# Black Creek, Hazle Creek, Wetzle Creek & Quakake Creek TMDLs

Carbon, Schuylkill & Luzerne Counties, Pennsylvania

Prepared by:

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**TMDL**
**Black Creek Watershed**
**Carbon County, Pennsylvania**

## Introduction

This Total Maximum Daily Load (TMDL) calculation has been prepared for segments in the Black Creek Watershed (Attachment A) which include segments on Hazle, Wetzle, Quakake and Black Creeks. The TMDL was completed to address the impairments noted on the 1996-2008 Pennsylvania 303(d) lists, required under the Clean Water Act, and covers the listed segments shown in Table 1. Metals and acidity in discharge water from abandoned coalmines cause the impairment. The TMDL addresses the three primary metals associated with abandoned mine drainage (iron, manganese, aluminum), and pH.

**Table 1. 303(d) and Integrated Water Quality Report Listed Segments**

State Water Plan (SWP) Subbasin: 02B

HUC: 02040106-Lehigh

| Year | Miles | Use Designation | Assessment ID | Segment ID | DEP Stream Code | Stream Name | Desig-nated Use | Data Source | Source | EPA 305(b) Cause Code |
|---|---|---|---|---|---|---|---|---|---|---|
| 1996 | 4.7 | * | * | * | 4139 | Black Creek | CWF | 303 (d) List | Resource Extraction | Metals |
| 1996 | 1.5 | * | * | * | 4153 | Hazle Creek | HQ CWF | 303 (d) List | Resource Extraction | Metals |
| 1996 | 3.4 | * | * | * | 4153 | Hazle Creek | HQ CWF | 303 (d) List | Resource Extraction | pH |
| 1998 | 4.43 | * | * | 654 | 4139 | Black Creek | CWF | 303 (d) List | AMD | Metals |
| 1998 | 4.43 | * | * | 6218 | 4153 | Hazle Creek | HQ CWF | 303 (d) List | AMD | Metals |
| 1998 | 4.43 | * | * | 6218 | 4153 | Hazle Creek | HQ CWF | 303 (d) List | AMD | pH |
| 2002 | 4.43 | * | * | 20010530-1449-TTS | 4139 | Black Creek | CWF | SWMP | AMD | Metals |
| 2002 | 4.43 | * | * | 20010530-1449-TTS | 4139 | Black Creek | CWF | SWMP | AMD | pH |
| 2002 | 4.43 | * | * | 20010927-1030-TTS | 4153 | Hazle Creek | HQ CWF | SWMP | AMD | Metals |
| 2002 | 4.43 | * | * | 20010927-1030-TTS | 4153 | Hazle Creek | HQ CWF | SWMP | AMD | pH |
| 2004 | 4.4 | Aquatic Life | * | 20010530-1449-TTS | 4139 | Black Creek | CWF | SWMP | AMD | pH |
| 2004 | 4.4 | Aquatic Life | * | 20010530-1449-TTS | 4139 | Black Creek | CWF | SWMP | AMD | Metals |
| 2004 | 4.4 | Aquatic Life | * | 20010927-1030-TTS | 4153 | Hazle Creek | HQ CWF | SWMP | AMD | pH |
| 2004 | 4.4 | Aquatic Life | * | 20010927-1030-TTS | 4153 | Hazle Creek | HQ CWF | SWMP | AMD | Metals |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 2004 | 0.3 | Aquatic Life | * | 20010927-1031-TTS | 63052 | Hazle Creek UNT 63052 | HQ CWF | SWMP | AMD | pH |
| 2004 | 0.3 | Aquatic Life | * | 20010927-1031-TTS | 63052 | Hazle Creek UNT 63052 | HQ CWF | SWMP | AMD | Metals |
| 2004 | 1.3 | Aquatic Life | * | 20010706-1238-TTS | 4146 | Wetzle Creek | CWF | SWMP | AMD | Metals |
| 2004 | 1.3 | Aquatic Life | * | 20010706-1238-TTS | 4146 | Wetzle Creek | CWF | SWMP | AMD | pH |
| 2004 | 1.8 | Aquatic Life | * | 20010706-1238-TTS | 4147 | Wetzle Creek UNT 04147 | HQ CWF | SWMP | AMD | Metals |
| 2004 | 1.8 | Aquatic Life | * | 20010706-1238-TTS | 4147 | Wetzle Creek UNT 04147 | HQ CWF | SWMP | AMD | pH |
| 2006 | 4.42 | Aquatic Life | 2002 | * | 4139 | Black Creek | CWF | SWMP | AMD | pH |
| 2006 | 4.42 | Aquatic Life | 2002 | * | 4139 | Black Creek | CWF | SWMP | AMD | Metals |
| 2006 | 2.01 | Aquatic Life | 6750 | * | 4139 | Black Creek | CWF | SWMP | AMD | Metals |
| 2006 | 2.01 | Aquatic Life | 6750 | * | 4139 | Black Creek | CWF | SWMP | AMD | pH |
| 2006 | 3.97 | Aquatic Life | 2872 | * | 4153 | Hazle Creek | HQ CWF | SWMP | AMD | Metals |
| 2006 | 3.97 | Aquatic Life | 2872 | * | 4153 | Hazle Creek | HQ CWF | SWMP | AMD | pH |
| 2006 | 0.76 | Aquatic Life | 6733 | * | 63049 | Hazle Creek UNT 63049 | HQ CWF | SWMP | AMD | pH |
| 2006 | 0.21 | Aquatic Life | 6733 | * | 63050 | Hazle Creek UNT 63050 | HQ CWF | SWMP | AMD | pH |
| 2006 | 0.37 | Aquatic Life | 2873 | * | 63052 | Hazle Creek UNT 63052 | HQ CWF | SWMP | AMD | pH |
| 2006 | 0.37 | Aquatic Life | 2873 | * | 63052 | Hazle Creek UNT 63052 | HQ CWF | SWMP | AMD | Metals |
| 2006 | 2.07 | Aquatic Life | 6684 | * | 4144 | Quakake Creek | CWF | SWMP | AMD | Metals |
| 2006 | 2.07 | Aquatic Life | 6684 | * | 4144 | Quakake Creek | CWF | SWMP | AMD | pH |
| 2006 | 2.91 | Aquatic Life | 2378 | * | 4146 | Wetzle Creek | CWF | SWMP | AMD | Metals |
| 2006 | 2.91 | Aquatic Life | 2378 | * | 4146 | Wetzle Creek | CWF | SWMP | AMD | pH |
| 2006 | 2.41 | Aquatic Life | 2378 | * | 04147 | Wetzle Creek UNT 04147 | CWF | SWMP | AMD | pH |
| 2006 | 2.41 | Aquatic Life | 2378 | * | 04147 | Wetzle Creek UNT 04147 | CWF | SWMP | AMD | Metals |
| 2008 | 4.42 | Aquatic Life | 2002 | * | 4139 | Black Creek | CWF | SWMP | AMD | pH |
| 2008 | 4.42 | Aquatic Life | 2002 | * | 4139 | Black Creek | CWF | SWMP | AMD | Metals |
| 2008 | 2.01 | Aquatic Life | 6750 | * | 4139 | Black Creek | CWF | SWMP | AMD | Metals |
| 2008 | 2.01 | Aquatic Life | 6750 | * | 4139 | Black Creek | CWF | SWMP | AMD | pH |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 2008 | 3.97 | Aquatic Life | 2872 | * | 4153 | Hazle Creek | HQ CWF | SWMP | AMD | Metals |
| 2008 | 3.97 | Aquatic Life | 2872 | * | 4153 | Hazle Creek | HQ CWF | SWMP | AMD | pH |
| 2008 | 0.76 | Aquatic Life | 6733 | * | 63049 | Hazle Creek UNT 63049 | HQ CWF | SWMP | AMD | pH |
| 2008 | 0.21 | Aquatic Life | 6733 | * | 63050 | Hazle Creek UNT 63050 | HQ CWF | SWMP | AMD | pH |
| 2008 | 0.37 | Aquatic Life | 2873 | * | 63052 | Hazle Creek UNT 63052 | HQ CWF | SWMP | AMD | pH |
| 2008 | 0.37 | Aquatic Life | 2873 | * | 63052 | Hazle Creek UNT 63052 | HQ CWF | SWMP | AMD | Metals |
| 2008 | 2.07 | Aquatic Life | 6684 | * | 4144 | Quakake Creek | CWF | SWMP | AMD | Metals |
| 2008 | 2.07 | Aquatic Life | 6684 | * | 4144 | Quakake Creek | CWF | SWMP | AMD | pH |
| 2008 | 2.91 | Aquatic Life | 2378 | * | 4146 | Wetzle Creek | CWF | SWMP | AMD | Metals |
| 2008 | 2.91 | Aquatic Life | 2378 | * | 4146 | Wetzle Creek | CWF | SWMP | AMD | pH |
| 2008 | 2.41 | Aquatic Life | 2378 | * | 04147 | Wetzle Creek UNT 04147 | CWF | SWMP | AMD | pH |
| 2008 | 2.41 | Aquatic Life | 2378 | * | 04147 | Wetzle Creek UNT 04147 | CWF | SWMP | AMD | Metals |

[1] Pennsylvania's 1996, 1998, and 2002 Section 303(d) lists and the 2004 and 2006 Integrated Water Quality Report were approved by the Environmental Protection Agency (EPA). The 1996 Section 303(d) list provides the basis for measuring progress under the 1997 lawsuit settlement of *American Littoral Society and Public Interest Group of Pennsylvania v. EPA.*

Resource Extraction = RE
Cold Water Fisheries = CWF
High Quality = HQ
Surface Water Monitoring Program = SWMP
Abandoned Mine Drainage = AMD
See Attachment D, *Excerpts Justifying Changes Between the 1996, 1998, and 2002 Section 303(d) Lists and the 2004 and 2006 Integrated Water Quality Report.* The use designations for the stream segments in this TMDL can be found in PA Title 25 Chapter 93.

## Directions to the Black Creek Watershed

The Hazle, Wetzle, Quakake and Black Creek Watersheds are located in Eastern Pennsylvania. Hazle Creek is located in southern Luzerne and northern Carbon counties between Hazleton and Weatherly. Wetzle and Quakake Creeks are located in Carbon and Schuylkill counties between McAdoo and Weatherly. Black Creek is located in Carbon County between Weatherly and the Lehigh River.

The watershed areas are found on the Hazleton and Weatherly United States Geological Survey 7.5 Minute Quadrangles. The area within the Black Creek Watershed consists of approximately 60 square miles.

**Segments addressed in this TMDL**

The majority of the Black Creek Watershed is affected by pollution from AMD. This pollution has caused high levels of metals in the Hazle Creek, Wetzle Creek, Quakake Creek and Black Creek Watersheds all of which are within the Black Creek Watershed. Table 1 and Attachment A give an explanation and locations of the AMD allocation points.

There are currently no mining permits issued in the Black Creek Watershed. All of the discharges in the watershed are from abandoned mines and will be treated as non-point sources. The distinction between non-point and point sources in this case is determined on the basis of whether or not there is a responsible party for the discharge. These TMDLs will be expressed as long-term, average loadings. Due to the nature and complexity of mining effects on the watershed, expressing the TMDL as a long-term average gives a better representation of the data used for the calculations. See Attachment C for TMDL calculations.

**Clean Water Act Requirements**

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

Additionally, the federal Clean Water Act and the 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 (BMPs), etc.).

**303(d) List and Integrated Water Quality Report 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 and/or the Integrated Water Quality Report. With guidance from the USEPA, the states have developed methods for assessing the waters within their respective jurisdictions.

The primary method adopted by the Pennsylvania Department of Environmental Protection (Pa. DEP) for evaluating waters changed between the publication of the 1996 and 1998 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 305(b) reporting process. Pa. DEP is now using the Unassessed Waters Protocol (UWP), a modification of the USEPA Rapid Bioassessment Protocol II (RPB-II), as the primary mechanism to assess Pennsylvania's waters. The UWP 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 included 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.

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 are documented. An impaired stream must be listed on the state's 303(d) list and/or the Integrated Water Quality Report 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 pre-existing 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 Black Creek Watershed TMDL.

**Watershed History**

The Hazle, Wetzle, Quakake and Black Creek Watersheds are situated in the Appalachian Ridge and Valley Physiographic Province. It is characterized by folding, faulting and steeply dipping anticline and synclinal geology. The highest elevation is 1930'MSL on Spring Mountain near McAdoo. The lowest elevation is 725'MSL at the mouth of the Black Creek.

The study area is located in the Eastern Middle Anthracite Field, which consists of several discontinuous coal basins. There are two coal basins with discharges impacting the study area; the Jeansville and Hazleton Basins. Only the eastern portions of these basins drain to the study area, the western portions of the basins drain to the Little Nescopeck and Catawissa Watersheds.

Portions of the Hazle Creek Watershed are in the eastern end of the Hazleton Basin. Historically Hazle Creek flows from its headwaters near Hazleton to its mouth near Weatherly. Due to underground mining, most of the surface drainage in the Hazleton Basin has been destroyed. Surface water infiltrates into the underlying minepool through fractured strata or abandoned strip mines and either discharges to the Little Nescopeck Creek in the Susquehanna River Basin via the Jeddo Tunnel or into Hazle Creek from the Hazlebrook Discharge. The Hazlebrook Discharge refers to a collection of three smaller discharges that merge together in a shallow five acre pond which flows into Hazle Creek. There are two discharges from airways; one is in the northwest corner of the pond, the other is approximately 800' northeast of the pond. During high flows water from a flooded abandoned strip mine to the north may overflow into the pond.

Wetzle and Quakake Creeks lie outside of the coal measures, but are impacted from AMD from the Quakake Drainage Tunnel which dewaters the eastern portion of the Jeansville Basin to the north. The Quakake Tunnel was driven approximately 3,900' northward through Spring Mountain to intercept the workings of the Beaver Meadows Colliery at 1307' MSL. The underground drainage area of the tunnel includes the Beaver Meadows, Coleraine and portions of the Spring Mountain Colliers. The western portion of the Jeansville Basin drains to the Audenried Tunnel which is in the Catawissa Watershed. The Quakake Tunnel Discharge has the highest flow of all the abandoned mine discharges in the Lehigh Watershed, averaging over 6,000 gpm.

There are not any AMD discharges within the Black Creek Watershed, but it is impacted by AMD from two if its tributaries; Quakake and Hazle Creeks.

**AMD Methodology**

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

The statistical analysis described below can be applied to situations where all of the pollutant loading is from non-point sources as well as those where there are both point and non-point sources. The following defines what are considered point sources and non-point sources for the purposes of our evaluation; point sources are defined as permitted discharges, non-point 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 load allocation made at that point will be for all of the watershed area that is above that point. For situations where there are point-source impacts alone, or in combination with 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[1] by performing 5,000 iterations to determine the required percent reduction so that the water quality criteria, as defined in the *Pennsylvania Code. Title 25 Environmental Protection, Department of Environmental Protection, Chapter 93, Water Quality Standards,* will be met instream at least 99 percent of the time. For each iteration, the required percent reduction is:

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

PR = required percent reduction for the current iteration

Cc = criterion in mg/l

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

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

Mean = average observed concentration

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

Standard Deviation = standard deviation of observed data

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

LTA = Mean * (1 – PR99) where (2)

LTA = allowable LTA source concentration in mg/l

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

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

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

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

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

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

**TMDL Endpoints**

One of the major components of a TMDL is the establishment of an instream numeric endpoint, which is used to evaluate the attainment of acceptable 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 load allocations that are specified above a point in the stream segment.  All allocations will be specified as long-term average daily concentrations.  These long-term average daily concentrations are expected to meet water quality criteria 99 percent of the time.  Pennsylvania Title 25 Chapter 96.3(c) specifies that a minimum 99 percent level of protection is required.  All metals criteria evaluated in this TMDL are specified as total recoverable.  Pennsylvania does have dissolved criteria for iron; however, the data used for this analysis report iron as total recoverable. Table 2 shows the water quality criteria for the selected parameters.

**Table 2. Applicable Water Quality Criteria**

| Parameter | ***Criterion Value (mg/l)*** | ***Total Recoverable/Dissolved*** |
|---|---|---|
| Aluminum (Al) | 0.75 | Total Recoverable |
| Iron (Fe) | 1.50 | Total Recoverable |
| Manganese (Mn) | 1.00 | Total Recoverable |
| pH * | 6.0-9.0 | N/A |

*The pH values shown will be used when applicable.  In the case of freestone streams with little or no buffering capacity, the TMDL endpoint for pH will be the natural background water quality.  These values are typically as low as 5.4 (Pennsylvania Fish and Boat Commission).

For high quality waters, applicable water-quality criteria are determined using the unimpaired segment of the TMDL water or the 95th percentile of a reference Water Quality Network (WQN) stream. For segments on the Hazle Creek Watershed, WQN339 on Little Fishing Creek (SWP05C) is used as the reference water. Table 3 shows the criteria used in the Hazle Creek TMDL. Attachment D explains how to select a reference stream for HQ TMDL development.

**Table 3. Reference Little Fishing Creek Criteria**

| **Parameter** | **Criterion Value** |
|---|---|
| Aluminum (Al) | 0.200 mg/L |
| Iron (Fe) | 0.134 mg/L |
| Manganese (Mn) | 0.0101 mg/L |
| Area | 18 square miles |
| Alkalinity | 14 mg/L |

## TMDL Elements (WLA, LA, MOS)

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

## Allocation Summary

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 re-evaluated to reflect current conditions. Table 4 presents the estimated reductions identified for all points in the watershed. Attachment C gives detailed TMDLs by segment analysis for each allocation point.

**Table 4. Summary Table – Black Creek Watershed**

| Station | Parameter | Existing Load (lbs/day) | TMDL Allowable Load (lbs/day) | WLA (lbs/day) | LA (lbs/day) | Load Reduction (lbs/day) | Percent Reduction % |
|---|---|---|---|---|---|---|---|
| HC 2 | HC 2 Hazle Creek Headwaters | | | | | | |
| | Al | 0.83 | 0.16 | - | 0.16 | 0.7 | 81 |
| | Fe | ND | NA | NA | NA | NA | NA |
| | Mn | 0.33 | 0.00 | - | 0.00 | 0.3 | 99 |
| | Acidity | 49.57 | 6.44 | - | 6.44 | 43.1 | 87 |
| HC 3 | HC 3 Hazlebrook Discharge to Hazle Creek | | | | | | |
| | Al | 18.44 | 1.84 | - | 1.84 | 16.6 | 90 |
| | Fe | 45.79 | 0.92 | - | 0.92 | 44.9 | 98 |
| | Mn | 5.75 | 0.12 | - | 0.12 | 5.6 | 98 |
| | Acidity | 417.12 | 179.36 | - | 179.36 | 237.8 | 57 |
| HC 4 | HC 4 Hazle Creek Downstream of HC 2 & HC 3 | | | | | | |
| | Al | 22.35 | 3.35 | - | 3.35 | 1.7* | 34* |
| | Fe | 35.69 | 1.43 | - | 1.43 | 0.0* | 0.0* |
| | Mn | 7.13 | 0.14 | - | 0.14 | 1.0* | 88* |
| | Acidity | 569.44 | 176.53 | - | 176.53 | 112.0* | 39* |
| HC 5 | HC 5 Mouth of Beaver Creek | | | | | | |
| | Al | ND | NA | NA | NA | NA | NA |
| | Fe | 1.37 | 1.37 | - | 1.37 | 0.0 | 0 |
| | Mn | ND | NA | NA | NA | NA | NA |
| | Acidity | 74.99 | 9.75 | - | 9.75 | 65.2 | 87 |
| HC 6 | HC 6 Black Creek Downstream of Confluence with Beaver Creek | | | | | | |
| | Al | ND | NA | NA | NA | NA | NA |
| | Fe | ND | NA | NA | NA | NA | NA |
| | Mn | 6.75 | NA | NA | NA | NA | NA |
| | Acidity | 612.19 | 238.76 | - | 238.76 | 0.0* | 0* |
| HC 7 | HC 7 Black Creek Upstream of Confluence with Quakake Creek | | | | | | |
| | Al | 58.97 | 36.56 | - | 36.56 | 22.4* | 38* |
| | Fe | 83.29 | 34.98 | - | 34.98 | 48.3* | 58* |
| | Mn | 10.96 | NA | NA | NA | NA | NA |

| Station | Parameter | Existing Load (lbs/day) | TMDL Allowable Load (lbs/day) | WLA (lbs/day) | LA (lbs/day) | Load Reduction (lbs/day) | Percent Reduction % |
|---|---|---|---|---|---|---|---|
| | Acidity | 2032.19 | 751.91 | - | 751.91 | 906.8* | 55* |
| Q 1 | Q 1 Wetzle Creek Headwaters | | | | | | |
| | Al | 396.63 | 35.70 | - | 35.70 | 360.9 | 91 |
| | Fe | 39.33 | NA | NA | NA | NA | NA |
| | Mn | 104.83 | 56.61 | - | 56.61 | 48.2 | 46 |
| | Acidity | 106.90 | NA | NA | NA | NA | NA |
| Q 2 | Q 2 Wetzle Creek Mouth | | | | | | |
| | Al | 386.02 | 38.60 | - | 38.60 | 0.0* | 0* |
| | Fe | NA | NA | NA | NA | NA | NA |
| | Mn | 102.10 | 53.09 | - | 53.09 | 2.0* | 4* |
| | Acidity | NA | NA | NA | NA | NA | NA |
| Q 4 | Q 4 Quakake Creek Mouth | | | | | | |
| | Al | 549.17 | 82.38 | - | 82.38 | 119.4* | 59* |
| | Fe | 59.94 | NA | NA | NA | NA | NA |
| | Mn | 148.18 | 100.76 | - | 100.76 | 0.0* | 0* |
| | Acidity | 7821.83 | 625.75 | - | 625.75 | 5897.6* | 90* |
| BC 1 | BC 1 Black Creek Downstream of Confluence with Quakake Creek | | | | | | |
| | Al | 791.70 | 150.42 | - | 150.42 | 152.1* | 50* |
| | Fe | 132.49 | NA | NA | NA | NA | NA |
| | Mn | 216.06 | 175.01 | - | 175.01 | 0.0* | 0* |
| | Acidity | 12986.48 | 1038.92 | - | 1032.66 | 3471.2* | 77* |
| BC 2 | BC 2 Black Creek Main Stem | | | | | | |
| | Al | 748.67 | 269.52 | - | 269.52 | 0.0* | 0* |
| | Fe | 192.28 | NA | NA | NA | NA | NA |
| | Mn | 230.07 | NA | NA | NA | NA | NA |
| | Acidity | 13194.30 | 1187.49 | - | 1181.23 | 59.3* | 5* |
| BC 3 | BC 3 Black Creek Mouth | | | | | | |
| | Al | 776.54 | 217.43 | - | 217.43 | 79.96* | 27* |
| | Fe | 157.02 | NA | NA | NA | NA | NA |
| | Mn | 237.22 | NA | NA | NA | NA | NA |
| | Acidity | 10735.52 | 1395.62 | - | 425.28 | 0.0* | 0* |

*Takes into account load reductions from upstream sources.
ND = Non-detectable
NA = Not Applicable

## Recommendations

There is currently no watershed group focused on the Black Creek Watershed area. It is recommended that agencies work with local interests to form a watershed organization. This watershed organization could then work to implement projects to achieve the reductions recommended in this TMDL document.

Various methods to eliminate or treat pollutant sources and to provide a reasonable assurance that the proposed TMDLs can be met exist in Pennsylvania. These methods include PADEP's primary efforts to improve water quality through reclamation of abandoned mine lands (for abandoned mining) and through the National Pollution Discharge Elimination System (NPDES) permit program (for active mining). Funding sources available that are currently being used for projects designed to achieve TMDL reductions include the Environmental Protection Agency (EPA) 319 grant program and Pennsylvania's Growing Greener Program. Federal funding is through the Department of the Interior, Office of Surface Mining (OSM), for reclamation and mine drainage treatment through the Appalachian Clean Streams Initiative and through Watershed Cooperative Agreements.

OSM reports that nationally, of the $8.5 billion of high priority (defined as priority 1&2 features or those that threaten public health and safety) coal related AML problems in the AML inventory, $6.6 billion (78%) have yet to be reclaimed; $3.6 billion of this total is attributable to Pennsylvania watershed costs. Almost 83 percent of the $2.3 billion of coal related environmental problems (priority 3) in the AML inventory are not reclaimed.

The Bureau of Abandoned Mine Reclamation (BAMR) is Pennsylvania's primary bureau in dealing with abandoned mine reclamation (AMR) issues. BAMR has established a comprehensive plan for AMR throughout the Commonwealth. The plan prioritizes and guides reclamation efforts throughout the state and makes the most of available funds. For more information please visit (www.dep.state.pa.us/dep/deputate/minres/bamr/complan1.htm).

In developing and implementing a comprehensive plan for abandoned mine reclamation, the resources (both human and financial) of the participants must be coordinated to insure cost-effective results. The following set of principles is intended to guide this decision making process:

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

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

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

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

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

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

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

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

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

In addition to the abandoned mine reclamation program, regulatory programs also are assisting in the reclamation and restoration of Pennsylvania's land and water. PADEP has been effective in implementing the NPDES program for mining operations throughout the Commonwealth. This reclamation was done through the use of remining permits that have the potential for reclaiming abandoned mine lands, at no cost to the Commonwealth or the federal government. Long-term treatment agreements were initialized for facilities/operators that need to assure treatment of post-mining discharges or discharges they degraded which will provide for long-term treatment of discharges. According to OSM, "PADEP is conducting a program where active mining sites are, with very few exceptions, in compliance with the approved regulatory program".

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

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

- Awards of grants for 1) proposals with economic development or industrial application as their primary goal and which rely on recycled mine water and/or a site that has been made suitable for the location of a facility through the elimination of existing Priority 1 or 2 hazards, and 2) new and innovative mine drainage treatment technologies that will provide waters of higher purity that may be needed by a particular industry at costs below conventional treatment costs as in common use today or reduce the costs of water treatment below those of conventional lime treatment plants. Eight contracts totaling $4.075 M were awarded in 2006 under this program.

- Projects using water from mine pools in an innovative fashion, such as the Shannopin Deep Mine Pool (in southwestern Pennsylvania), the Barnes & Tucker Deep Mine Pool (the

Susquehanna River Basin Commission into the Upper West Branch Susquehanna River), and the Wadesville Deep Mine Pool (Excelon Generation in Schuylkill County).

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

**Public Participation**

Public notice of the draft TMDL was published in the *Pennsylvania Bulletin* on November 15, 2008 and the draft on November 17, 2008 to foster public comment on the allowable loads calculated. A public meeting was held on December 4, 2008 beginning at 10AM at the Pottsville District Mining Office in Pottsville, PA to discuss the proposed TMDL.

**Future TMDL Modifications**

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

**Changes in TMDLs That May Require EPA Approval**

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

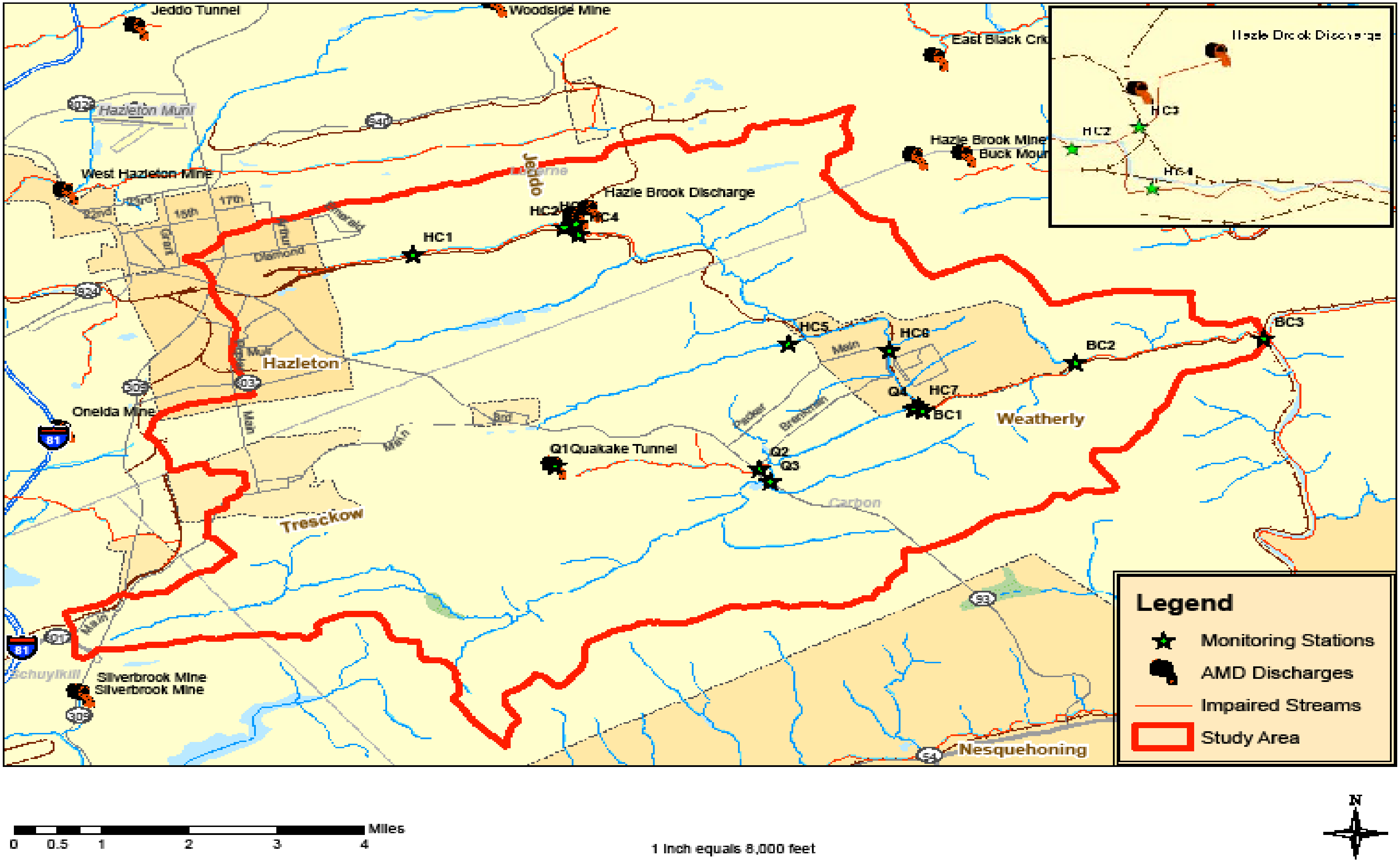
## Changes in TMDLs That May Not Require EPA Approval

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

# *Attachment A*

## Black Creek Watershed Maps

Hazle, Quakake and Black Creek TMDLs



# *Attachment B*

## Method for Addressing Section 303(d) List and/or Integrated Water Quality Report Listings for pH

## Method for Addressing 303(d) List and/or Integrated Water Quality Report Listings for pH

Potenz hydrogen (pH) is a measurement of hydrogen ion concentration presented as a negative logarithm. As such, pH measurements are not conducive to standard statistics. Additionally, pH does not measure latent acidity and 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 that would result from the treatment of abandoned mine drainage.

Research published by the Pa. Department of Environmental Protection demonstrates that by plotting net alkalinity (alkalinity minus acidity) vs. pH for 794 mine sample points, the 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 Chapter 93. Thus, it is required that the acid load in streams with pH impairments shall be reduced so that net alkalinity is greater than zero 99% of the time.

Based on the above information, Pennsylvania is using the following approach to address the stream impairments noted on the 303(d) List and/or Integrated Water Quality Report due to pH. Net alkalinity will be used to evaluate pH in TMDL calculations. 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 measured in units of milligrams per liter (mg/l) $CaCO_3$ by titration. The same statistical procedure that has been described for use in the evaluation of the metals that have numeric water quality criteria 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 of six to 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 also assures that Pennsylvania's standard for pH is attained when the acid concentration reduction is attained.

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

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

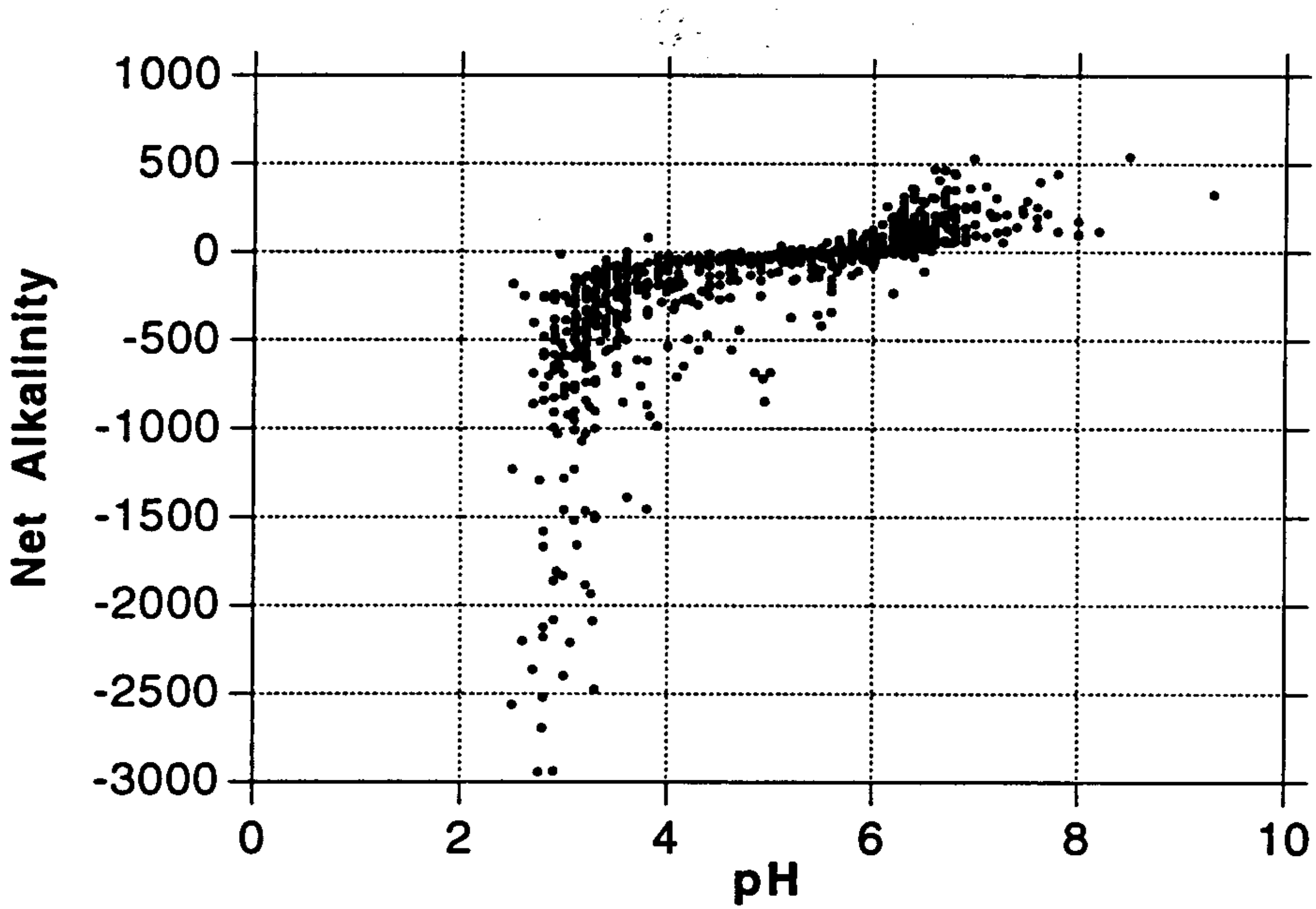



**Figure 1**. Net Alkalinity vs. pH. Taken from Figure 1.2 Graph C, pages 1-5, of Coal Mine Drainage Prediction and Pollution Prevention in Pennsylvania

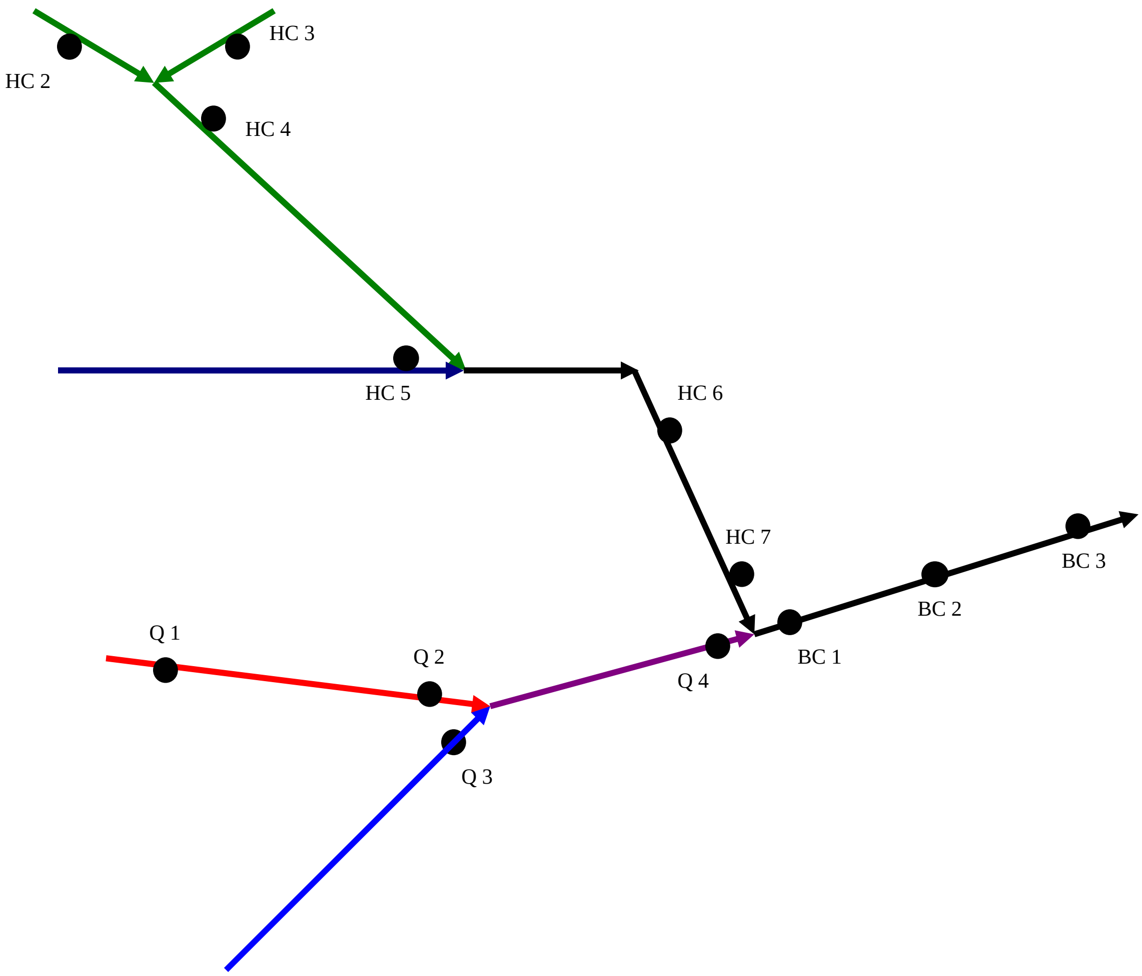
# *Attachment C*

## TMDLs By Segment

**Black Creek Watershed Sampling Stations Diagram**
Arrows represent direction of flow
Diagram not to scale

**Hazle Creek HQ CWF H2-H4**
**Beaver Creek CWF HC5**
**Black Creek CWF HC6-HC7 & BC1-BC3**
**Wetzle Creek CWF Q1-Q2**
**Quakake Creek HQ CWF Q3**
**Quakake Creek CWF Q4**

High Quality Cold Water Fishery (HQ CWF)



**Black Creek Watershed**

The TMDL for the Black Creek Watershed consists of load allocations for three sampling stations along Hazle Creek, one sampling station along Beaver Creek, two sampling stations along Wetzle Creek, two sampling stations along Quakake Creek, and five sampling stations along Black Creek.

The Black Creek Watershed is listed for metals and pH from AMD as being the cause of the degradation to the stream. The method and rationale for addressing pH is contained in Attachment B.

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

**HC 2 Hazle Creek Headwaters**

The TMDL for this sample point on Hazle Creek consists of a load allocation to the segment upstream to the source. The load allocation for this segment was computed using water-quality sample data collected at point HC 2. The average flow, measured at HC 2 (0.28 MGD), is used for these computations.

The pH will be addressed in this TMDL because of the mining impacts. The objective is to reduce acid loading to the stream, which will in turn raise the pH to the desired range and keep a net alkalinity above zero, 99% of the time. The result of this analysis is an acid loading reduction that equates to meeting standards for pH (see TMDL Endpoint section in the report, Table 2). The method and rationale for addressing pH is contained in Attachment B.

**Table C1. Load Allocations for Point HC 2**

| | Measured Sample Data | | Allowable | |
|---|---|---|---|---|
| Parameter | Conc. (mg/l) | Load (lbs/day) | Conc. (mg/l) | Load (lbs/day) |
| Al | 0.36 | 0.83 | 0.07 | 0.16 |
| Fe | ND | ND | NA | NA |
| Mn | 0.14 | 0.33 | 0.001 | 0.003 |
| Acid | 21.53 | 49.57 | 2.80 | 6.44 |
| Alk | 5.47 | 12.58 | | |

| Table C2. Calculation of Load Reductions Necessary at Point HC 2 | | | |
|---|---|---|---|
| | Al (lb/day) | Mn (lbs/day) | Acidity (lbs/day) |
| Existing Load | 0.83 | 0.33 | 49.57 |
| Allowable Load = TMDL | 0.16 | 0.003 | 6.44 |
| Load Reduction | 0.68 | 0.327 | 43.13 |
| % Reduction Segment | 81 | 99.1 | 87 |

**HC 3 Hazle Creek at Hazlebrook Discharge**

The TMDL for this sample point on Hazle Creek consists of a load allocation to the segment upstream to the source. The load allocation for this segment was computed using water-quality sample data collected at point HC 3. The average flow, measured at HC 3 (2.34 MGD), is used for these computations.

The pH will be addressed in this TMDL because of the mining impacts. The objective is to reduce acid loading to the stream, which will in turn raise the pH to the desired range and keep a net alkalinity above zero, 99% of the time. The result of this analysis is an acid loading reduction that equates to meeting standards for pH (see TMDL Endpoint section in the report, Table 2). The method and rationale for addressing pH is contained in Attachment B.

| Table C3. Load Allocations for Point HC 3 | | | | |
|---|---|---|---|---|
| | Measured Sample Data | | Allowable | |
| Parameter | Conc. (mg/l) | Load (lbs/day) | Conc. (mg/l) | Load (lbs/day) |
| Al | 0.95 | 18.44 | 0.09 | 1.84 |
| Fe | 2.35 | 45.79 | 0.05 | 0.92 |
| Mn | 0.30 | 5.75 | 0.01 | 0.12 |
| Acid | 21.40 | 417.12 | 9.20 | 179.36 |
| Alk | 4.80 | 93.56 | | |

| Table C4. Calculation of Load Reductions Necessary at Point HC 3 | | | | |
|---|---|---|---|---|
| | Al (lb/day) | Fe (lbs/day) | Mn (lbs/day) | Acidity (lbs/day) |
| Existing Load | 18.44 | 45.79 | 5.75 | 417.12 |
| Allowable Load = TMDL | 1.84 | 0.92 | 0.12 | 179.36 |
| Load Reduction | 16.60 | 44.88 | 5.64 | 237.76 |
| % Reduction Segment | 90 | 98 | 98 | 57 |

**HC 4 Hazle Creek Downstream of HC 2 & HC 3**

The TMDL for this sample point on Hazle Creek consists of a load allocation to the watershed area between sample points HC 2, HC 3 and HC 4. The load allocation for this segment of Hazle Creek was computed using water-quality sample data collected at point HC 4. The average flow, measured at HC 4 (3.57 MGD), is used for these computations.

The pH will be addressed in this TMDL because of the mining impacts. The objective is to reduce acid loading to the stream, which will in turn raise the pH to the desired range and keep a net alkalinity above zero, 99% of the time. The result of this analysis is an acid loading reduction that equates to meeting standards for pH (see TMDL Endpoint section in the report, Table 2). The method and rationale for addressing pH is contained in Attachment B.

**Table C5. Load Allocations for Point HC 4**

| | Measured Sample Data | | Allowable | |
|---|---|---|---|---|
| Parameter | Conc. (mg/l) | Load (lbs/day) | Conc. (mg/l) | Load (lbs/day) |
| Al | 0.75 | 22.35 | 0.11 | 3.35 |
| Fe | 1.20 | 35.69 | 0.05 | 1.43 |
| Mn | 0.24 | 7.13 | 0.00 | 0.14 |
| Acid | 19.10 | 569.44 | 5.92 | 176.53 |
| Alk | 5.60 | 166.96 | | |

The calculated load reductions for all the loads that enter point HC 4 must be accounted for in the calculated reductions at sample point HC 4 shown in Table C6.

**Table C6. Calculation of Load Reduction at Point HC 4**

| | Al | Fe | Mn | Acidity |
|---|---|---|---|---|
| Existing Load | 22.35 | 35.69 | 7.13 | 569.44 |
| Difference in Existing Load between HC 2, HC 3 & HC 4 | 3.08 | -10.45 | 1.05 | 102.76 |
| Load tracked from HC 2 & HC 3 | 2.00 | 1.22 | 0.123 | 185.81 |
| Total Load tracked from HC 2 & HC 3 | 5.08 | 0.95 | 1.173 | 288.56 |
| Allowable Load at HC 4 | 3.35 | 1.43 | 0.14 | 176.53 |
| Load Reduction at HC 4 | 1.73 | 0.00 | 1.033 | 112.04 |
| % Reduction required at HC 4 | 34 | 0 | 88 | 39 |

**HC 5 Beaver Creek Mouth**

The TMDL for this sample point consists of a load allocation to the segment upstream to the source. The load allocation for this segment was computed using water-quality sample data collected at point HC 5. The average flow, measured at HC 5 (0.46 MGD), is used for these computations.

The pH will be addressed in this TMDL because of the mining impacts. The objective is to reduce acid loading to the stream, which will in turn raise the pH to the desired range and keep a net alkalinity above zero, 99% of the time. The result of this analysis is an acid loading reduction that equates to meeting standards for pH (see TMDL Endpoint section in the report, Table 2). The method and rationale for addressing pH is contained in Attachment B.

| Table C7. Load Allocations for Point HC 5 | | | | |
|---|---|---|---|---|
| | Measured Sample Data | | Allowable | |
| Parameter | Conc. (mg/l) | Load (lbs/day) | Conc. (mg/l) | Load (lbs/day) |
| Al | ND | ND | NA | NA |
| Fe | 0.36 | 1.37 | NA | NA |
| Mn | ND | ND | NA | NA |
| Acid | 19.76 | 74.99 | 2.57 | 9.75 |
| Alk | 11.28 | 42.81 | | |

| Table C8. Calculation of Load Reductions Necessary at Point HC 5 | |
|---|---|
| | Acidity (lbs/day) |
| Existing Load | 74.99 |
| Allowable Load = TMDL | 9.75 |
| Load Reduction | 65.24 |
| % Reduction Segment | 87 |

**HC 6 Black Creek Downstream of Beaver Creek Confluence**

The TMDL for this sample point on Black Creek consists of a load allocation to the watershed area between sample points HC 4, HC 5 and NC 6. The load allocation for this segment of Black Creek was computed using water-quality sample data collected at point HC 6. The average flow, measured at HC 6 (11.21 MGD), is used for these computations.

The pH will be addressed in this TMDL because of the mining impacts. The objective is to reduce acid loading to the stream, which will in turn raise the pH to the desired range and keep a net alkalinity above zero, 99% of the time. The result of this analysis is an acid loading reduction that equates to meeting standards for pH (see TMDL Endpoint section in the report, Table 2). The method and rationale for addressing pH is contained in Attachment B.

| Table C9. Load Allocations at Point HC 6 | | | | |
|---|---|---|---|---|
| | **Measured Sample Data** | | **Allowable** | |
| Parameter | Conc. (mg/l) | Load (lbs/day) | Conc. (mg/l) | Load (lbs/day) |
| Al | ND | ND | NA | NA |
| Fe | ND | ND | NA | NA |
| Mn | 0.07 | 6.75 | NA | NA |
| Acid | 6.55 | 612.19 | 2.55 | 238.76 |
| Alk | 8.30 | 775.76 | | |

The calculated load reductions for all the loads that enter point HC 6 must be accounted for in the calculated reductions at sample point HC 6 shown in Table C10.

| Table C10. Calculation of Load Reduction at Point HC 6 | |
|---|---|
| | Acidity (lbs/day) |
| Existing Load | 612.19 |
| Difference in Existing Load between HC 4,HC 5, & HC 6 | -32.24 |
| Load tracked from HC 4 & HC 5 | 186.28 |
| Total Load tracked from HC 4 & HC 5 | 176.96 |
| Allowable Load at HC 6 | 238.76 |
| Load Reduction at HC 6 | 0.00 |
| % Reduction required at HC 6 | 0 |

**HC 7 Black Creek Upstream of Quakake Creek Confluence**

The TMDL for this segment of Black Creek consists of a load allocation to the area between sample points HC 6 and HC 7. The load allocation for this segment was computed using water-quality sample data collected at point HC 7. The average flow, measured at HC 7 (19.97 MGD), is used for these computations.

The pH will be addressed in this TMDL because of the mining impacts. The objective is to reduce acid loading to the stream, which will in turn raise the pH to the desired range and keep a net alkalinity above zero, 99% of the time. The result of this analysis is an acid loading reduction that equates to meeting standards for pH (see TMDL Endpoint section in the report, Table 2). The method and rationale for addressing pH is contained in Attachment B.

| Table C11. Load Allocations for Point HC 7 | | | | |
|---|---|---|---|---|
| | Measured Sample Data | | Allowable | |
| Parameter | Conc. (mg/l) | Load (lbs/day) | Conc. (mg/l) | Load (lbs/day) |
| Al | 0.35 | 58.97 | 0.22 | 36.56 |
| Fe | 0.50 | 83.29 | 0.21 | 34.98 |
| Mn | 0.07 | 10.96 | NA | NA |
| Acid | 12.20 | 2032.19 | 4.51 | 751.91 |
| Alk | 12.76 | 2125.47 | | |

The calculated load reductions for all the loads that enter point HC 7 must be accounted for in the calculated reductions at sample point HC 7 shown in Table C12.

| Table C12. Calculation of Load Reduction at Point HC 7 | | | |
|---|---|---|---|
| | Al | Fe | Acidity |
| Existing Load | 58.97 | 83.29 | 2032.19 |
| Difference in Existing Load between HC 6 & HC 7 | 35.60 | 69.27 | 1420.00 |
| Load tracked from HC 6 | 23.37 | 14.02 | 238.76 |
| Total Load tracked from HC 6 | 58.97 | 83.29 | 1658.75 |
| Allowable Load at HC 7 | 36.56 | 34.98 | 751.91 |
| Load Reduction at HC 7 | 22.41 | 48.31 | 906.84 |
| % Reduction required at HC 7 | 38 | 58 | 55 |

**Q 1 Wetzle Creek Headwaters**

The TMDL for this sample point consists of a load allocation to the segment upstream to the source. The load allocation for this segment was computed using water-quality sample data collected at point Q 1. The average flow, measured at Q 1 (8.94 MGD), is used for these computations.

The pH will be addressed in this TMDL because of the mining impacts. The objective is to reduce acid loading to the stream, which will in turn raise the pH to the desired range and keep a net alkalinity above zero, 99% of the time. The result of this analysis is an acid loading reduction that equates to meeting standards for pH (see TMDL Endpoint section in the report, Table 2). The method and rationale for addressing pH is contained in Attachment B.

**Table C13. Load Allocations for Point Q 1**

| | Measured Sample Data | | Allowable | |
|---|---|---|---|---|
| Parameter | Conc. (mg/l) | Load (lbs/day) | Conc. (mg/l) | Load (lbs/day) |
| Al | 5.32 | 396.63 | 0.48 | 35.70 |
| Fe | 0.53 | 39.33 | NA | NA |
| Mn | 1.41 | 104.83 | 0.76 | 56.61 |
| Acid | 1.43 | 106.90 | NA | NA |
| Alk | 55.30 | 4124.25 | | |

**Table C14. Calculation of Load Reductions Necessary at Point Q 1**

| | Al (lb/day) | Mn (lbs/day) |
|---|---|---|
| Existing Load | 396.63 | 104.83 |
| Allowable Load = TMDL | 35.70 | 56.61 |
| Load Reduction | 360.93 | 48.22 |
| % Reduction Segment | 91 | 46 |

**Q 2 Wetzle Creek Mouth**

The TMDL for this segment of Wetzle Creek consists of a load allocation to the area between sample points Q 1 and Q 2. The load allocation for this segment was computed using water-quality sample data collected at point Q 2. The average flow, measured at Q 2 (9.93 MGD), is used for these computations.

The pH will be addressed in this TMDL because of the mining impacts. The objective is to reduce acid loading to the stream, which will in turn raise the pH to the desired range and keep a net alkalinity above zero, 99% of the time. The result of this analysis is an acid loading reduction that equates to meeting standards for pH (see TMDL Endpoint section in the report, Table 2). The method and rationale for addressing pH is contained in Attachment B.

| Table C15. Load Allocations for Point Q 2 | | | | |
|---|---|---|---|---|
| | Measured Sample Data | | Allowable | |
| Parameter | Conc. (mg/l) | Load (lbs/day) | Conc. (mg/l) | Load (lbs/day) |
| Al | 4.66 | 386.02 | 0.47 | 38.60 |
| Fe | 0.38 | 31.81 | NA | NA |
| Mn | 1.23 | 102.10 | 0.64 | 53.09 |
| Acid | 3.40 | 281.51 | NA | NA |
| Alk | 52.47 | 4344.14 | | |

The calculated load reductions for all the loads that enter point Q 2 must be accounted for in the calculated reductions at sample point Q 2 shown in Table C16.

| Table C16. Calculation of Load Reduction at Point Q 2 | |
|---|---|
| | Mn |
| Existing Load | 102.10 |
| Difference in Existing Load between Q1 & Q2 | -2.73 |
| Load tracked from Q1 | 56.61 |
| Total Load tracked from Q1 | 55.14 |
| Allowable Load at Q2 | 53.09 |
| Load Reduction at Q2 | 2.04 |
| % Reduction required at Q2 | 4 |

**Q 3 Quakake Creek Headwaters**

Biological assessments demonstrate that the Quakake Creek segment from Q3 to source is attaining its designated uses. Because its uses are being attained, no TMDL is necessary.

**Q 4 Quakake Creek Mouth**

The TMDL for this segment of Quakake Creek consists of a load allocation to the area between sample points Q 2 and Q 4. The load allocation for this segment was computed using water-quality sample data collected at point Q 4. The average flow, measured at Q 4 (31.09 MGD), is used for these computations.

The pH will be addressed in this TMDL because of the mining impacts. The objective is to reduce acid loading to the stream, which will in turn raise the pH to the desired range and keep a net alkalinity above zero, 99% of the time. The result of this analysis is an acid loading reduction that equates to meeting standards for pH (see TMDL Endpoint section in the report, Table 2). The method and rationale for addressing pH is contained in Attachment B.

| Table C17. Load Allocations for Point Q 4 | | | | |
|---|---|---|---|---|
| | Measured Sample Data | | Allowable | |
| Parameter | Conc. (mg/l) | Load (lbs/day) | Conc. (mg/l) | Load (lbs/day) |
| Al | 2.12 | 549.17 | 0.32 | 82.38 |
| Fe | 0.23 | 59.94 | NA | NA |
| Mn | 0.57 | 148.18 | 0.39 | 100.76 |
| Acid | 30.17 | 7821.83 | 2.41 | 625.75 |
| Alk | 7.47 | 1936.01 | | |

The calculated load reductions for all the loads that enter point Q 4 must be accounted for in the calculated reductions at sample point Q 4 shown in Table C18.

| Table C18. Calculation of Load Reduction at Point Q 4 | | |
|---|---|---|
| | Al | Acidity |
| Existing Load | 549.17 | 7821.83 |
| Difference in Existing Load between Q 2, Q 3, & Q 4 | 132.85 | 5875.61 |
| Load tracked from Q 2 & Q 3 | 68.91 | 647.75 |
| Total Load tracked from Q 2 & Q 3 | 201.75 | 6523.36 |
| Allowable Load at Q 4 | 82.38 | 625.75 |
| Load Reduction at Q 4 | 119.38 | 5897.61 |
| % Reduction required at Q 4 | 59 | 90 |

**BC 1 Black Creek Downstream of Quakake Creek Confluence**

The TMDL for this segment of Black Creek consists of a load allocation to the area between sample points HC 7, Q 4 and BC 1. The load allocation for this segment was computed using water-quality sample data collected at point BC 1. The average flow, measured at BC 1 (62.96 MGD), is used for these computations.

The pH will be addressed in this TMDL because of the mining impacts. The objective is to reduce acid loading to the stream, which will in turn raise the pH to the desired range and keep a net alkalinity above zero, 99% of the time. The result of this analysis is an acid loading reduction that equates to meeting standards for pH (see TMDL Endpoint section in the report, Table 2). The method and rationale for addressing pH is contained in Attachment B.

| Table C19. Load Allocations for Point BC 1 | | | | |
|---|---|---|---|---|
| | Measured Sample Data | | Allowable | |
| Parameter | Conc. (mg/l) | Load (lbs/day) | Conc. (mg/l) | Load (lbs/day) |
| Al | 1.51 | 791.70 | 0.29 | 150.42 |
| Fe | 0.25 | 132.49 | NA | NA |
| Mn | 0.41 | 216.06 | 0.33 | 175.01 |
| Acid | 24.73 | 12986.48 | 1.98 | 1038.92 |
| Alk | 7.50 | 3937.95 | | |

The calculated load reductions for all the loads that enter point BC 1 must be accounted for in the calculated reductions at sample point BC 1 shown in Table C20.

| Table C20. Calculation of Load Reduction at Point BC 1 | | |
|---|---|---|
| | Al | Acidity |
| Existing Load | 791.70 | 12986.48 |
| Difference in Existing Load between HC 7, Q 4, & BC 1 | 183.57 | 3132.45 |
| Load tracked from HC 7 & Q 4 | 118.94 | 1377.66 |
| Total Load tracked from HC 7 & Q 4 | 302.50 | 4510.11 |
| Allowable Load at BC 1 | 150.42 | 1038.92 |
| Load Reduction at BC 1 | 152.08 | 3471.19 |
| % Reduction required at BC 1 | 50 | 77 |

**BC 2 Black Creek Main Stem**

The TMDL for this segment of Narrows Creek consists of a load allocation to the area between sample points BC 1 and BC 2. The load allocation for this segment was computed using water-quality sample data collected at point BC 2. The average annual flow, derived using the US Geological Survey Streamstats Tool at BC 2 (79.50 MGD), is used for these computations.

The pH will be addressed in this TMDL because of the mining impacts. The objective is to reduce acid loading to the stream, which will in turn raise the pH to the desired range and keep a net alkalinity above zero, 99% of the time. The result of this analysis is an acid loading reduction that equates to meeting standards for pH (see TMDL Endpoint section in the report, Table 2). The method and rationale for addressing pH is contained in Attachment B.

| Table C21. Load Allocations for Point BC 2 | | | | |
|---|---|---|---|---|
| | Measured Sample Data | | Allowable | |
| Parameter | Conc. (mg/l) | Load (lbs/day) | Conc. (mg/l) | Load (lbs/day) |
| Al | 1.13 | 748.67 | 0.41 | 269.52 |
| Fe | 0.29 | 192.28 | NA | NA |
| Mn | 0.35 | 230.07 | NA | NA |
| Acid | 19.90 | 13194.30 | 1.79 | 1187.49 |
| Alk | 7.50 | 4972.73 | | |

The calculated load reductions for all the loads that enter point BC 2 must be accounted for in the calculated reductions at sample point BC 2 shown in Table C22.

| Table C22. Calculation of Load Reduction at Point BC 2 | |
|---|---|
| | Acidity |
| Existing Load | 13194.30 |
| Difference in Existing Load between BC 1 & BC 2 | 207.82 |
| Load tracked from BC 1 | 1038.92 |
| Total Load tracked from BC 1 | 1246.74 |
| Allowable Load at BC 2 | 1187.49 |
| Load Reduction at BC 2 | 59.25 |
| % Reduction required at BC 2 | 5 |

**BC 3 Black Creek Mouth**

The TMDL for this segment of Narrows Creek consists of a load allocation to the area between sample points BC 2 and BC 3. The load allocation for this segment was computed using water-quality sample data collected at point BC 3. The average annual flow, derived using the US Geological Survey Streamstats Tool at BC 3 (83.37 MGD), is used for these computations.

The pH will be addressed in this TMDL because of the mining impacts. The objective is to reduce acid loading to the stream, which will in turn raise the pH to the desired range and keep a net alkalinity above zero, 99% of the time. The result of this analysis is an acid loading reduction that equates to meeting standards for pH (see TMDL Endpoint section in the report, Table 2). The method and rationale for addressing pH is contained in Attachment B.

| Table C23. Load Allocations for Point BC 3 | | | | |
|---|---|---|---|---|
| | Measured Sample Data | | Allowable | |
| Parameter | Conc. (mg/l) | Load (lbs/day) | Conc. (mg/l) | Load (lbs/day) |
| Al | 1.12 | 776.54 | 0.31 | 217.43 |
| Fe | 0.23 | 157.02 | 0.23 | 157.02 |
| Mn | 0.34 | 237.22 | 0.34 | 237.22 |
| Acid | 15.44 | 10735.52 | 2.01 | 1395.62 |
| Alk | 7.67 | 5330.68 | | |

The calculated load reductions for all the loads that enter point BC 3 must be accounted for in the calculated reductions at sample point BC 3 shown in Table C24.

| Table C24. Calculation of Load Reduction at Point BC 3 | |
|---|---|
| | Al |
| Existing Load | 776.54 |
| Difference in Existing Load between BC 2 & BC 3 | 27.87 |
| Load tracked from BC 2 | 269.52 |
| Total Load tracked from BC 2 | 297.39 |
| Allowable Load at BC 3 | 217.43 |
| Load Reduction at BC 3 | 79.96 |
| % Reduction required at BC 3 | 27 |

**Margin of Safety (MOS)**

PADEP used an implicit MOS in these TMDLs derived from the Monte Carlo statistical analysis. The Water-Quality standard states that water-quality criteria must be met at least 99% of the time. All of the @Risk analyses results surpass the minimum 99% level of protection. Another margin of safety used for this TMDL analysis results from:

A MOS is added when the calculations were performed with a daily iron average instead of the 30-day average.

**Seasonal Variation**

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

**Critical Conditions**

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

# *Attachment D*

## Use of Reference Stream Water Quality for High Quality Waters

Streams placed on the 1996 303 (d) list with a designated use of high quality (HQ) will be subject to Pennsylvania's anti degradation policy. Therefore, DEP must establish instream goals for TMDLs that restore the waterbody to existing (pre-mining) quality. This is accomplished by sampling an unaffected stretch of stream to use as a reference. This stretch typically is the headwaters segment of the high quality stream in question. If an unaffected stretch isn't available, a nearby-unimpaired stream will function as a surrogate reference. The reference stream data will be selected from statewide ambient Water Quality Network (WQN) stations. To determine which WQN station represents existing water quality appropriate for use in developing TMDLs for HQ waters, alkalinity and drainage area are considered.

1. First step is to match alkalinities of the TMDL stream and WQN reference stream. If alkalinities for candidate stream are not available, use pH as a surrogate. As a last resort, if neither pH nor alkalinity are available, match geologies using current geological maps.

2. The second consideration is drainage area.

3. Finally, from the subset of stations with similar alkalinity and drainage area select the station nearest the TMDL stream.

Once a reference stream is selected, the 95th percentile confidence limit on the median for aluminum, iron and manganese is used as the applicable water quality criteria and run the @Risk model.

# *Attachment E*

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

The following are excerpts from the Pennsylvania DEP Section 303(d) narratives that justify changes in listings between the 1996, 1998, and 2002 303(d) Lists and the 2004 and 2006 Integrated Water Quality Report. The Section 303(d) listing process has undergone an evolution in Pennsylvania since the development of the 1996 list.

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

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

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

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

## Migration to National Hydrography Data (NHD)

New to the 2006 report is use of the 1/24,000 National Hydrography Data (NHD) streams GIS layer. Up until 2006 the Department relied upon its own internally developed stream layer. Subsequently, the United States Geologic Survey (USGS) developed 1/24,000 NHD streams layer for the Commonwealth based upon national geodatabase standards. In 2005, DEP contracted with USGS to add missing streams and correct any errors in the NHD. A GIS contractor transferred the old DEP stream assessment information to the improved NHD and the old DEP streams layer was archived. Overall, this marked an improvement in the quality of the streams layer and made the stream assessment data compatible with national standards but it necessitated a change in the Integrated Listing format. The NHD is not attributed with the old DEP five digit stream codes so segments can no longer be listed by stream code but rather only by stream name or a fixed combination of NHD fields known as reachcode and ComID. The NHD is aggregated by Hydrologic Unit Code (HUC) watersheds so HUCs rather than the old State Water Plan (SWP) watersheds are now used to group streams together. A more basic change was the shift in data management philosophy from one of “dynamic segmentation” to “fixed segments”. The dynamic segmentation records were proving too difficult to mange from an historical tracking perspective. The fixed segment methods will remedy that problem. The stream assessment data management has gone through many changes over the years as system requirements and software changed. It is hoped that with the shift to the NHD and OIT’s (Office of Information Technology) fulltime staff to manage and maintain SLIMS the systems and formats will now remain stable over many Integrated Listing cycles.

# *Attachment F*

## Water Quality Data Used In TMDL Calculations

**Monitoring Point: HC 2 Hazle Creek Headwaters**

| Date Collected | HOT A MG/L | ALK MG/L | Al MG/L | Fe MG/L | Mn MG/L |
|---|---|---|---|---|---|
| 10/17/07 | 45.8 | 4.2 | 0.587 | 0.150 | 0.286 |
| 3/18/08 | 10.4 | 6.0 | 0.250 | 0.150 | 0.066 |
| 4/23/08 | 8.4 | 6.2 | 0.250 | 0.150 | 0.072 |
| avg= | ***21.53*** | ***5.5*** | ***0.362*** | ***0.150*** | ***0.141*** |
| stdev= | ***21.04*** | ***1.1*** | ***0.195*** | ***0.000*** | ***0.125*** |

**Monitoring Point: HC 3 Hazle Creek at Hazlebrook Discharge**

| Date Collected | HOT A MG/L | ALK MG/L | FE MG/L | MN MG/L | AL MG/L |
|---|---|---|---|---|---|
| 9/5/07 | 22.8 | 2.8 | 0.971 | 2.320 | 0.312 |
| 10/17/07 | 24.8 | 4.4 | 0.782 | 2.920 | 0.274 |
| 3/18/08 | 24.2 | 5.4 | 1.470 | 2.886 | 0.383 |
| 4/23/08 | 14.8 | 6.4 | 0.568 | 0.659 | 0.213 |
| 8/7/08 | 20.4 | 5.0 | 0.940 | 2.962 | 0.293 |
| avg= | ***21.40*** | ***4.800*** | ***0.946*** | ***2.349*** | ***0.295*** |
| stdev= | ***4.06*** | ***1.334*** | ***0.334*** | ***0.981*** | ***0.062*** |

**Monitoring Point: HC 4 Hazle Creek Downstream of HC 2 & HC 3**

| Date Collected | HOT A MG/L | ALK MG/L | FE MG/L | MN MG/L | AL MG/L |
|---|---|---|---|---|---|
| 10/17/07 | 30.0 | 4.6 | 0.722 | 1.300 | 0.257 |
| 3/18/08 | 14.8 | 6.6 | 0.882 | 1.297 | 0.232 |
| 4/23/08 | 12.2 | 6.6 | 0.511 | 0.403 | 0.183 |
| 8/7/08 | 19.4 | 4.6 | 0.884 | 1.788 | 0.284 |
| avg= | ***19.10*** | ***5.60*** | ***0.750*** | ***1.197*** | ***0.239*** |
| stdev= | ***7.85*** | ***1.15*** | ***0.176*** | ***0.577*** | ***0.043*** |

**Monitoring Point: HC 5 Beaver Creek Mouth**

| Date Collected | HOT A MG/L | ALK MG/L | FE MG/L | MN MG/L | AL MG/L |
|---|---|---|---|---|---|
| 9/5/07 | 36.2 | 11.4 | 0.250 | 0.572 | 0.025 |
| 10/17/07 | 38.2 | 12.6 | 0.250 | 0.562 | 0.025 |
| 11/14/08 | 2.8 | 12.8 | 0.250 | 0.150 | 0.025 |
| 3/31/08 | 11.6 | 9.6 | 0.250 | 0.150 | 0.025 |
| 4/21/08 | 10.0 | 10.0 | 0.250 | 0.369 | 0.025 |
| avg= | ***19.76*** | ***11.28*** | ***0.250*** | ***0.361*** | ***0.025*** |
| stdev= | ***16.28*** | ***1.46*** | ***0.000*** | ***0.209*** | ***0.000*** |

**Monitoring Point: HC 6 — Black Creek Downstream of Beaver & Hazle Creeks**

| Date Collected | HOT A MG/L | ALK MG/L | FE MG/L | MN MG/L | AL MG/L |
|---|---|---|---|---|---|
| 9/5/07 | 11.8 | 8.6 | 0.250 | 0.150 | 0.063 |
| 11/14/07 | 3.8 | 9.0 | 0.250 | 0.150 | 0.065 |
| 3/31/08 | 7.8 | 7.4 | 0.250 | 0.150 | 0.082 |
| 4/21/08 | 2.8 | 8.2 | 0.250 | 0.150 | 0.079 |
| avg= | ***6.55*** | ***8.30*** | ***0.250*** | ***0.150*** | ***0.072*** |
| stdev= | ***4.11*** | ***0.68*** | ***0.000*** | ***0.000*** | ***0.010*** |

**Monitoring Point: HC 7 — Black Creek Upstream of Quakake Creek**

| Date Collected | HOT A MG/L | ALK MG/L | FE MG/L | MN MG/L | AL MG/L |
|---|---|---|---|---|---|
| 9/12/07 | 10.8 | 12.2 | 0.250 | 0.150 | 0.025 |
| 10/25/07 | 23.2 | 16.2 | 0.250 | 0.150 | 0.083 |
| 11/15/07 | 6.8 | 11.4 | 0.770 | 1.900 | 0.092 |
| 3/17/08 | 8.6 | 9.0 | 0.250 | 0.150 | 0.068 |
| 4/21/08 | 11.6 | 15.0 | 0.250 | 0.150 | 0.061 |
| avg= | ***12.20*** | ***12.76*** | ***0.354*** | ***0.500*** | ***0.066*** |
| stdev= | ***6.43*** | ***2.88*** | ***0.233*** | ***0.783*** | ***0.026*** |

**Monitoring Point: Q 1 — Wetzle Creek Headwaters**

| Date Collected | HOT A MG/L | ALK MG/L | Al MG/L | Fe MG/L | Mn MG/L |
|---|---|---|---|---|---|
| 9/12/07 | 0.0 | 90.4 | 6.840 | 0.706 | 1.710 |
| 10/24/07 | 0.8 | 73.0 | 5.600 | 0.589 | 1.310 |
| 11/13/08 | 1.8 | 47.6 | 5.690 | 0.523 | 1.410 |
| 3/31/08 | 2.8 | 41.6 | 4.250 | 0.395 | 1.210 |
| 4/17/08 | 1.2 | 33.2 | 4.643 | 0.454 | 1.341 |
| 7/21/08 | 2.0 | 46.0 | 4.886 | 0.497 | 1.453 |
| avg= | ***1.43*** | ***55.30*** | ***5.318*** | ***0.527*** | ***1.406*** |
| stdev= | ***0.98*** | ***21.76*** | ***0.929*** | ***0.109*** | ***0.171*** |

**Monitoring Point: Q 2 — Wetzle Creek Mouth**

| Date Collected | HOT A MG/L | ALK MG/L | FE MG/L | MN MG/L | AL MG/L |
|---|---|---|---|---|---|
| 9/12/07 | 2.0 | 89.4 | 6.330 | 0.397 | 1.600 |
| 10/24/07 | 4.6 | 76.4 | 3.720 | 0.690 | 0.875 |
| 11/14/07 | 3.6 | 40.8 | 4.850 | 0.326 | 1.220 |
| 3/31/08 | 4.0 | 35.8 | 3.960 | 0.401 | 1.100 |
| 4/17/08 | 2.4 | 30.0 | 4.484 | 0.341 | 1.228 |
| 7/21/08 | 3.8 | 42.4 | 4.629 | 0.150 | 1.376 |
| avg= | ***3.40*** | ***52.47*** | ***4.662*** | ***0.384*** | ***1.233*** |
| stdev= | ***1.00*** | ***24.32*** | ***0.920*** | ***0.176*** | ***0.245*** |

| Monitoring Point: | Q 3 | | Quakake Creek Headwaters | | |
|---|---|---|---|---|---|
| **Date Collected** | **HOT A MG/L** | **ALK MG/L** | **FE MG/L** | **MN MG/L** | **AL MG/L** |
| 9/12/07 | 17.8 | 8.8 | 0.250 | 0.150 | 0.025 |
| 10/24/07 | 14.0 | 20.6 | 0.250 | 0.359 | 0.057 |
| 11/14/07 | 13.0 | 1.4 | 0.250 | 0.150 | 0.025 |
| 3/17/08 | 9.2 | 4.2 | 0.250 | 0.150 | 0.025 |
| 4/17/08 | 9.0 | 0.6 | 0.250 | 0.150 | 0.025 |
| 7/21/08 | 19.4 | 0.0 | 0.250 | 0.150 | 0.050 |
| avg= | ***13.73*** | ***5.93*** | ***0.250*** | ***0.185*** | ***0.035*** |
| stdev= | ***4.29*** | ***7.88*** | ***0.000*** | ***0.085*** | ***0.015*** |

| Monitoring Point: | Q 4 | | Quakake Creek Mouth | | |
|---|---|---|---|---|---|
| **Date Collected** | **HOT A MG/L** | **ALK MG/L** | **Al MG/L** | **Fe MG/L** | **Mn MG/L** |
| 9/12/07 | 42.6 | 7.2 | 2.600 | 0.150 | 0.737 |
| 10/24/07 | 54.8 | 6.8 | 1.900 | 0.637 | 0.419 |
| 11/13/07 | 15.2 | 8.0 | 1.630 | 0.150 | 0.423 |
| 3/17/08 | 16.0 | 7.2 | 1.284 | 0.150 | 0.312 |
| 4/21/08 | 26.2 | 8.2 | 1.747 | 0.150 | 0.506 |
| 7/23/08 | 26.2 | 7.4 | 3.547 | 0.150 | 1.032 |
| avg= | ***30.17*** | ***7.47*** | ***2.118*** | ***0.231*** | ***0.572*** |
| stdev= | ***15.60*** | ***0.53*** | ***0.824*** | ***0.199*** | ***0.267*** |

| Monitoring Point: | BC 1 | | Black Creek Confluence of Quakake Creek | | |
|---|---|---|---|---|---|
| **Date Collected** | **HOT A MG/L** | **ALK MG/L** | **FE MG/L** | **MN MG/L** | **AL MG/L** |
| 9/17/07 | 51.6 | 7.4 | 2.560 | 0.150 | 0.703 |
| 10/25/07 | 42.8 | 7.8 | 0.815 | 0.150 | 0.244 |
| 11/15/07 | 14.8 | 7.4 | 1.360 | 0.764 | 0.228 |
| 3/17/08 | 12.2 | 7.2 | 0.854 | 0.150 | 0.217 |
| 4/22/08 | 17.0 | 7.8 | 1.255 | 0.150 | 0.367 |
| 8/20/08 | 10.0 | 7.4 | 2.203 | 0.150 | 0.710 |
| avg= | ***24.73*** | ***7.50*** | ***1.508*** | ***0.252*** | ***0.412*** |
| stdev= | ***17.78*** | ***0.24*** | ***0.719*** | ***0.251*** | ***0.235*** |

| Monitoring Point: | BC 2 | Black Creek | | | |
|---|---|---|---|---|---|
| **Date Collected** | **HOT A MG/L** | **ALK MG/L** | **FE MG/L** | **MN MG/L** | **AL MG/L** |
| 9/17/07 | 37.8 | 7.4 | 1.500 | 0.150 | 0.565 |
| 10/25/07 | 40.2 | 8.2 | 0.824 | 0.389 | 0.245 |
| 11/15/07 | 11.6 | 7.4 | 1.490 | 0.751 | 0.223 |
| 3/17/08 | 14.0 | 7.0 | 0.790 | 0.150 | 0.196 |
| 4/22/08 | 13.8 | 7.8 | 1.207 | 0.150 | 0.358 |
| 8/20/08 | 2.0 | 7.2 | 0.964 | 0.150 | 0.495 |
| avg= | ***19.90*** | ***7.50*** | ***1.129*** | ***0.290*** | ***0.347*** |
| stdev= | ***15.45*** | ***0.43*** | ***0.319*** | ***0.245*** | ***0.154*** |

| Monitoring Point: | BC 3 | Black Creek Mouth | | | |
|---|---|---|---|---|---|
| **Date Collected** | **HOT A MG/L** | **ALK MG/L** | **FE MG/L** | **MN MG/L** | **AL MG/L** |
| 9/17/07 | 38.8 | 8.0 | 1.900 | 0.150 | 0.607 |
| 10/25/07 | | 8.0 | 0.670 | 0.150 | 0.223 |
| 11/15/07 | 12.2 | 7.6 | 1.680 | 0.605 | 0.224 |
| 3/17/08 | 12.4 | 7.2 | 0.751 | 0.150 | 0.221 |
| 4/22/08 | 9.4 | 7.8 | 0.934 | 0.150 | 0.304 |
| 8/20/08 | 4.4 | 7.4 | 0.766 | 0.150 | 0.468 |
| avg= | ***9.60*** | ***7.60*** | ***0.960*** | ***0.241*** | ***0.288*** |
| stdev= | ***3.73*** | ***0.32*** | ***0.414*** | ***0.203*** | ***0.107*** |

# *Attachment G*

## Comment and Response

No public comments were received for the Black Creek Watershed TMDL.

# *Attachment H*

## TMDLs and NPDES Permitting Coordination

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

**Load Tracking Mechanisms**

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

**Options for Permittees in TMDL Watersheds**

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

**Options identified**

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

## Other possible options

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

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

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