8	3.26	1.72	1.12	37.6	7	80.3
		Avg	**5.23**	**4.60**	**4.54**	**2.32**	**1.68**	**48.73**	**6.10**	**131.30**
		St Dev	**2.60**	**0.29**	**1.67**	**0.82**	**0.49**	**11.24**	**1.76**	**51.85**
	SBTR2.0									
SRBC	SBTR2.0	12/12/02	0.94	5.1	< 0.3	0.326	< 0.5	27.2	8	29.7
SRBC	SBTR2.0	1/22/03	0.67	5.2	< 0.3	0.267	< 0.5	28.2	7.6	24.5
SRBC	SBTR2.0	4/2/03	2.15	5.3	< 0.3	0.154	< 0.5	18	8.2	20
SRBC	SBTR2.0	5/28/03	1.09	5.3	< 0.3	0.192	< 0.5	16.4	6	20
SRBC	SBTR2.0	7/1/03	0.28	5.4	< 0.3	0.283	< 0.5	17.4	7.4	39.1
SRBC	SBTR2.0	7/29/03	1.28	5.8	0.319	0.223	< 0.5	31.6	8	22.4
		Avg	**1.07**	**5.35**	**0.32**	**0.24**	**#DIV/0!**	**23.13**	**7.53**	**25.95**
		St Dev	**0.63**	**0.24**	**#DIV/0!**	**0.06**	**#DIV/0!**	**6.61**	**0.81**	**7.38**
	SBBR2.0									
SRBC	SBBR2.0	12/12/02	6.01	4.8	3.75	2.05	1.53	53.6	8	100.3
SRBC	SBBR2.0	1/23/03	2.45	4.7	5.55	2.94	1.99	52.2	7.6	172.4
SRBC	SBBR2.0	4/2/03	17.07	4.4	1.93	1.15	1.09	27.6	5	68.6
SRBC	SBBR2.0	5/28/03	10.37	4.5	2.79	2.03	1.19	40	5.8	100.3
SRBC	SBBR2.0	7/1/03	3.99	3.9	2.65	3.22	1.5	45.2	0	188.2
SRBC	SBBR2.0	7/29/03	10.63	4.7	2.36	1.61	0.91	32.4	6.6	71.8
		Avg	**8.42**	**4.50**	**3.17**	**2.17**	**1.37**	**41.83**	**5.50**	**116.93**
		St Dev	**5.38**	**0.33**	**1.31**	**0.79**	**0.39**	**10.51**	**2.91**	**51.15**
	SBTR1.0									
SRBC	SBTR1.0	12/12/02	0.98	4.1	0.635	1.44	2.91	59.8	4	76.1
SRBC	SBTR1.0	1/23/03	0.91	3.9	1.21	1.95	4.81	59.4	0	152.4
SRBC	SBTR1.0	4/2/03	2.2	3.6	1.53	1.46	4.27	57	0	115.8
SRBC	SBTR1.0	5/28/03	1.49	3.8	0.822	1.05	2.44	51.4	0	77.3
SRBC	SBTR1.0	7/1/03	0.42	3.7	1.13	1.85	4.03	59.6	0	145.5
SRBC	SBTR1.0	7/29/03	1.64	3.8	1.04	1.24	2.3	30.6	0	68.8
		Avg	**1.27**	**3.82**	**1.06**	**1.50**	**3.46**	**52.97**	**0.67**	**105.98**
		St Dev	**0.63**	**0.17**	**0.31**	**0.35**	**1.05**	**11.41**	**1.63**	**37.18**
	SBBR1.0									

Data Source	Site	Date	Flow mgd	pH (lab)	TFe mg/L	TMn mg/L	TAl mg/L	Acid mg/L	Alk mg/L	TSO4 mg/L
SRBC	SBBR1.0	12/11/02	2.38	4.7	3.9	2.53	1.79	55	8.2	129.2
SRBC	SBBR1.0	1/21/03	5.71	4.5	5.27	2.82	2.57	50	6.6	134.8
SRBC	SBBR1.0	4/1/03	11.02	4.1	4.18	1.91	2.33	45	2.6	116.4
SRBC	SBBR1.0	5/28/03	9.92	4.2	1.79	1.68	1.37	50.8	3.8	90.7
SRBC	SBBR1.0	6/30/03	4.7	3.8	1.48	2.91	1.87	47.6	0	163.2
SRBC	SBBR1.0	7/28/03	20.19	4.5	1.34	1.09	0.933	45	7.6	57.7
		Avg	**8.99**	**4.30**	**2.99**	**2.16**	**1.81**	**48.90**	**4.80**	**115.33**
		St Dev	**6.38**	**0.33**	**1.67**	**0.72**	**0.60**	**3.85**	**3.21**	**36.86**

	BRTR2.0									
SRBC	BRTR2.0	12/11/02	0.99	6.2	< 0.3	0.094	< 0.5	1.6	24	72
SRBC	BRTR2.0	1/21/03	0.8	7.1	< 0.3	0.106	< 0.5	0	22.4	55.1
SRBC	BRTR2.0	4/1/03	2.06	6.5	< 0.3	0.148	0.594	0	15.8	48.6
SRBC	BRTR2.0	5/27/03	1.47	7	< 0.3	0.121	< 0.5	0	13.4	32
SRBC	BRTR2.0	6/30/03	0.29	7.2	< 0.3	0.079	< 0.5	0	25	68.9
SRBC	BRTR2.0	7/28/03	2.89	6.9	< 0.3	0.126	< 0.5	0	18.6	34.9
		Avg	**1.42**	**6.82**	**#DIV/0!**	**0.11**	**0.59**	**0.27**	**19.87**	**51.92**
		St Dev	**0.94**	**0.39**	**#DIV/0!**	**0.02**	**#DIV/0!**	**0.65**	**4.69**	**16.73**

	BRTR1.0									
SRBC	BRTR1.0	12/11/02	0.55	6.3	< 0.3	< 0.05	< 0.5	0	32	139.6
SRBC	BRTR1.0	1/21/03	0.47	7.2	< 0.3	< 0.05	< 0.5	0	29	149
SRBC	BRTR1.0	4/1/03	0.83	6.7	< 0.3	< 0.05	< 0.5	0	26.2	122.6
SRBC	BRTR1.0	5/27/03	0.8	7.4	< 0.3	< 0.05	< 0.5	0	29.4	68.7
SRBC	BRTR1.0	7/1/03	0.13	7.4	0.398	0.112	< 0.5	0	43	145.2
SRBC	BRTR1.0	7/28/03	1.43	7.3	< 0.3	< 0.05	< 0.5	0	39.4	65.1
		Avg	**0.70**	**7.05**	**0.398**	**0.112**	**#DIV/0!**	**0.00**	**33.17**	**115.03**
		St Dev	**0.44**	**0.45**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**0.00**	**6.59**	**38.38**

	BEAR1.0									
SRBC	BEAR1.0	12/11/02	7.54	5.1	2.91	1.89	1.02	50	8.2	100.2
SRBC	BEAR1.0	1/21/03	8.79	5	3.32	2.07	1.47	36.8	8.2	102.9
SRBC	BEAR1.0	4/1/03	18.04	4.7	2.01	1.43	1.41	34.8	6.2	74.6
SRBC	BEAR1.0	5/27/03	19.96	4.9	1.08	1.14	0.754	33.6	5.8	51.3
SRBC	BEAR1.0	7/1/03	5.7	4.4	0.823	2.33	1.22	58.6	5.2	131.5

Data Source	Site	Date	Flow mgd	pH (lab)	TFe mg/L	TMn mg/L	TAl mg/L	Acid mg/L	Alk mg/L	TSO4 mg/L
SRBC	BEAR1.0	7/28/03	33.9	5.7	1.09	0.728	0.606	47	9.6	40.4
		Avg	**15.66**	**4.97**	**1.87**	**1.60**	**1.08**	**43.47**	**7.20**	**83.48**
		St Dev	**10.67**	**0.44**	**1.05**	**0.61**	**0.35**	**10.01**	**1.72**	**34.45**
		Bear Run Headwaters: BEAR4.0								
ICCD	BRS1	07/28/2004	2.87	6.4	0.47	0.14	0.24	0.00	17.00	17.00
ICCD	BRS1	11/10/2004	0.42							
		Avg	**1.65**	**6.40**	**0.47**	**0.14**	**0.24**	**0.00**	**17.00**	**17.00**
		St Dev	**1.73**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**
			South Branch Bear Run Headwaters: SBBR7.0							
ICCD	SBS1	07/07/2004	0.26	6.4	0.33	0.05	0.07	0.00	15.00	15.00
ICCD	SBS1	11/10/2004	1.03							
		Avg	**0.65**	**6.40**	**0.33**	**0.05**	**0.07**	**0.00**	**15.00**	**15.00**
		St Dev	**0.54**							
		UNT 27047 to South Branch Bear Run								
ICCD	UTS4	07/07/2004	0.17	3.4	2.47	1.56	2.42	36	0	100.00
		UNT 27046 to South Branch Bear Run								
ICCD	UTS5	08/24/2004	0.03	4.3	0.12	0.87	0.49	12	4	51
		UNT 27045 to South Branch Bear Run								
ICCD	UTS6	07/28/2004	0.25	4.7	0.39	0.33	0.35	8.00	4.00	17.00
		UNT 27041 to South Branch Bear Run								
ICCD	UTS8	08/24/2004	0.13	3.7	0.82	2.24	0.42	20	0	66
		UNT 27039 to South Branch Bear Run								
ICCD	UTS9	07/28/2004	1.35	4.1	0.51	2.39	2.12	21.00	1.00	57.00
ICCD	UTS9	11/10/2004	0.24							
		UNT 27040 to South Branch Bear Run								

Data Source	Site	Date	Flow mgd	pH (lab)	TFe mg/L	TMn mg/L	TAl mg/L	Acid mg/L	Alk mg/L	TSO4 mg/L
ICCD	UTS11	07/28/2004	1.87	3.5	2.24	0.80	2.95	43.00	0.00	61.00
ICCD	UTS11	11/10/2004	0.34							

AMD Discharges

Data Source	Site	Date	Flow mgd	pH (lab)	TFe mg/L	TMn mg/L	TAl mg/L	Acid mg/L	Alk mg/L	TSO4 mg/L
Becker Coal Co	MP1 (D)	03/14/2002	0.01	5.6	0.27	0.59	*	0	10	135
Becker Coal Co	MP1 (D)	04/25/2002	0.01	5.4	0.09	0.66	*	6	8	121
Becker Coal Co	MP1 (D)	09/19/2002	0.002	6.5	0.4	1.55	*	0	22	205
Becker Coal Co	MP1 (D)	11/13/2002	0.004	6.3	0.06	0.67	*	0	24	169
Becker Coal Co	MP1 (D)	03/07/2003	0.01	6	0.02	0.52	*	0	12	151
Becker Coal Co	MP1 (D)	06/24/2003	0.01	5.1	0.03	0.79	*	18	7	184
Becker Coal Co	MP1 (D)	08/15/2003	0.01	5.2	0.06	0.84	*	6	7	134
Becker Coal Co	MP1 (D)	12/05/2003	0.01	5.9	< 0.05	0.31	*	2	8	125
Ebensburg DMO	MP1 (D)	03/02/1998	0.01	5.7	0.608	0.342	2.43	17.4	14.4	99.3
Ebensburg DMO	MP1 (D)	02/08/1999	0.01	5.5	1.1	0.666	3.22	5	13.6	112
Ebensburg DMO	MP1 (D)	01/04/2000	0.01	5.9	1.43	0.578	5.84	0	26	151.6
Ebensburg DMO	MP1 (D)	11/03/2000	0.003	5.6	0.927	0.531	3.07	10.4	20	163.3
Ebensburg DMO	MP1 (D)	03/06/2001	0.003	5.5	< 0.3	0.586	2.34	0	14.8	129.3
Ebensburg DMO	MP1 (D)	12/05/2001	0.001	6.2	1.39	0.08	2.7	0	62	208.3
Ebensburg DMO	MP1 (D)	03/21/2002	0.01	5.4	< 0.3	0.464	1.76	32	12.4	112.7
Ebensburg DMO	MP1 (D)	11/13/2002	0.003	6.2	< 0.3	0.63	< 0.5	0	24	169.6
Ebensburg DMO	MP1 (D)	04/01/2003	*	5	< 0.3	0.695	1.58	15	7.6	134.4
Ebensburg DMO	MP1 (D)	10/16/2003	*	55	2.5	0.673	13.4	37	11.2	132.3
Ebensburg DMO	MP1 (D)	03/10/2004	*	6	0.581	0.26	2.62	11	17	103.2
		Avg	**0.0079**	**5.70**	**0.45**	**0.67**	**4.84**	**9.77**	**13.09**	**144.32**
		St Dev	**0.003**	**0.48**	**0.79**	**0.31**	**5.72**	**12.58**	**6.48**	**29.71**

Becker Coal Co	MP2 (D)	03/14/2002	0.01	3.5	0.4	0.96	*	42	0	151
Becker Coal Co	MP2 (D)	04/25/2002	0.02	3.5	0.2	1.01	*	38	0	143
Becker Coal Co	MP2 (D)	11/13/2002	0.003	3.6	0.15	1.23	*	36	0	176
Becker Coal Co	MP2 (D)	03/07/2003	0.01	3.5	0.2	1.08	*	36	0	167
Becker Coal Co	MP2 (D)	06/24/2003	0.01	3.6	0.18	1.02	*	41	0	154

Data Source	Site	Date	Flow mgd	pH (lab)	TFe mg/L	TMn mg/L	TAl mg/L	Acid mg/L	Alk mg/L	TSO4 mg/L
Becker Coal Co	MP2 (D)	08/15/2003	0.02	3.6	0.17	0.92	*	31	0	143
Becker Coal Co	MP2 (D)	12/05/2003	0.02	3.7	0.1	0.61	*	22	0	140
Becker Coal Co	MP2 (D)	02/14/2004	0.003	3.8	0.11	0.88	*	53	0	127
Ebensburg DMO	MP2 (D)	03/21/2002	0.01	3.5	< 0.3	0.959	2.69	80.2	0	143.8
Ebensburg DMO	MP2 (D)	11/13/2002	0.01	3.5	< 0.3	1.22	3.02	62.8	0	183.1
Ebensburg DMO	MP2 (D)	04/01/2003	*	3.6	< 0.3	1.17	2.47	51	0	158
Ebensburg DMO	MP2 (D)	10/16/2003	*	3.7	< 0.3	0.715	1.62	51.2	0	134.9
Ebensburg DMO	MP2 (D)	03/10/2004	*	3.8	0.993	0.605	1.18	41.2	0	141.8
		Avg	**0.0116**	**3.61**	**0.28**	**0.95**	**2.20**	**45.03**	**0.0**	**150.97**
		St Dev	**0.01**	**0.11**	**0.28**	**0.21**	**0.77**	**14.92**	**0.0**	**16.30**

Becker Coal Co	MP5 (D)	03/14/2002	0.01	3.4	0.15	0.27	*	36	0	100
Becker Coal Co	MP5 (D)	11/13/2002	0.002	3.7	0.31	0.61	*	32	0	154
Becker Coal Co	MP5 (D)	03/07/2003	0.003	3.6	0.02	0.38	*	28	0	111
Becker Coal Co	MP5 (D)	06/24/2003	0.01	3.7	0.09	0.24	*	32	0	89
Becker Coal Co	MP5 (D)	08/15/2003	0.003	3.7	0.1	0.23	*	24	0	95
Becker Coal Co	MP5 (D)	12/05/2003	0.01	3.7	0.07	0.12	*	18	0	78
Becker Coal Co	MP5 (D)	02/14/2004	0.0001	3.8	0.08	0.24	*	43	0	69
Ebensburg DMO	MP5 (D)	03/21/2002	0.01	3.6	< 0.3	0.239	1.58	61	0	69
Ebensburg DMO	MP5 (D)	11/13/2002	0.001	3.6	0.303	0.61	2.79	77.4	0	161.2
Ebensburg DMO	MP5 (D)	04/01/2003	*	3.7	< 0.3	0.238	1.27	44	0	96
Ebensburg DMO	MP5 (D)	10/16/2003	*	3.8	< 0.3	0.198	1.1	43.8	0	87.7
Ebensburg DMO	MP5 (D)	03/01/2004	*	3.8	< 0.3	0.232	0.788	36	0	99.5
		Avg	**0.0055**	**3.68**	**0.14**	**0.30**	**1.51**	**39.60**	**0.00**	**100.78**
		St Dev	**0.0**	**0.11**	**0.11**	**0.16**	**0.77**	**16.30**	**0.00**	**29.38**

A&T Coal Co.	D	01/11/2002	0.17	6.47	13.27	2.16	*	34.7	78	66.8
A&T Coal Co.	D	06/10/2002	0.004	6.91	2.37	2.51	*	9.1	37.7	122.4
A&T Coal Co.	D	10/14/2002	0	6.48	11.13	1.74	*	33.9	62.9	57.9
A&T Coal Co.	D	11/15/2002	0.02	6.52	12.2	2.4	*	30.3	53.4	89.7
A&T Coal Co.	D	12/27/2002	*	6.08	3.33	0.51	*	17.7	18.6	168.3
A&T Coal Co.	D	01/16/2003	*	6.7	9.17	0.67	*	13.1	25.5	160.5

Data Source	Site	Date	Flow mgd	pH (lab)	TFe mg/L	TMn mg/L	TAl mg/L	Acid mg/L	Alk mg/L	TSO4 mg/L
A&T Coal Co.	D	06/03/2003	*	6	12.51	0.63	*	3.3	10.9	95.3
A&T Coal Co.	D	11/26/2003	0.06	6.47	9.98	3.52	*	24.7	32.9	161.7
A&T Coal Co.	D	12/08/2003	0.06	6.32	12.35	2.91	*	42.4	12.35	134.1
Ebensburg DMO	D	01/10/2002	*	6.5	4.41	2.9	< 0.5	0	46	173.5
Ebensburg DMO	D	11/13/2002	*	6.4	13.1	1.95	< 0.5	0	76	60.4
Ebensburg DMO	D	04/01/2003	*	6.5	16.1	2.53	< 0.5	0	78.6	107.2
Ebensburg DMO	D	10/16/2003	*	6.5	13.7	2.03	< 0.5	0	75.4	75
Ebensburg DMO	D	11/07/2003	*	6.5	8.65	3.08	< 0.5	0	58.6	105.1
		Avg	**0.0523**	**6.45**	**10.16**	**2.11**		**14.94**	**47.63**	**112.71**
		St Dev	**0.06**	**0.22**	**4.16**	**0.94**		**15.52**	**24.94**	**41.34**
ICCD	SBD1	07/07/2004	1.08	5.9	14.60	2.11	0.05	0.00	51.00	60.00
ICCD	SBD1	08/17/2004	0.71	6.6	13.20	2.19	0.05	0.00	56.00	59.00
ICCD	SBD1	09/27/2004	0.8	6.5	13.40	1.86	0.05	0.00	58.00	54.00
ICCD	SBD1	11/10/2004	0.65							
ICCD	SBD1	11/21/2004	0.71							
		Avg	**0.79**	**6.33**	**13.73**	**2.05**	**0.05**	**0.00**	**55.00**	**57.67**
		St Dev	**0.17**	**0.38**	**0.76**	**0.17**	**0.00**	**0.00**	**3.61**	**3.21**
ICCD	SBD14	07/28/2004	0.05	3.2	21.50	7.95	4.77	81.00	0.00	320.00
ICCD	SBD14	08/17/2004	0.06	3.1	24.30	8.57	4.75	94.00	0.00	348.00
ICCD	SBD14	09/27/2004	0.08	3.3	15.60	6.60	3.10	67.00	0.00	286.00
ICCD	SBD14	11/10/2004	0.07							
ICCD	SBD14	11/21/2004	0.09							
		Avg	**0.07**	**3.20**	**20.47**	**7.71**	**4.21**	**80.67**	**0.00**	**318.00**
		St Dev	**0.02**	**0.10**	**4.44**	**1.01**	**0.96**	**13.50**	**0.00**	**31.05**
ICCD	SBD5	07/28/2004	0.1	3.1	6.15	4.42	3.73	70.00	0.00	269.00
ICCD	SBD5	08/17/2004	0.04	3.1	6.24	4.74	4.89	92.00	0.00	312.00
ICCD	SBD5	09/27/2004	0.06	3.3	17.70	4.74	4.26	68.00	0.00	255.00
ICCD	SBD5	11/10/2004	0.04							
ICCD	SBD5	11/21/2004	0.05							
		Avg	**0.06**	**3.17**	**10.03**	**4.63**	**4.29**	**76.67**	**0.00**	**278.67**

Data Source	Site	Date	Flow mgd	pH (lab)	TFe mg/L	TMn mg/L	TAl mg/L	Acid mg/L	Alk mg/L	TSO4 mg/L
		St Dev	**0.02**	**0.12**	**6.64**	**0.18**	**0.58**	**13.32**	**0.00**	**29.70**
ICCD	SBD6	07/28/2004	0.53	5.5	47.10	4.67	0.10	0.00	23.00	295.00
ICCD	SBD6	08/17/2004	0.4	6.0	45.80	4.65	0.06	0.00	26.00	301.00
ICCD	SBD6	09/27/2004	0.6	6.2	41.30	4.70	0.35	4.00	41.00	293.00
ICCD	SBD6	11/10/2004	0.33							
ICCD	SBD6	11/21/2004	0.24							
		Avg	**0.42**	**5.90**	**44.73**	**4.67**	**0.17**	**1.33**	**30.00**	**296.33**
		St Dev	**0.15**	**0.36**	**3.04**	**0.03**	**0.16**	**2.31**	**9.64**	**4.16**
ICCD	SBD7	07/28/2004	0.26	3.4	14.90	3.49	0.16	30.00	0.00	138.00
ICCD	SBD7	08/17/2004	0.11	3.0	25.70	6.48	0.22	74.00	0.00	337.00
ICCD	SBD7	09/27/2004	0.21	4.4	20.40	4.45	0.13	47.00	4.00	245.00
ICCD	SBD7	11/10/2004	0.19							
ICCD	SBD7	11/21/2004	0.16							
		Avg	**0.19**	**3.60**	**20.33**	**4.81**	**0.17**	**50.33**	**1.33**	**240.00**
		St Dev	**0.06**	**0.72**	**5.40**	**1.53**	**0.05**	**22.19**	**2.31**	**99.59**
ICCD	SBD8	07/28/2004	0.05	3.3	2.91	7.12	4.71	65.00	0.00	187.00
		Avg	**0.05**	**3.30**	**2.91**	**7.12**	**4.71**	**65.00**	**0.00**	**187.00**
		St Dev								
ICCD	SBD10	07/07/2004	0.25	3.3	3.31	3.12	3.47	46.00	0.00	132.00
ICCD	SBD10	08/17/2004	0.25	3.3	2.41	2.80	3.11	54.00	0.00	140.00
ICCD	SBD10	09/27/2004	0.22	3.5	3.00	5.56	4.95	56.00	0.00	198.00
ICCD	SBD10	11/11/2004	0.2							
ICCD	SBD10	11/21/2004	0.17							
		Avg	**0.22**	**3.37**	**2.91**	**3.83**	**3.84**	**52.00**	**0.00**	**156.67**
		St Dev	**0.03**	**0.12**	**0.46**	**1.51**	**0.98**	**5.29**	**0.00**	**36.02**
ICCD	SBD11	07/07/2004	0.05	2.9	3.86	1.49	18.10	176.00	0.00	317.00
ICCD	SBD11	08/17/2004	0.08	2.9	5.02	1.69	20.00	202.00	0.00	401.00
ICCD	SBD11	09/27/2004	0.24	3.3	4.85	1.30	8.43	95.00	0.00	192.00
ICCD	SBD11	11/11/2004	0.05							
ICCD	SBD11	11/21/2004	0.02							

Data Source	Site	Date	Flow mgd	pH (lab)	TFe mg/L	TMn mg/L	TAl mg/L	Acid mg/L	Alk mg/L	TSO4 mg/L
		Avg	**0.09**	**3.03**	**4.58**	**1.49**	**15.51**	**157.67**	**0.00**	**303.33**
		St Dev	**0.09**	**0.23**	**0.63**	**0.20**	**6.20**	**55.81**	**0.00**	**105.17**
ICCD	BRD2	07/07/2004	0.01	3	4.99	1.31	10.70	118.00	0.00	178.00
ICCD	BRD3	07/21/2004	0.004	3.4	2.05	2.74	2.38	34.00	0.00	71.00
ICCD	BRD9	07/28/2004	0.06	5.9	0.63	5.38	1.59	7.00	7.00	133.00
ICCD	BRD5	07/21/2004	0.05	5.1	18.80	22.10	0.08	56.00	6.00	512.00
ICCD	BRD6	07/21/2004	0.05	3.5	1.52	11.50	1.03	40.00	0.00	300.00
ICCD	BRD7	07/21/2004	0.06	4.0	0.23	7.84	0.91	17.00	4.00	212.00
ICCD	BRD8	07/21/2004	0.1	5.1	0.36	2.39	0.56	6.00	5	99.00

Attachment F
Comment and Response

PennFuture Comments

Comment
DEP's "No Limit Therefore No WLA" Rationale is Incorrect and Unintentionally Leads to the Result that Non-Detect NPDES Permit Limits Must be Required Where the Existing Load Equals or Exceeds the Allowable Load.

Response
An aluminum waste load allocation (WLA) is included for each mining permit even if the permit does not contain an aluminum effluent limit. The WLA was assigned the Best Available Technology limit of 2.0 mg/l.

Comment
The Allocation at SBTR3.1 and the Need for More Stringent WLAs and the Imposition of WQBELs.

A. Math Errors

Response
Table D7 has been corrected to indicate an allowable load for manganese of 1.6 pounds per day. This loading has been carried through to all affected tables in the report.

B. Total Elimination of Metals Loadings from Nonpoint Sources is Untenable.

Response
The dataset was refined to include only data from a consistent time period (2002 to 2004). The revised data show that on average, water quality standards are being met at SBTR3.1, therefore no TMDL is necessary at this point. WLAs for the Becker mine (BCBJ) and A&T mine (ATFS) are mass balanced in the next downstream point: SBBR6.0. A 100 percent reduction of nonpoint sources is no longer applicable as the segment is meeting water quality standards.

C. Because the Sum of the Technology-Based WLAs Exceeds the Total Maximum Daily Load for Each of the Three Metals, WQBELs Based on More Stringent WLAs are Necessary.

Response
The revised data have changed segments requiring TMDLs. WQBELs are not necessary for the Becker (BCBJ) and A&T (ATFS) WLAs. The revised data show that on average, water quality standards are being met at SBTR3.1, therefore no TMDL is necessary at this point. BCBJ and ATFS WLAs are evaluated at the next downstream point (SBBR6.0).