FINAL

ELK CREEK WATERSHED TMDL

Cambria County

For Acid Mine Drainage Affected Segments

Prepared by:

Pennsylvania Department of Environmental Protection

January 14, 2005

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Introduction

This report presents the Total Maximum Daily Loads (TMDLs) developed for segments in the Elk Creek Watershed (Attachments A). These were done to address the impairments noted on the 1996 Pennsylvania Section 303(d) list of impaired waters, required under the Clean Water Act, and covers two segments[2] on this list (shown in Table 1). In 1999 a portion of the watershed was resurveyed and split into three new segment ids. High levels of metals and other inorganics caused these impairments. All impairments resulted from acid drainage from abandoned coalmines. The TMDL addresses the three primary metals associated with acid mine drainage (iron, manganese, aluminum) and pH.

Table 1. 303(d) Sub-List								
State Water Plan (SWP) Subbasin: 18-D Two Lick Creek								
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
1996	4.6	5084	44523	Elk Creek	CWF	305(b) Report	RE	Metals
1996	2.4	5084	44523	Elk Creek	CWF	305(b) Report	RE	Other Inorganics
1998	8.37	5084	44523	Elk Creek	CWF	SWMP	AMD	Metals & Other Inorganics
2002	5.0	5084	44523	Elk Creek	CWF	SWMP	AMD	Metals & Other Inorganics
2002	1.6	New survey; new id. 990222-1030-ALF	44523	Elk Creek	CWF	SWMP	AMD	Metals
2002	1.2	New survey; new id. 990222-1100-ALF	44523	Elk Creek	CWF	SWMP	AMD	Metals
2002	0.5	New survey; new id. 990222-1300-ALF	44523	Elk Creek	CWF	SWMP	AMD	Metals

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

[2] Elk Creek segment 5084 is listed twice on the 1996 Section 303(d) List, once for each cause of impairment.

Table 1. 303(d) Sub-List								
State Water Plan (SWP) Subbasin: 18-D Two Lick Creek								
Year	**Miles**	**Segment ID**	**DEP Stream Code**	**Stream Name**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
Impairment Causes for which TMDLs are not completed								
2002	1.6	990222-1030-ALF	44523	Elk Creek	CWF	SWMP	AMD HM	Siltation Siltation
2002	1.2	990222-1100-ALF	44523	Elk Creek	CWF	SWMP	AMD	Siltation
2002	0.5	990222-1300-ALF	44523	Elk Creek	CWF	SWMP	AMD	Siltation

Resource Extraction=RE
Cold Water Fishes = CWF
Surface Water Monitoring Program = SWMP
Abandoned Mine Drainage = AMD
Habitat Modification = HM

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

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

Elk Creek is also included on the 2002 PA Section 303(d) List for siltation impairments from AMD and Habitat Modifications. Siltation is not addressed in this TMDL, but will be addressed at a later date.

Directions to the Elk Creek Watershed

The Elk Creek Watershed is located in southwestern Pennsylvania, occupying the central portion of Cambria County. The watershed area is found on the United States Geological Survey maps covering portions of Colver and Strongstown, PA 7.5-Minute Quadrangles. The area within the watershed consists of 22.8 square miles. Land uses within the watershed include agriculture, abandoned mine lands, forestland, and rural residential properties with small communities throughout the area. The town of Colver, formerly a coal mining and railroad town, is located at the headwaters of Elk Creek along S.R. 4002. The mouth of Elk Creek is located at White Mill Crossing in Blacklick Township, Cambria County at the 422 Bridge over Blacklick Creek.

The watershed area lies within the Allegheny Mountain section of the Appalachian Plateau Province, characterized by broad, open folds, and relatively gentle flank dips. Elevations range from a low at the confluence of Elk Creek and Blacklick Creek of 1,560 feet above sea level to the ridges along the headwaters of Elk Creek at over 2,220 feet above sea level.

Segments addressed in this TMDL

There are two active mining operations in the watershed. The Maple Coal Company Colver Site, SMP Number 11900201 (NPDES PA0599051), is a refuse reprocessing operation. This site has polluting discharges that pre-date Maple Coal Company's operation. The permit, therefore, is issued under DEP's subchapter F regulations, which provide that the permittee's effluent limits are based on baseline pollution conditions rather than standard coal mining BAT standards. Therefore, the subchapter F discharges on these sites have been treated as nonpoint source for the purpose of doing the TMDL. Included in the Maple Coal Company's permit is a mine drainage treatment facility discharge; however, because it is a refuse reprocessing operation there is no pit water to be treated and therefore no discharge.

The second active mining permit is the Eastern Associated Coal Corp. Colver Mine Treatment Facility "Y-Portal", Post Mining Activity Permit 11981701. There is no NPDES number associated with this permit. Because liability exists, the discharge from the treatment facility is assigned a WLA.

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 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 NPDES/mining permit.

Table 2 contains the average concentrations and flows from the two preexisting discharges located on the Maple Coal Company Colver Site. The map in attachment A shows the location of these two discharges. The individual discharges are not assigned load allocations, however; discharge affects on the stream are taken into account at the closest downstream sampling point and it is noted that the discharges are a contributing pollutant source to the segment.

Table 2. Pre-existing Discharge Average Concentrations and Flow

Discharge	Acidity mg/L	Iron mg/L	Manganese mg/L	Aluminum mg/L	Flow gpm
2B	1304	682	3.99	96.99	30.85
23	17.93	1.3	0.46	1.15	48.42

All of the remaining discharges in the watershed are from abandoned mines and will be treated as non-point sources. Each segment on the PA Section 303(d) list will be addressed as a separate TMDL. 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 Environmental Protection Agency's (EPA) implementing regulations (40 CFR Part 130) require:

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

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

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

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

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

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

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

These TMDLs were developed in partial fulfillment of the 1997 lawsuit settlement of *American Littoral Society and Public Interest Group of Pennsylvania v. EPA.*

Section 303(d) Listing Process

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

The primary method adopted by the Pennsylvania Department of Environmental Protection (DEP) for evaluating waters changed between the publication of the 1996 and 1998 Section 303(d) lists. Prior to 1998, data used to list streams were in a variety of formats, collected under differing protocols. Information also was gathered through the Section 305(b)[3] reporting process. DEP is now using the Statewide Surface Waters Assessment Protocol (SSWAP), a modification of the EPA's 1989 Rapid Bioassessment Protocol II (RBP-II), as the primary mechanism to assess Pennsylvania's waters. The SSWAP provides a more consistent approach to assessing Pennsylvania's streams.

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

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

Basic Steps for Determining a TMDL

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

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

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

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

Watershed History

A majority of the acid mine drainage in the Elk Creek Watershed is from two deep mines and their associated refuse piles. The Watkins Coal Company opened the Watkins Number 1 Mine at the turn of the 20^{th} century. This mine was later sold to the Pennsylvania Coal and Coke Company who operated the mine as the Number 18 Mine. In 1918, Barnes and Tucker Coal Company bought the mine and renamed the mine the Lancashire Number 15 Mine. Barnes and Tucker conducted room and pillar and retreat mining until the mine was abandoned in May 1969 and subsequently flooded. In 1970 the mine pool rose and subsequently broke out onto the surface. In November 1970, Barnes and Tucker began pumping and treating the mine pool at the Duman's water treatment facility, lowering the mine pool and effectively eliminating the mine breakout. Barnes and Tucker had been pumping and treating the Lancashire Number 15 mine pool up until they filed for bankruptcy and the Department took over the pumping and treating on September 11, 2001.

The area of the Elk Creek Watershed is largely undermined on the Lower Kittanning coal seam as evident by the large coal refuse disposal sites in its headwaters. The Eastern Associated Coal Corporation, Colver Mine operated for many years on the Lower Kittanning coal seam prior to its closure in 1978. The resulting refuse piles were dumped into Elk Creek and runoff from the piles has added to the poor water quality of Elk Creek at its upper breaches. The Colver Mine has been maintaining a pumping and treatment plant at the "Y portal" since mining was active and it is located approximately 3 miles upstream from the confluence of Elk Creek with Blacklick Creek.

In 1981, Zev Energy, SMP Number 11813045 began coal reprocessing activities at the Colver Refuse pile but ceased operations shortly thereafter due to bankruptcy. The coal refuse pile which had been previously mined to remove the reusable coal in the pile, was permitted by Maple Coal Company, SMP Number 11900201 and was issued on January 14, 1993 for refuse reprocessing for use at the newly constructed Colver Power Project's Co-Generation Plant. The refuse pile is expected to be nearly completely removed for use in the plant and alkaline fly-ash to be put in its place. The operation remains active to this day and has many years to remain. The refuse clean-up and subsequent fly-ash placement is expected to improve the water quality in Elk Creek.

AMD Methodology

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

The statistical analysis described below can be applied to situations where all of the pollutant loading is from non-point sources as well as those where there are both point and non-point sources. The following defines what are considered point sources and non-point sources for the purposes of our evaluation; point sources are defined as permitted discharges or a discharge that has a responsible party, non-point sources are then any pollution sources that are not point sources. For situations where all of the impact is due to 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[4] by performing 5,000 iterations to determine the required percent reduction so that the water quality criteria, as defined in the *Pennsylvania Code. Title 25 Environmental Protection, Department of Environmental Protection, Chapter 93, Water Quality Standards*, will be met instream at least 99 percent of the time. For each iteration, the required percent reduction is:

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

PR = required percent reduction for the current iteration

Cc = criterion in mg/l

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

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

Mean = average observed concentration

Standard Deviation = standard deviation of observed data

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

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:

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

LTA = allowable LTA source concentration in mg/l

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

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

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

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

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

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

TMDL Endpoints

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

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

Table 3. Applicable Water Quality Criteria

Parameter	*Criterion Value (mg/l)*	*Total Recoverable/Dissolved*
Aluminum (Al)	0.75	Total Recoverable
Iron (Fe)	1.50	30 day average; Total Recoverable
Manganese (Mn)	1.00	Total Recoverable
Sulfate (SO4)	250	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.

Other Inorganics

The cause of inorganic impairment as listed on the 1996 Section 303(d) list is sulfates. Due to Title 25 Chapter 96.3(d), which requires the criterion to be met at the point of potable water supply withdrawals, a TMDL to address sulfates is not necessary. The nearest potable water withdrawal to Elk Creek occurs approximately 100 miles downstream of the mouth at the Buffalo Township Municipal Authority (PWSID 5030019) located on the Allegheny River. Elk Creek is connected to the Allegheny River via the following streams (rivers): Blacklick Creek, Conemaugh River, and the Kiskiminetas River, which drains to the Allegheny River. Because of the distance between Elk Creek and the nearest downstream water supply intake and the assimilative capacity of the streams into which Elk Creek drains, the sulfates in Elk Creek have a negligible affect on the sulfate concentration at the water supply intake. In addition, the average sulfate concentration at the mouth of Elk Creek is 197 mg/L, which is less than the criterion of 250 mg/L.

TMDL Elements (WLA, LA, MOS)

$$TMDL = WLA + LA + MOS$$

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

Allocation Summary

These TMDLs will focus remediation efforts on the identified numerical reduction targets for each watershed. The reduction schemes in Table 4 for each segment are based on the assumption that all upstream allocations are achieved and take into account all upstream reductions. Attachment C contains the TMDLs by segment analysis for each allocation point in a detailed discussion. As changes occur in the watershed, the TMDLs may be re-evaluated to reflect current conditions. An implicit MOS based on conservative assumptions in the analysis is included in the TMDL calculations.

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

Each permitted discharge in a segment is assigned a waste load allocation and the total waste load allocation for each segment is included in this table. There are currently two active permits in the watershed; however, only the Eastern Associated Coal Corp. Colver Treatment Facility has a discharge requiring a waste load allocation. The difference between the TMDL and the WLA at each point is the load allocation (LA) at the point. The LA at each point includes all loads entering the segment, including those from upstream allocation points. The percent reduction is calculated to show the amount of load that needs to be reduced within a segment in order for water quality standards to be met at the point.

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

Table 4. TMDL Component Summary for the Elk 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 %
	Elk Creek, upstream of Colver refuse pile						
	Al	0.2	0.2	NA	NA	0.0	0
	Fe	0.8	0.8	NA	NA	0.0	0
	Mn	0.2	0.2	NA	NA	0.0	0
	Acidity	0.0	0.0	NA	NA	0.0	0
	Elk Creek, downstream of Colver refuse pile						
	Al	657.0	0.0	0.0	0.0	657.0	100
	Fe	434.6	4.3	0.0	4.3	430.3	99
	Mn	16.7	3.5	0.0	3.5	13.2	79
	Acidity	4,952.5	990.5	0.0	990.5	3,962.0	80
	Mouth of California Run						
	Al	3.9	3.9	NA	NA	0.0	0
	Fe	24.4	6.6	0.0	6.6	17.8	73
	Mn	25.0	2.2	0.0	2.2	22.8	91
	Acidity	11.9	11.9	NA	NA	0.0	0
	Elk Creek, upstream of Crooked Run						
	Al	0.9	0.9	NA	NA	0.0	0
	Fe	6.9	5.2	0.0	5.2	0.0	0
	Mn	3.2	3.1	0.0	3.1	0.0	0
	Acidity	39.3	39.3	NA	NA	0.0	0
	Crooked Run below Duman Lake						
	Al	0.5	0.5	NA	NA	0.0	0
	Fe	1.8	1.8	NA	NA	0.0	0
	Mn	0.5	0.5	NA	NA	0.0	0
	Acidity	0.6	0.6	NA	NA	0.0	0
	Mouth of Crooked Run						
	Al	695.2	7.0	0.0	7.0	688.2	99
	Fe	419.0	33.5	0.0	33.5	385.5	92
	Mn	90.7	9.1	0.0	9.1	81.6	90
	Acidity	4,884.3	0.0	0.0	0.0	4,884.3	100
	Elk Creek, upstream of Eastern Associated Coal Corp. plant						
	Al	310.2	52.7	0.0	52.7	0.0	0
	Fe	348.7	101.1	0.0	101.1	0.0	0
	Mn	62.4	62.4	NA	NA	0.0	0
	Acidity	0.0	0.0	NA	NA	0.0	0
	Elk Creek, downstream of Eastern Associated Coal Corp. plant						
	Al	255.5	58.8	53.8	5.0	0.0	0
	Fe	368.4	132.6	94.2	38.4	0.0	0
	Mn	77.7	77.7	53.8	23.9	0.0	0
	Acidity	0.0	0.0	NA	NA	0.0	0

Station	Parameter	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	Load Reduction (lbs/day)	Percent Reduction %
	Mouth of Little Elk Creek						
	Al	1.8	1.8	NA	NA	0.0	0
	Fe	3.2	3.2	NA	NA	0.0	0
	Mn	1.6	1.6	NA	NA	0.0	0
	Acidity	69.4	45.1	0.0	45.1	24.3	35
	Mouth of Elk Creek						
	Al	250.3	87.6	0.0	87.6	0.0	0
	Fe	313.1	131.5	0.0	131.5	0.0	0
	Mn	75.6	75.6	NA	NA	0.0	0
	Acidity	0.0	0.0	NA	NA	0.0	0

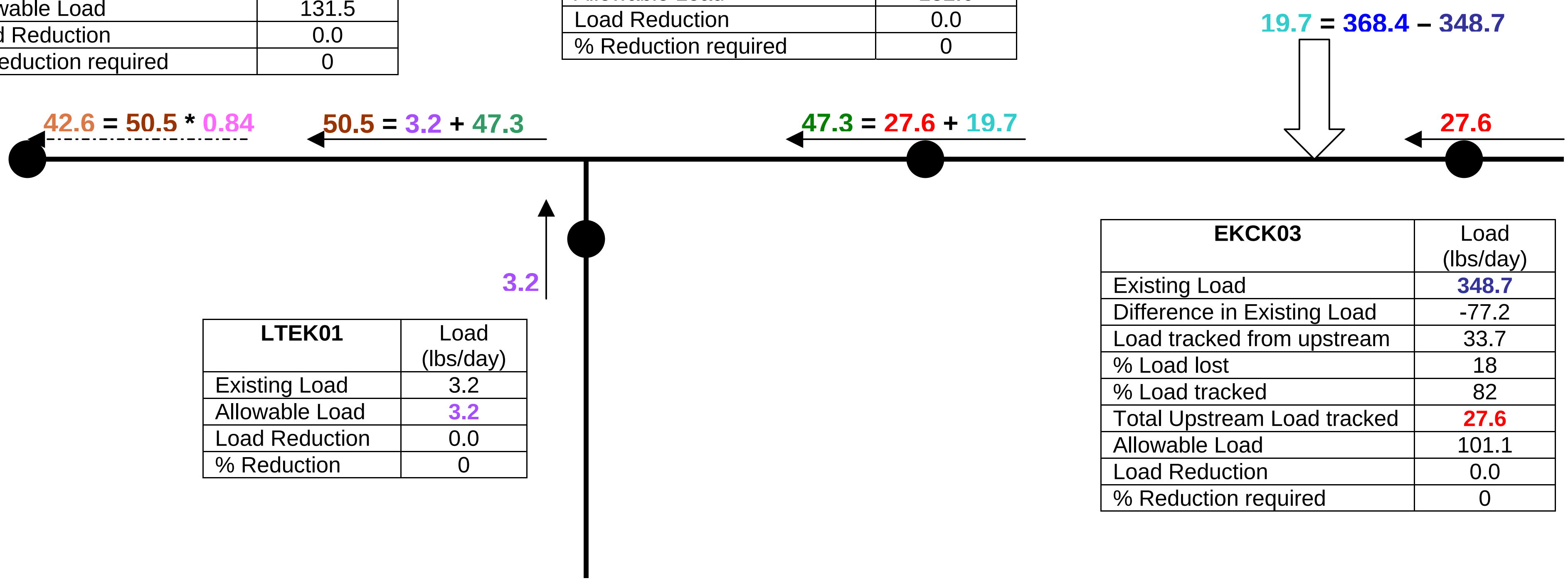
NA meets WQS. No TMDL necessary.

In the instance that the allowable load is equal to the measured load (e.g. aluminum EKCK05, Table 4), the simulation determined that water quality standards are being met instream and therefore 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.

Following is an example of how the allocations, presented in Table 4, for a stream segment are calculated. For this example, iron allocations for EKCK01, EKCK02, EKCK03 and LTEK01 are shown. As demonstrated in the example, all upstream contributing loads are accounted for at each point. Attachment C contains the TMDLs by segment analysis for each allocation point in a detailed discussion. These analyses follow the example. Attachment A contains a map of the sampling point locations for reference.

EKCK01	Load (lbs/day)
Existing Load	313.1
Difference in Existing Load	-58.5
Load tracked from upstream	**50.5**
% Load lost	16
% Load tracked	**84**
Total Load tracked	**42.6**
Allowable Load	131.5
Load Reduction	0.0
% Reduction required	0

EKCK02	Load (lbs/day)
Existing Load	**368.4**
Difference in Existing Load	**19.7**
Load tracked from upstream	**27.6**
Total Load tracked	**47.3**
Allowable Load	132.6
Load Reduction	0.0
% Reduction required	0



LTEK01	Load (lbs/day)
Existing Load	3.2
Allowable Load	**3.2**
Load Reduction	0.0
% Reduction	0

EKCK03	Load (lbs/day)
Existing Load	**348.7**
Difference in Existing Load	-77.2
Load tracked from upstream	33.7
% Load lost	18
% Load tracked	82
Total Upstream Load tracked	**27.6**
Allowable Load	101.1
Load Reduction	0.0
% Reduction required	0

A waste load allocation is assigned to the Colver Treatment Facility discharge contained on the Eastern Associated Coal Corp. Post Mining Activity Permit 11981701. Waste load allocations are calculated using the average discharge flow multiplied by the permit limit for each parameter. An aluminum limit is not included in the permit; however, a WLA for aluminum is included to provide an allowance for the discharge of aluminum. The BAT limit of 2.0 is used in the calculation.

No required reductions of permit limits are required at this time. All necessary reductions are assigned to non-point sources.

Table 5 below contains the WLA for the Colver Treatment Facility discharge.

Table 5. Waste Load Allocations of Permitted Discharge

Parameter	Allowable Average Monthly Conc. (mg/L)	Measured Average Flow (MGD)	WLA (lbs/day)
Eastern Associated Coal Corp. Post Mining Activity Permit 11981701			
Outfall 001			
Fe	3.5	3.23	94.2
Mn	2.0	3.23	53.8
Al	2.0	3.23	53.8

Recommendations

The refuse reprocessing permit by Maple Coal Company is expected to improve the water quality of the upper breaches of Elk Creek and the continued water treatment of the Eastern Associated Coal Corporation and Barnes and Tucker mine pools will have an overall positive effect on Elk Creek.

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

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

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

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

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

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

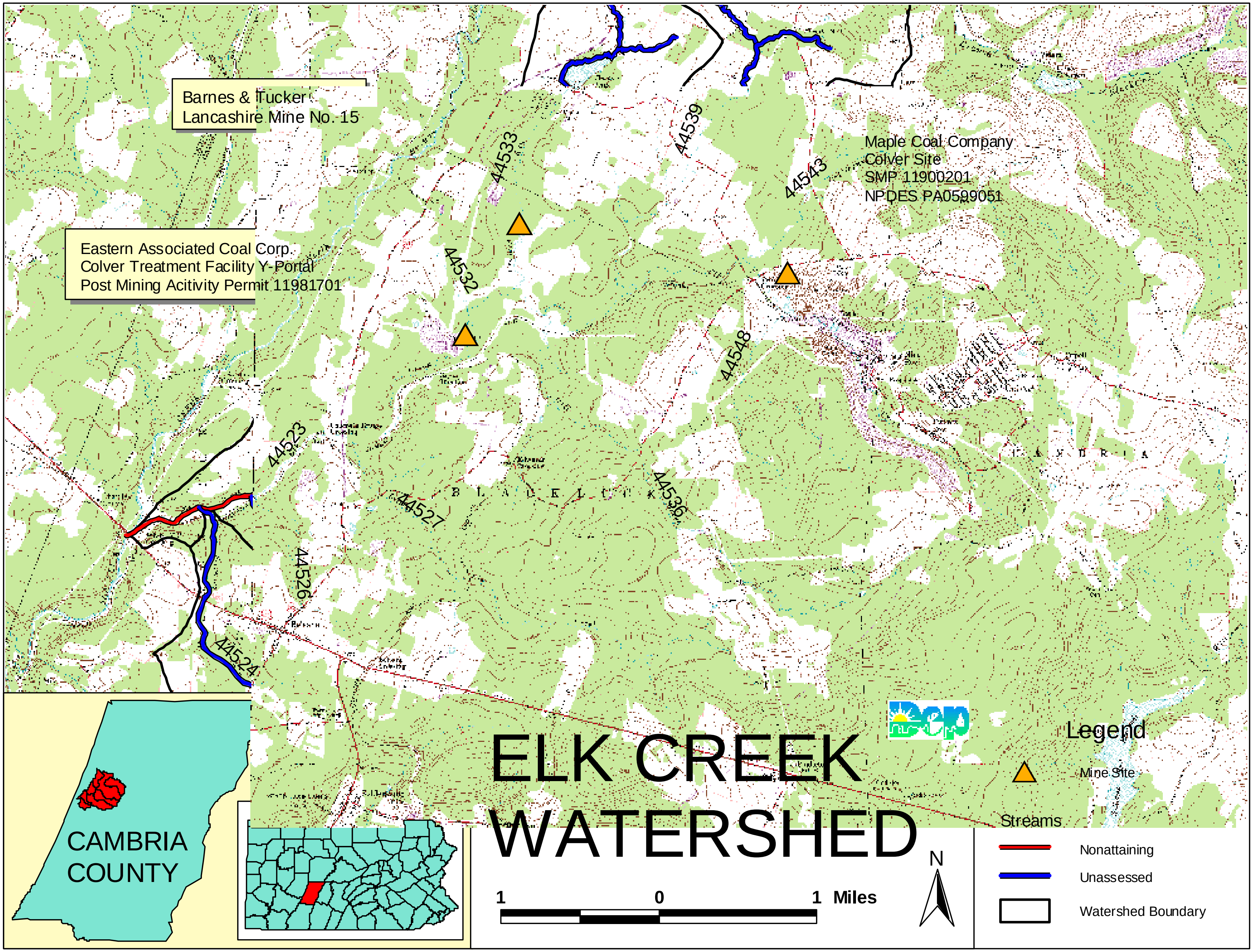
Reclaim PA is DEP's initiative designed to maximize reclamation of the state's quarter million acres of abandoned mineral extraction lands. Abandoned mineral extraction lands in Pennsylvania constituted a significant public liability – more than 250,000 acres of abandoned surface mines, 2,400 miles of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

Public Participation

Public notice of the draft TMDL was published in the *Pennsylvania Bulletin* on November 6, 2004, *The Tribune Democrat* on November 1, 2004 and the *Nanty Glo Journal* on November 3, 2004 to foster public comment on the allowable loads calculated. The public comment period on this TMDL was open from November 6, 2004 to January 5, 2005. A public meeting was held on November 16, 2004 at the Nanty Glo Firehall in Nanty Glo, PA to discuss the proposed TMDL.

Attachment A

Elk Creek Watershed Maps


Barnes & Tucker
Lancashire Mine No. 15
Eastern Associated Coal Corp.
Colver Treatment Facility Y-Portal
Post Mining Acitivity Permit 11981701
Maple Coal Company
Colver Site
SMP 11900201
NPDES PA0599051
44533
44539
44543
44532
44548
44523
44527
44536
44526
44524
CAMBRIA
COUNTY
ELK CREEK
WATERSHED
1
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Legend
Mine Site
Streams
Nonattaining
Unassessed
Watershed Boundary

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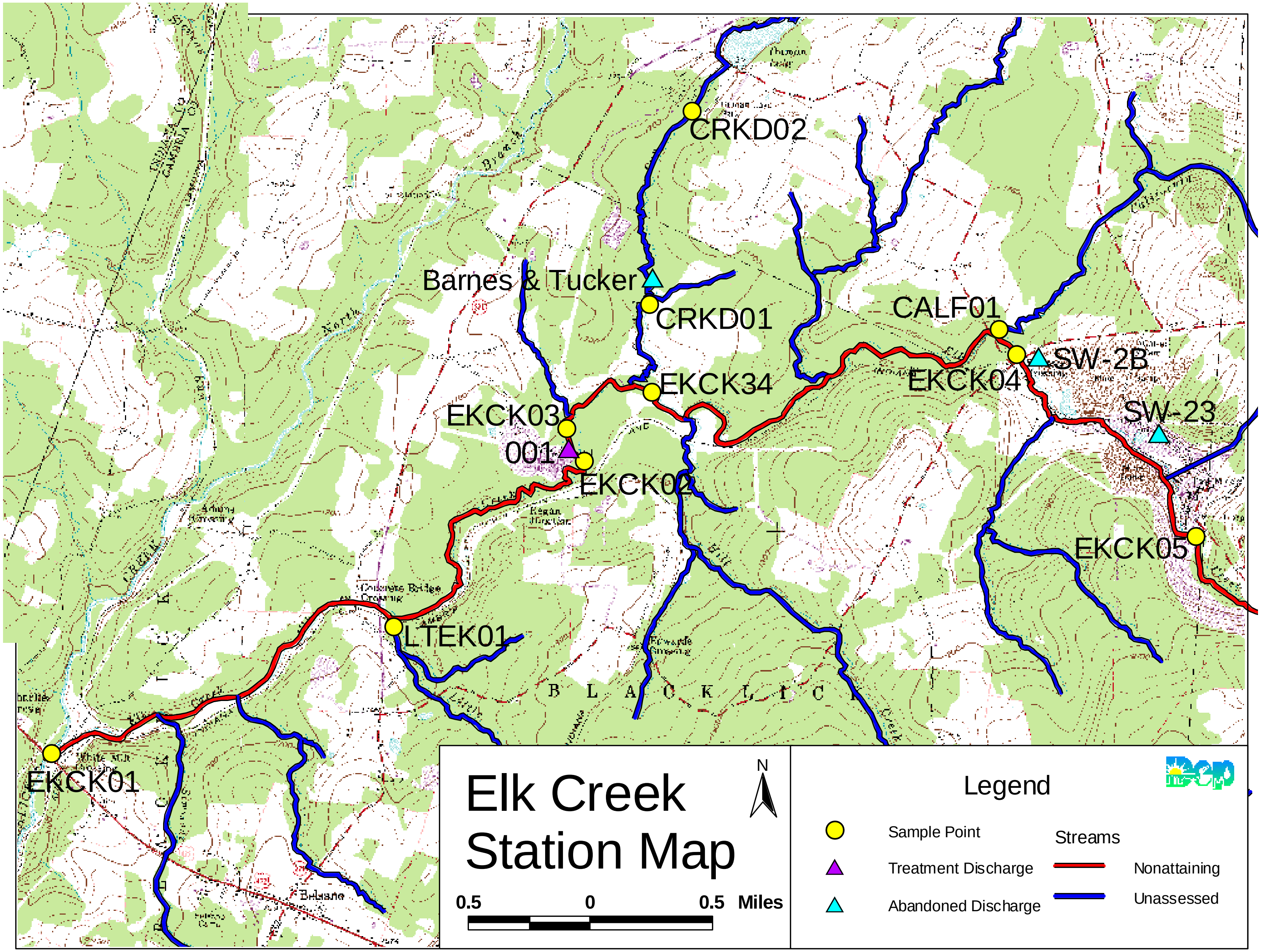
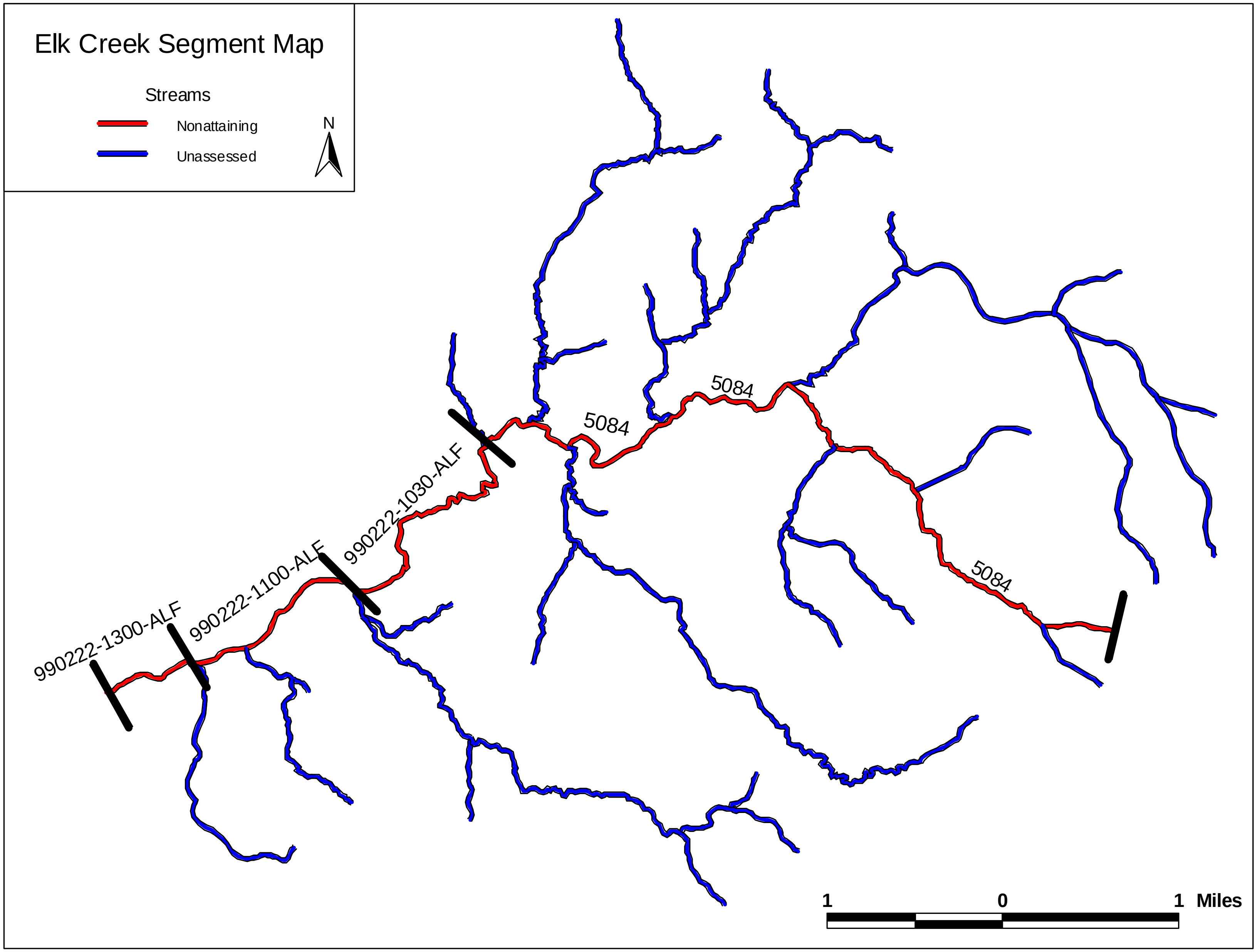
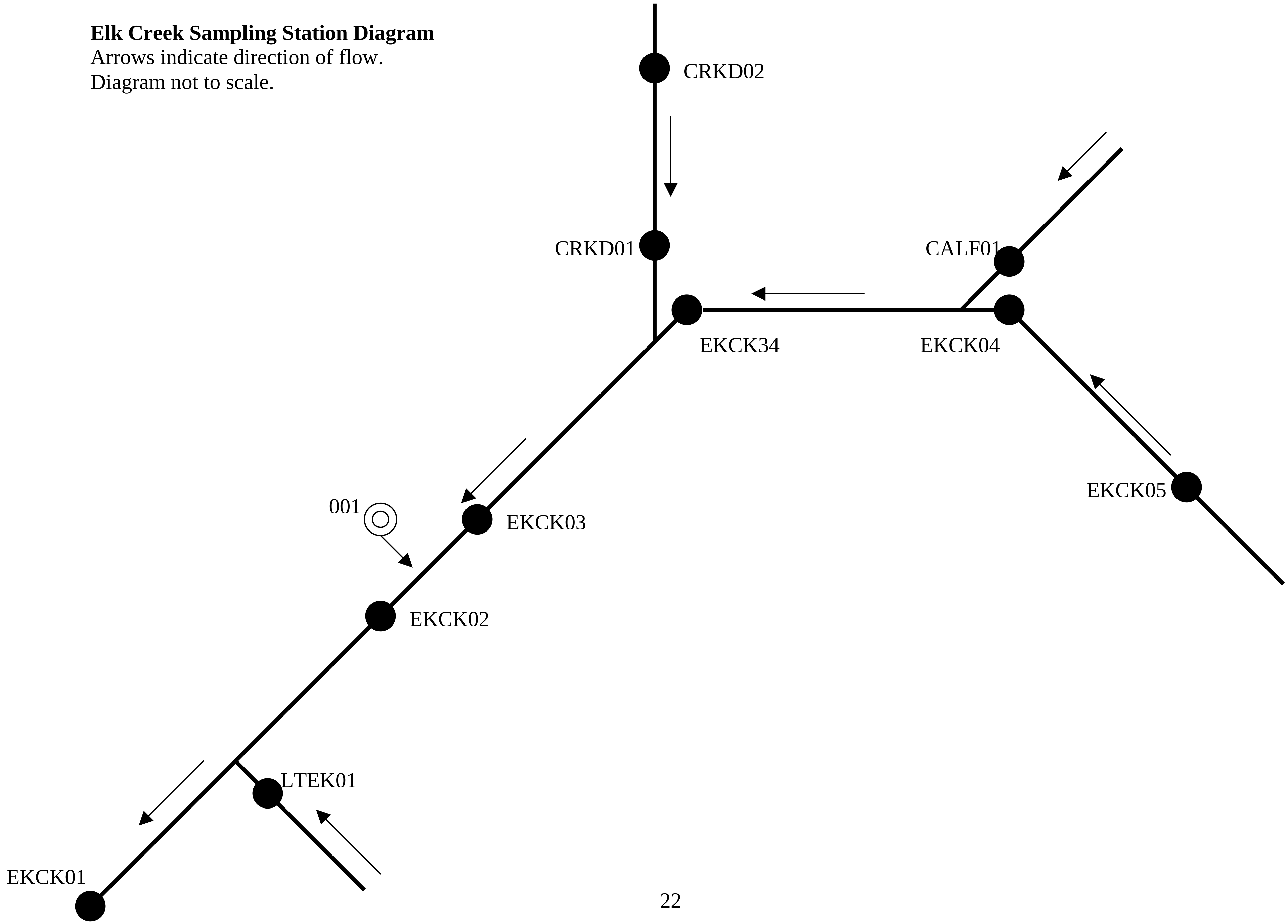

CRKD02
Barnes & Tucker
CRKD01
CALF01
SW-2B
EKCK04
EKCK34
EKCK03
001
EKCK02
SW-23
EKCK05
LTEK01
EKCK01
Elk Creek
Station Map
N
0.5
0
0.5
Miles
Legend
Sample Point
Treatment Discharge
Abandoned Discharge
Streams
Nonattaining
Unassessed



Elk Creek Segment Map
Streams
Nonattaining
Unassessed
N
5084
5084
5084
990222-1030-ALF
990222-1100-ALF
990222-1300-ALF
1
0
1 Miles

Elk Creek Sampling Station Diagram
Arrows indicate direction of flow.
Diagram not to scale.



Attachment B

Method for Addressing Section 303(d) Listings for pH

Method for Addressing Section 303(d) Listings for pH

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

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

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

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

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

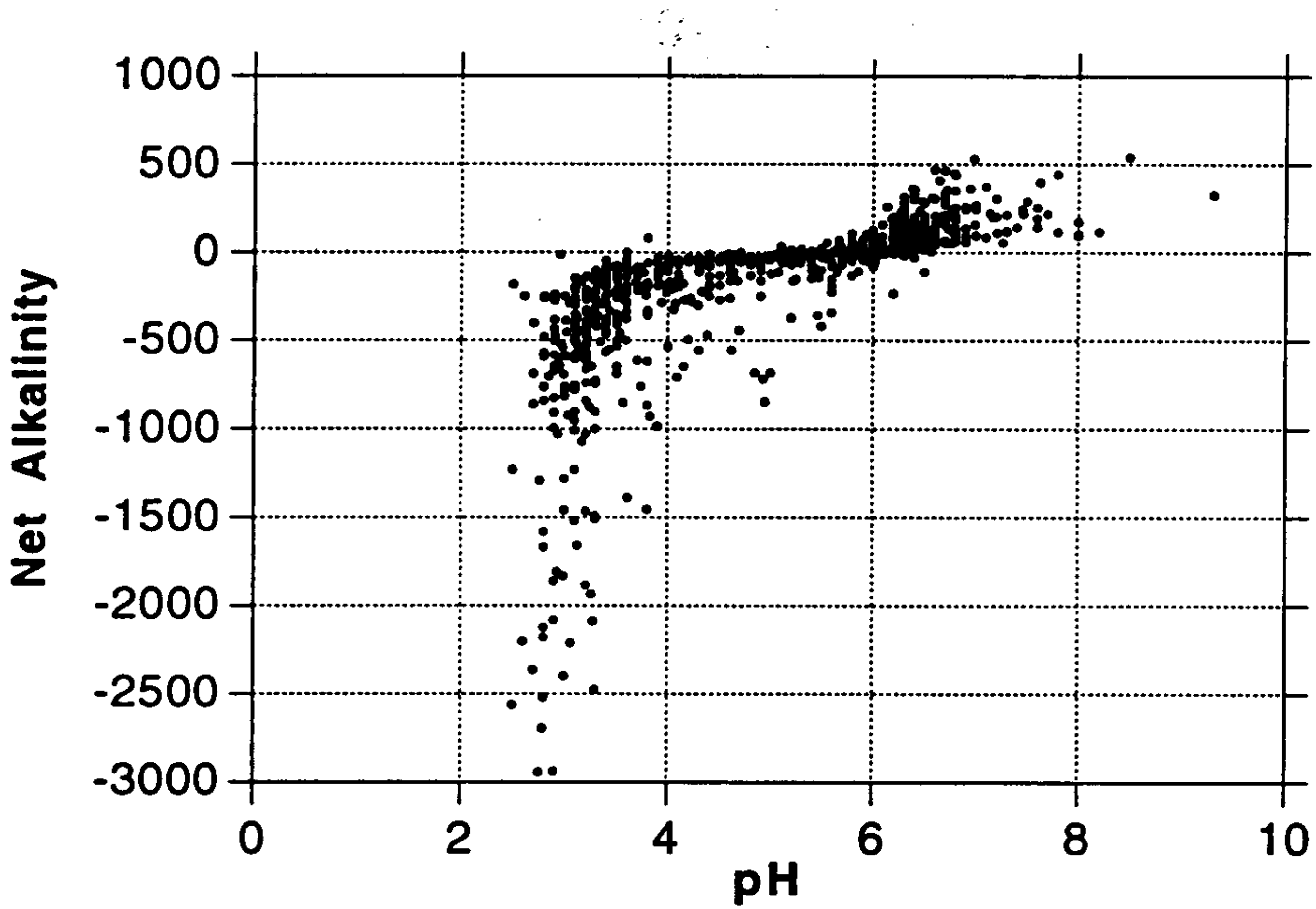


Figure 1. Net Alkalinity vs. pH. Taken from Figure 1.2 Graph C, pages 1-5, of Coal Mine Drainage Prediction and Pollution Prevention in Pennsylvania

Attachment C
TMDLs By Segment

Elk Creek

The TMDL for the Elk Creek consists of load allocations of three tributaries and six sampling sites along the stream. A waste load allocation is assigned to the discharge from the Eastern Associated Coal Corp. Colver Treatment Facility discharge.

Elk Creek is listed as impaired on the PA Section 303(d) list by high metals from AMD as being the cause of the degradation to the stream. Elk Creek is not listed for pH; however, some areas of the stream experiences depressed pH. The objective is to reduce acid loading to the stream that will in turn raise the pH to the acceptable range. The result of this analysis is an acid loading reduction that equates to meeting standards for pH (see TMDL Endpoint section in the report, Table 2). The method and rationale for addressing pH is contained in Attachment B.

Elk Creek is also listed for siltation impairments from AMD and habitat modifications. Siltation is not addressed in this TMDL, but will be addressed at a later date.

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

TMDL Calculations - Sample Point EKCK05, Elk Creek upstream of the Colver Refuse piles

Elk Creek above point EKCK05 is not impaired. Water quality analysis at EKCK05 determined that the measured loads for all parameters are equal to the allowable loads for all parameters. Because WQS are met, no TMDLs are necessary at EKCK05. This segment was included on the 1996 PA Section 303(d) lists for metals impairments from AMD.

Table C1. TMDL Calculations at Point EKCK05

Flow = 0.53 MGD	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	0.05	0.2	0.05	0.2
Fe	0.17	0.8	0.17	0.8
Mn	0.03	0.2	0.03	0.2
Acidity	0.00	0.0	0.00	0.0
Alkalinity	38.48	169.0		

Table C2. Calculation of Load Reduction Necessary at Point EKCK05				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	0.2	0.8	0.2	0.0
Allowable Load	0.2	0.8	0.2	0.0
Load Reduction	0.0	0.0	0.0	0.0
Total % Reduction	0	0	0	0

Although TMDLs are not necessary at EKCK05, all existing loads are considered at the next downstream point EKCK04.

TMDL Calculations - Sampling Point EKCK04, Elk Creek downstream of Colver Refuse piles

The TMDL for sampling point EKCK04 consists of a load allocation to the area between sample points EKCK05 and EKCK04. The load allocation for this stream segment was computed using water-quality sample data collected at point EKCK04. The average flow of 2.18 MGD, measured at the point, is used for these computations.

This segment was included on the 1996 PA Section 303(d) lists for metals impairments from AMD. Sample data at point EKCK04 shows pH ranging between 2.80 and 4.36; pH is addressed as part of this TMDL because of the mining impacts.

Affects from the preexisting discharges 23 and 2B, located on the Maple Coal Company Colver Site, are incorporated into the LA portion of the TMDL for point EKCK04.

Table C3. TMDL Calculations at Point EKCK04				
Flow = 2.18 MGD	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	36.08	657.0	0.00	0.0
Fe	23.87	434.6	0.24	4.3
Mn	0.92	16.7	0.19	3.5
Acidity	271.99	4,952.5	54.40	990.5
Alkalinity	0.00	0.0		

The calculated load reductions for all the loads that enter point EKCK04 must be accounted for in the calculated reductions at sample point EKCK04 shown in Table C4. A comparison of measured loads between points EKCK04 and EKCK05 shows that there is additional loading entering the segment for all parameters.

Table C4. Calculation of Load Reduction Necessary at Point EKCK04				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	657.0	434.6	16.7	4,952.5
Difference in Existing Load between EKCK04 & EKCK05	656.8	433.8	16.5	4,952.5
Load tracked from EKCK04	0.2	0.8	0.2	0.0
Total Load tracked between points EKCK04 & EKCK05	657.0	434.6	16.7	4,952.5
Allowable Load at EKCK04	0.0	4.3	3.5	990.5
Load Reduction at EKCK04	657.0	430.3	13.2	3,962.0
% Reduction required at EKCK04	100	99	79	80

TMDL Calculations - Sample Point CALF01, mouth of California Run

The TMDL for sample point CALF01 consists of a load allocation to all of the area above the point (Attachment A). The load allocation for this tributary was computed using water-quality sample data collected at point CALF01. The average flow of 1.60 MGD, measured at the point, is used for these computations.

This segment is not included on the PA Section 303(d) list impairments from AMD. Sample data at point CALF01 shows pH ranging between 5.99 and 6.74; pH is not addressed as part of this TMDL.

Table C5. TMDL Calculations at Point CALF01				
Flow = 1.60 MGD	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	0.29	3.9	0.29	3.9
Fe	1.83	24.4	0.49	6.6
Mn	1.87	25.0	0.17	2.2
Acidity	0.89	11.9	0.89	11.9
Alkalinity	20.87	278.0		

Table C6. Calculation of Load Reduction Necessary at Point CALF01				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	3.9	24.4	25.0	11.9
Allowable Load	3.9	6.6	2.2	11.9
Load Reduction	0.0	17.8	22.8	0.0
Total % Reduction	0	73	91	0

TMDL Calculations - Sampling Point EKCK34, Elk Creek upstream of Crooked Run

The TMDL for sampling point EKCK34 consists of a load allocation to the area between sample points EKCK34, CALF01 and EKCK04. The load allocation for this stream segment was computed using water-quality sample data collected at point EKCK34. The average flow of 2.25 MGD, measured at the point, is used for these computations.

This segment was included on the 1996 PA Section 303(d) lists for metals impairments from AMD. Sample data at point EKCK34 shows pH ranging between 5.82 and 7.14; pH is not addressed as part of this TMDL.

Water quality analysis determined that the measured aluminum load is equal to the allowable load. Because the WQS is met, a TMDL for aluminum is not necessary at EKCK34. Although a TMDL is not necessary, the measured aluminum load at EKCK34 is considered at the next downstream point EKCK03.

Table C7. TMDL Calculations at Point EKCK34				
Flow = 2.25 MGD	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	0.05	0.9	0.05	0.9
Fe	0.37	6.9	0.28	5.2
Mn	0.17	3.2	0.16	3.1
Acidity	2.10	39.3	2.10	39.3
Alkalinity	17.83	334.1		

The calculated load reductions for all the loads that enter point EKCK34 must be accounted for in the calculated reductions at sample point EKCK34 shown in Table C8. A comparison of measured loads between points EKCK34, CALF01 and EKCK04 shows that there is a loss of loading within the segment for all parameters. For loss of load, the percent of load lost within the segment is calculated and applied to the upstream loads to determine the amount of the upstream load that is tracked through the segment.

Table C8. Calculation of Load Reduction Necessary at Point EKCK34				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	0.9	6.9	3.2	39.3
Difference in Existing Load between points	-660.0	-452.1	-38.5	-4,925.1
Load tracked from EKCK04 & CALF01	3.9	10.9	5.7	1,002.4
Percent loss due to instream process	99.9	98	92	99
Percent of loads tracked through segment	0.1	2	8	1
Total Load tracked between points	0.01	0.2	0.4	7.9
Allowable Load at EKCK34	0.9	5.2	3.1	39.3
Load Reduction at EKCK34	0.0	0.0	0.0	0.0
% Reduction required at EKCK34	0	0	0	0

TMDL Calculations - Sample Point CRKD02, Crooked Run below Duman Lake

Crooked Run above point CRKD02 is not impaired. Water quality analysis at CRKD02 determined that the measured loads for all parameters are equal to the allowable loads for all parameters. Because WQS are met, no TMDLs are necessary at CRKD02. This segment is not included on the PA Section 303(d) lists for impairments from AMD.

Table C9. TMDL Calculations at Point CRKD02				
Flow = 0.46 MGD	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	0.14	0.5	0.14	0.5
Fe	0.47	1.8	0.47	1.8
Mn	0.13	0.5	0.13	0.5
Acidity	0.17	0.6	0.17	0.6
Alkalinity	21.04	80.8		

Table C10. Calculation of Load Reduction Necessary at Point CRKD02				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	0.5	1.8	0.5	0.6
Allowable Load	0.5	1.8	0.5	0.6
Load Reduction	0.0	0.0	0.0	0.0
Total % Reduction	0	0	0	0

Although TMDLs are not necessary at CRKD02, the existing loads are considered at the next downstream point CRKD01.

TMDL Calculations - Sampling Point CRKD01, mouth of Crooked Run

The TMDL for sampling point CRKD01 consists of a load allocation to the area between sample points CRKD01 and CRKD02. The load allocation for this stream segment was computed using water-quality sample data collected at point CRKD01. The average flow of 6.15 MGD, measured at the point, is used for these computations.

This segment is not included on the PA Section 303(d) lists for impairments from AMD. Sample data at point CRKD01 shows pH ranging between 3.08 and 4.79; pH is addressed as part of this TMDL because of the mining impacts.

Affects from the Lancashire Mine No. 15 discharge are incorporated into the LA portion of the TMDL for point CRKD01.

Table C11. TMDL Calculations at Point CRKD01				
Flow = 6.15 MGD	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	13.56	695.2	0.14	7.0
Fe	8.17	419.0	0.65	33.5
Mn	1.77	90.7	0.18	9.1
Acidity	95.24	4,884.3	0.00	0.0
Alkalinity	0.28	14.2		

The calculated load reductions for all the loads that enter point CRKD01 must be accounted for in the calculated reductions at the sample point shown in Table C12. A comparison of measured loads between points CRKD01 and CRKD02 shows that there is additional loading entering the segment for all parameters.

Table C12. Calculation of Load Reduction Necessary at Point CRKD01				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	695.2	419.0	90.7	4,884.3
Difference in Existing Load between points	694.7	417.2	90.2	4,883.7
Load tracked from CRKD02	0.5	1.8	0.5	0.6
Total Load tracked between points	695.2	419.0	90.7	4,884.3
Allowable Load at CRKD01	7.0	33.5	9.1	0.0
Load Reduction at CRKD01	688.2	385.5	81.6	4,884.3
% Reduction required at CRKD01	99	92	90	100

TMDL Calculations - Sampling Point EKCK03, Elk Creek upstream of Y-Portal discharge

The TMDL for sampling point EKCK03 consists of a load allocation to the area between sample points EKCK03, EKCK34 and CRKD01. The load allocation for this stream segment was computed using water-quality sample data collected at point EKCK03. The average flow of 16.31 MGD, measured at the point, is used for these computations.

This segment was included on the 1996 PA Section 303(d) lists for metals impairments from AMD. Sample data at point EKCK03 shows pH ranging between 5.89 and 7.31; pH is not addressed as part of this TMDL.

Water quality analysis determined that the measured manganese load is equal to the allowable manganese load. Because the WQS is met, a TMDL is not necessary at EKCK03 for manganese. Although a TMDL is not necessary the measured load at EKCK03 is considered at the next downstream point EKCK02.

Table C13. TMDL Calculations at Point EKCK03				
Flow = 16.31 MGD	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	2.28	310.2	0.39	52.7
Fe	2.56	348.7	0.74	101.1
Mn	0.46	62.4	0.46	62.4
Acidity	0.00	0.0	0.00	0.0
Alkalinity	64.12	8,723.2		

The calculated load reductions for all the loads that enter point EKCK03 must be accounted for in the calculated reductions at the sample point shown in Table C14. A comparison of measured loads between points EKCK03, EKCK34 and CRKD01 shows that there is a loss of loading within the segment for all parameters. For loss of load, the percent of load lost within the segment is calculated and applied to the upstream loads to determine the amount of the upstream load that is tracked through the segment.

Table C14. Calculation of Load Reduction Necessary at Point EKCK03				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	310.2	348.7	62.4	0.0
Difference in Existing Load between points	-385.9	-77.2	-31.5	-4,923.5
Load tracked from EKCK34 & CRKD01	7.0	33.7	9.5	7.9
Percent load lost	55	18	34	100
Percent load tracked	45	82	66	0
Total Load tracked between points	3.1	27.6	6.3	0.0
Allowable Load at EKCK03	52.7	101.1	62.4	0.0
Load Reduction at EKCK03	0.0	0.0	0.0	0.0
% Reduction required at EKCK03	0	0	0	0

Waste Load Allocation – Eastern Associated Coal Corp. Colver Treatment Facility, 001

The Eastern Associated Coal Corp. Colver Treatment Facility "Y-Portal", Post Mining Activity Permit 11981701, has one permitted discharge, Outfall 001. The discharge, located on the map in Attachment A, discharges to Elk Creek upstream of EKCK02. The waste load allocation for 001 is calculated by multiplying the permit limits fore each parameter by the average flow from the treatment facility. Aluminum is not included in the permit; however, a WLA is included using the BAT limit of 2.0 mg/L to allow for the discharge of aluminum. The following table shows the waste load allocation for the discharge.

Table C15. Waste Load Allocation Colver Treatment Facility			
Parameter	**Monthly Avg. Allowable Conc. (mg/L)**	**Average Flow (MGD)**	**WLA (lbs/day)**
001			
Fe	3.5	3.23	94.2
Mn	2.0	3.23	53.8
Al	2.0	3.23	53.8

TMDL Calculations - Sampling Point EKCK02, Elk Creek downstream of Y-Portal discharge

The TMDL for sampling point EKCK02 consists of a waste load allocation to the Eastern Associated Coal Corp. Colver Treatment Facility discharge and a load allocation to the area between sample points EKCK02 and EKCK03. The load allocation for this stream segment was computed using water-quality sample data collected at point EKCK02. The average flow of 19.35 MGD, measured at the point, is used for these computations.

This segment was included on the 1996 PA Section 303(d) lists for metals impairments from AMD. In 1999 the segment was resurveyed and siltation was added as a cause of impairment to the 2002 PA Section 303(d) list. Sample data at point EKCK02 shows pH ranging between 6.09 and 8.11; pH is not addressed as part of this TMDL.

Water quality analysis determined that the measured manganese load is equal to the allowable manganese load. Because the WQS is met, a TMDL is not necessary at EKCK02 for manganese. Although a TMDL is not necessary, a WLA is assigned for manganese at EKCK02 and the measured load at EKCK02 is considered at the next downstream point EKCK01.

Table C16. TMDL Calculations at Point EKCK02				
Flow = 19.35 MGD	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	1.58	255.5	0.36	58.8
Fe	2.28	368.4	0.82	132.6
Mn	0.48	77.7	0.48	77.7
Acidity	0.00	0.0	0.00	0.0
Alkalinity	92.37	14,909.7		

The calculated load reductions for all the loads that enter point EKCK02 must be accounted for in the calculated reductions at the sample point shown in Table C17. A comparison of measured loads between points EKCK02 and EKCK03 shows that there is additional iron and manganese loading and loss of aluminum loading within the segment. For loss of load, the percent of load lost within the segment is calculated and applied to the upstream loads to determine the amount of the upstream load that is tracked through the segment. For the increase in iron and manganese load the total segment load is the sum of the upstream load and the load directly entering the segment.

Table C17. Calculation of Load Reduction Necessary at Point EKCK02				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	255.5	368.4	77.7	0.0
Difference in Existing Load between points	-54.7	19.7	15.3	0.0
Load tracked from EKCK03	3.1	27.6	6.3	0.0
Percent load lost	18	-	-	-
Percent load tracked	82	-	-	-
Total Load tracked between points	2.6	47.3	21.6	0.0
Allowable Load at EKCK02	58.8	132.6	77.7	0.0
WLA	53.8	94.2	53.8	-
LA	5.0	38.4	23.9	-
Load Reduction at EKCK02	0.0	0.0	0.0	0.0
% Reduction required at EKCK02	0	0	0	0

TMDL Calculations - Sample Point LTEK01, Mouth of Little Elk Creek

The TMDL for sampling point LTEK01 consists of a load allocation to the area above the sample point. The load allocation for this stream was computed using water-quality sample data collected at point LTEK01. The average flow of 2.29 MGD, measured at the point, is used for these computations.

This segment is not included on the PA Section 303(d) list for impairments from AMD. Sample data at point LTEK01 shows pH ranging between 5.76 and 6.75; pH is addressed as part of this TMDL.

Water quality analysis determined that the measured metals loads are equal to the allowable metals loads. Because WQS are met, TMDLs for iron, aluminum, and manganese are not necessary. Although TMDLs are not necessary the measured loads at LTEK01 are considered at the next downstream point EKCK01.

Table C18. TMDL Calculations at Point LTEK01

Flow = 2.29 MGD	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	0.09	1.8	0.09	1.8
Fe	0.17	3.2	0.17	3.2
Mn	0.08	1.6	0.08	1.6
Acidity	3.63	69.4	2.36	45.1
Alkalinity	7.81	149.1		

Table C19. Calculation of Load Reduction Necessary at Point LTEK01

	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	1.8	3.2	1.6	69.4
Allowable Load	1.8	3.2	1.6	45.1
Load Reduction	0.0	0.0	0.0	24.3
Total % Reduction	0	0	0	35

TMDL Calculations - Sampling Point EKCK01, Mouth of Elk Creek

The TMDL for sampling point EKCK01 consists of a load allocation to the area between sample points EKCK01, EKCK02 and LTEK01. The load allocation for this stream segment was computed using water-quality sample data collected at point EKCK01. The average flow of 24.29 MGD, measured at the point, is used for these computations.

This segment was included on the 1996 PA Section 303(d) lists for metals impairments from AMD. In 1999 the segment was resurveyed and siltation was added as a cause of impairment to the 2002 PA Section 303(d) list. Sample data at point EKCK01 shows pH ranging between 6.34 and 8.27; pH is not addressed as part of this TMDL.

Water quality analysis determined that the measured manganese load is equal to the allowable manganese load. Because the WQS is met, a TMDL is not necessary at EKCK01 for manganese.

Table C20. TMDL Calculations at Point EKCK01				
Flow = 24.29 MGD	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	1.24	250.3	0.43	87.6
Fe	1.55	313.1	0.65	131.5
Mn	0.37	75.6	0.37	75.6
Acidity	0.00	0.0	0.00	0.0
Alkalinity	63.35	12,830.9		

The calculated load reductions for all the loads that enter point EKCK01 must be accounted for in the calculated reductions at the sample point shown in Table C21. A comparison of measured loads between points EKCK01, EKCK02 and LTEK01 shows that there is a loss of loading for all parameters within the segment. For loss of load, the percent of load lost within the segment is calculated and applied to the upstream loads to determine the amount of the upstream load that is tracked through the segment.

Table C21. Calculation of Load Reduction Necessary at Point EKCK01				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	250.3	313.1	75.6	0.0
Difference in Existing Load between points	-7.0	-58.5	-3.7	-69.4
Load tracked from EKCK02 & LTEK01	4.3	50.5	23.2	45.1
Percent load lost	3	16	5	100
Percent load tracked	97	84	95	0
Total Load tracked between points	4.2	42.6	22.1	0.0
Allowable Load at EKCK01	87.6	131.5	75.6	0.0
Load Reduction at EKCK01	0.0	0.0	0.0	0.0
% Reduction required at EKCK01	0	0	0	0

Margin of Safety

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

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

Seasonal Variation

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

Critical Conditions

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

Attachment D

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

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

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

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

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

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

Attachment E
Water Quality Data Used In TMDL Calculations

Site	Date	Flow (gpm)	pH	Acidity (mg/L)	Alk (mg/L)	Al (mg/L)	Fe (mg/L)	Mn (mg/L)	SO4 (mg/L)
EKCK01	2/22/2002	17072	6.70	0	38	1.1	1.6	0.37	115
	4/5/2002	24095	7.17	0	49	1.2	2.0	0.33	170
Latitude	4/26/2002	21721	6.65	0	41	1.6	2.1	0.33	174
40.52867	6/24/2002	15690	6.34	0	66	1.7	1.7	0.41	227
Longitude	8/14/2002	8573	8.27	0	136	0.92	0.33	0.43	391
-78.88797	11/8/2002	14040	6.90	0	50	0.97	1.50	0.37	109
	Average	16865	7.01	0	63	1.2	1.5	0.4	198
	StDev	5550	0.68	0	37	0.32	0.64	0.04	104
LTEK01	2/22/2002	1712	5.92	3	5	0.08	0.05	0.07	13
	4/5/2002	2347	6.24	3	5	0.11	0.04	0.03	11
Latitude	4/26/2002	2677	5.96	5	6	0.11	0.00	0.04	10
40.53612	6/24/2002	1143	5.76	7	14	0.13	0.22	0.03	11
Longitude	8/14/2002	22	6.75	0	12	0.02	0.65	0.28	9
-78.86256	11/8/2002	1639	5.98	4	6	0.11	0.06	0.05	15
	Average	1590	6.10	4	8	0.09	0.17	0.08	11
	StDev	941	0.35	2	4	0.04	0.25	0.10	2
EKCK02	2/22/2002	13088	6.78	0	46	1.6	2.6	0.44	141
	4/5/2002	16207	8.11	0	157	1.2	2.5	0.42	240
Latitude	4/26/2002	16700	6.44	0	71	1.6	3.0	0.49	213
40.54528	6/24/2002	15418	6.09	0	78	2.6	2.3	0.51	286
Longitude	8/14/2002	5936	7.55	0	143	1.0	1.1	0.58	388
-78.84844	11/8/2002	13292	6.65	0	59.6	1.5	2.2	0.45	111
	Average	13440	6.94	0	92	1.58	2.28	0.48	230
	StDev	3966	0.75	0	46	0.54	0.64	0.06	101
EKCK03	2/22/2002	10733	6.24	0	42	1.8	2.7	0.40	110
	4/5/2002	14798	6.91	0	51	2.0	3.1	0.39	154
Latitude	4/26/2002	15298	6.36	0	45	2.6	3.4	0.40	184
40.54762	6/24/2002	11349	5.89	0	58	3.6	2.7	0.47	255
Longitude	8/14/2002	4597	7.31	0	130	2.1	0.99	0.62	346
-78.84872	11/8/2002	11191	6.45	0	59.0	1.6	2.5	0.47	119
	Average	11328	6.53	0	64	2.28	2.56	0.46	195
	StDev	3834	0.51	0	33	0.73	0.84	0.09	90
CRKD01	2/22/2002	4996	4.49	40	0	4.3	5.6	0.78	77
	4/5/2002	6562	4.79	43	1.7	5.1	6.9	0.76	90
Latitude	4/26/2002	5592	3.74	12	0	7.6	9.3	0.91	121
40.55055	6/24/2002	2997	3.65	108	0	14	9.2	1.44	283
Longitude	8/14/2002	402	3.08	332	0	46	13	5.9	783
-78.84412	11/8/2002	5073	4.24	36	0	4.3	5.1	0.82	120
	Average	4270	4.00	95	0.3	13.56	8.17	1.77	246
	StDev	2225	0.63	121	0.7	16.31	2.95	2.04	274

Site	Date	Flow (gpm)	pH	Acidity (mg/L)	Alk (mg/L)	Al (mg/L)	Fe (mg/L)	Mn (mg/L)	SO4 (mg/L)
CRKD02	2/22/2002	511	6.33	0	14	0.10	0.38	0.09	16
	4/5/2002	414	6.60	0	12	0.20	0.47	0.08	13
Latitude	4/26/2002	279	6.22	1	18	0.32	0.81	0.29	11
40.56879	6/24/2002	142	6.01	0	23	0.04	0.42	0.13	11
Longitude	8/14/2002	58	7.44	0	36	0.02	0.14	0.05	5
-78.83758	11/8/2002	514	6.32	0	23	0.13	0.58	0.16	13
	Average	320	6.49	0.2	21	0.14	0.47	0.13	12
	StDev	192	0.50	0.4	9	0.11	0.22	0.09	3
EKCK34	2/22/2002	1728	5.82	1	10	0.07	0.14	0.09	12
	4/5/2002	NA	NA	NA	NA	NA	NA	NA	NA
Latitude	4/26/2002	2686	6.92	6	12	0.07	0.16	0.05	12
40.5502	6/24/2002	1405	6.09	1	16	0.04	0.30	0.07	14
Longitude	8/14/2002	26	7.14	0	41	0.02	1.1	0.56	11
-78.84366	11/8/2002	1955	6.37	2	11	0.03	0.14	0.08	15
	Average	1560	6.47	2	18	0.05	0.37	0.17	13
	StDev	978	0.55	2	13	0.02	0.41	0.22	2
CALF01	2/22/2002	1356	6.08	3	15	0.34	1.5	0.99	38
	4/5/2002	1875	6.74	0	18	0.26	1.3	0.93	30
Latitude	4/26/2002	1372	6.27	0	20	0.26	1.2	0.97	28
40.5538	6/24/2002	867	5.99	0	30	0.13	1.3	0.95	37
Longitude	8/14/2002	22	6.39	0	27	0.41	4.0	6.3	143
-78.81487	11/8/2002	1164	6.17	3	16	0.34	1.7	1.10	47
	Average	1109	6.27	1	21	0.29	1.83	1.87	54
	StDev	626	0.27	1	6	0.10	1.08	2.17	44
EKCK04	2/22/2002	1579	4.36	93	0	12.5	10	0.38	138
	4/5/2002	2381	4.06	100	0	13.0	12	0.45	201
Latitude	4/26/2002	2094	3.25	143	0	17.0	17	0.49	232
40.55167	6/24/2002	1381	3.26	256	0	32	24	0.86	507
Longitude	8/14/2002	122	2.80	948	0	129	71	2.9	1804
-78.8134	11/8/2002	1540	3.77	92	0	13	8.8	0.43	229
	Average	1516	3.58	272	0	36.08	23.87	0.92	519
	StDev	781	0.58	337	0	46.12	23.74	0.99	642
EKCK05	2/22/2002	552	6.85	0	28	0.02	0.07	0.05	29
	4/5/2002	511	7.36	0	36	0.02	0.06	0.02	25
Latitude	4/26/2002	487	6.58	0	30	0.15	0.32	0.02	23
40.54161	6/24/2002	176	6.15	0	47	0.02	0.11	0.02	39
Longitude	8/14/2002	27	7.66	0	56	0.05	0.39	0.06	44
-78.8005	11/8/2002	441	6.46	0	33.6	0.02	0.09	0.04	28
	Average	366	6.84	0	38	0.05	0.17	0.03	31
	StDev	213	0.57	0	11	0.05	0.14	0.02	8

Attachment F

Comment and Response

Comments/Responses on the Elk Creek Watershed TMDL

A 60-day public comment period was open on the Elk Creek Watershed Draft TMDL from November 6, 2004 until January 5, 2005. During this time, no comments were received.