Final

BLACK CREEK, LITTLE NESCOPECK CREEK and UNT LITTLE NESCOPECK CREEK WATERSHED TMDL

Luzerne County

For Acid Mine Drainage Affected Segments

Prepared by:

Pennsylvania Department of Environmental Protection

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FIGURES

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ATTACHMENTS

[1]TMDL

Black Creek, Little Nescopeck Creek and Little Nescopeck Creek (UNT) Watershed
Luzerne County, Pennsylvania

Table 1. 303(d) Sub-List								
State Water Plan (SWP) Subbasin: 05-D Black Creek, Little Nescopeck Creek and Little Nescopeck Creek (UNT)								
Year	**Miles**	**Segment ID Assessment ID**	**DEP Stream Code**	**Stream Name**	**Designated Use**	**Data Source**	**Source**	**EPA 305(b) Cause Code**
1996	4.3	6179	28109	Black Creek	CWF	305(b) Report	RE	Metals
1996	9.1	4213	28140	Little Nescopeck Creek	CWF	305(b) Report	RE	pH
1996	0.2	4216	28205*	Little Nescopeck Creek (UNT)	CWF	305(b) Report	RE	Metals Other Inorganics
1998	18.58	6179	28109	Black Creek	CWF	SWMP	AMD	Metals Suspended Solids
1998	6.41	4213	28194*	Little Nescopeck Creek	CWF	SWMP	AMD	pH
1998	0.33	4216	28194	Little Nescopeck Creek	CWF	SWMP	AMD	Metals Other Inorganics
2002	24.1	990923-1510-TTS	28109	Black Creek	CWF	SWMP	AMD	Metals pH
2002	6.2	980923-1500-TTS	28140	Little Nescopeck Creek	CWF	SWMP	AMD	pH metals
2002	17.9	980927-1030-TTS		Nescopeck Creek	CWF	SWMP	AMD	Metals pH
2002	3	990923-1426-TTS		Cranberry Creek	CWF	SWMP	AMD	Flow alterations
2002	5.7	990923-1520-TTS		Cranberry Creek, Stony Creek	CWF	SWMP	AMD	Metals pH
2004	22	990923-1510-TTS	28109	Black Creek	Aquatic Life		AMD	Metals, pH Suspended solids
2004	2.1	990923-1511-TTS	28109	Black Creek	Aquatic Life		AMD	Metals, pH Suspended solids
2004	0.5	990923-1520-TTS	28118	Cranberry Creek	Aquatic Life		AMD	Metals, pH
2004	5.7	980923-1500-TTS	28140	Little Nescopeck Creek	Aquatic Life		AMD	Metals, pH Other Inorganics

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

2004	0.5	980923-1501-TTS	28147	UNT Little Nescopeck Creek	Aquatic Life		AMD	pH, metals
2004	17.9	980927-1030-TTS	28102	Nescopeck Creek	Aquatic Life		AMD	Metals, pH
2004	5.2	990923-1520-TTS	28119	Stony Creek	Aquatic Life		AMD	Metals, pH

Cold Water Fishery= CWF
Surface Water Monitoring Program = SWMP
Resource Extraction = RE
Abandoned Mine Drainage = AMD
See Attachment D, *Excerpts Justifying Changes Between the 1996, 1998, 2002 and 2004 Section 303(d) Lists.*
The use designations for the stream segments in this TMDL can be found in PA Title 25 Chapter 93
*segment not included on later 303 (d) lists.

Introduction

This Total Maximum Daily Load (TMDL) calculation has been prepared for three segments in the Black Creek, Little Nescopeck Creek and Little Nescopeck Creek (UNT) Watershed (Attachment A). It was done to address the impairments noted on the 1996 Pennsylvania 303(d) list, required under the Clean Water Act, and covers three segments on this list (shown in Table 1). The 2002 Pennsylvania 303 (d) metals and pH listings for Nescopeck Creek, Stony Creek and Cranberry Creek are also addressed in this document. High levels of metals, other inorganics and in some areas depressed pH caused these impairments. Impairments resulted due to acid drainage from abandoned coalmines. The TMDL addresses the three primary metals associated with acid mine drainage (iron, manganese, aluminum), and pH. The other inorganics listing will be addressed at a future date.

Directions to the Black Creek/Little Nescopeck Creek Watershed

The entire Nescopeck Creek Watershed is approximately 143 square miles in area. The watershed is located in Northeastern Pennsylvania and encompasses many communities including the City of Hazleton. The watershed area is found on United States Geological Survey maps covering portions of the Scranton, Sunbury, Williamsport and Allentown 30 X 60-Minute Series Quadrangles.

The headwaters of Black Creek are just north of Hazleton and easily assessable from SR 309. Little Nescopeck Creek is also assessable from SR 309 near its headwaters and flows westward towards the borough of Conyngham and meets the Nescopeck Creek near SR 93, which is assessable from Interstate 80. Nescopeck Creek flows westward from its headwaters in Dennison Township to its confluence with the Susquehanna River at the communities of Berwick and Nescopeck.

Forestland dominates the majority of the watershed. Croplands are abundant throughout the Little Nescopeck Creek watershed and the lower portion of the Nescopeck Creek watershed. The coal mine lands are situated within the Black Creek, Cranberry Creek, and Stony Creek watersheds.

Segments addressed in this TMDL

Little Nescopeck Creek, Little Nescopeck Creek (UNT), and Black Creek are affected by pollution from AMD. This pollution has caused high levels of metals in the watershed. The major source of AMD occurs at the Jeddo Tunnel discharge, which flows to the Little Nescopeck Creek. The Gowen and Derringer deep mine discharges are major sources of AMD to Black Creek. Other minor discharges/seeps are known to drain to Stony and Black Creeks.

There are active mining operations in the watershed. None of these active operations have an NPDES permit therefore no WLAs have been calculated. The AMD impairments to the watersheds are all caused by abandoned mines and are treated as non-point sources. Each segment on the 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 Table 4 for TMDL calculations and see Attachment C for TMDL explanations.

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 (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 non-point 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 have 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, many 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 non-point source Best Management Practices (BMPs), etc.).

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

Section 303(d) Listing Process

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

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

The assessment method requires selecting representative stream segments based on factors such as surrounding land uses, stream characteristics, surface geology, and point source discharge locations. The biologist selects as many sites as necessary to establish an accurate assessment for a stream segment; the length of the 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 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

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

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

Watershed History

Most of the Little Black Watershed lies within the Eastern Middle Anthracite Field, which is part of Anthracite Upland Section of the Ridge and Valley Province. The Eastern Middle Anthracite Field consists mainly of comparatively small, discontinuous coal basins. The coal seams that lied within these basins have been extensively mined since the early 1880s. As with all the anthracite fields in Pennsylvania, deep or underground mining was the primary means of mining the coal. Along with unregulated surface mining, the natural surface and surface drainage has been destroyed and replaced with flooded deep mine workings.

The coal basins are mostly drained to the surface by drainage tunnels and other deep mine openings. The drainage tunnels were constructed to dewater deep mine workings. The Jeddo Tunnel system is the largest of these drainage tunnels. Construction of the Jeddo Tunnel system started in 1891 and was completed in 1934. The Jeddo Tunnel system is nearly 9 miles in length and branches out to drain over 32 square miles from four major coal basins: Big Black Creek, Little Black Creek, Cross Creek, and Hazleton. All the drainage from the Jeddo Tunnel system discharges outside the coal basins to the Little Nescopeck Creek (UNT).

The Little Nescopeck Watershed lies to the north of the Eastern Middle Anthracite Field and except for the Jeddo Tunnel discharge it has not been impacted by abandoned mining operations. Farmland and forestland are the predominating land use throughout the valley.
Today, the deep mines are abandoned and workings have collapsed in some areas. The abandoned mining operations have destroyed the natural surface water and ground water systems within the coal basins.

Some streams within the watershed have been severely impacted by past mining operations. Cranberry Creek, just west of City of Hazleton, originates at the Grape Run Reservoir and is intact until it crosses the Hazleton Basin, where past strip mining eliminated the stream. From there the stream channel is intact for most of its length through the basin, but very little to no water leaves this basin from Cranberry Creek due to breeches or other infiltration areas. PADEP Bureau of Abandoned Mine Reclamation (BAMR) has plans to backfill the strip pit and reconstruct the stream and to ultimately restore flow for the entire Cranberry Creek. These projects are consistent with restoration sites identified in an assessment report prepared by the Susquehanna River Basin Commission in 1999.

Black Creek from its headwaters to State Route 940, just north of Hazleton, shares a similar state as Cranberry Creek. In this case, past mining has relocated portions of the stream and flow is lost until the stream reaches State Route 940. Sources of AMD drain to Black Creek from smaller coal basins to the west of Hazleton where two major AMD sources from the Gowen and Derringer Tunnels reach the stream, just before it flows out of the Eastern Anthracite Middle Field. Eventually, portions of Black Creek will be restored through reclamation of an active mining operation

Table 2. Active Mining Permits in Nescopeck Creek Watershed

Permit No.	*Operation and Company Name*	*Operation Status*
40663029	Highland 5 Mine, Pagnotti Enterprises, Inc.	Active refuse reprocessing operation.
40663028	Jeddo Basin East Mine, Pagnotti Enterprises, Inc.	Active strip-mining operation.
40663013	Jeddo No. 7 Mine, Jeddo Highland Coal Co	Active refuse reprocessing and disposal operation.
40930102	Lattimer Basin Mine, Mammoth Anthracite LLC	Active strip mining, refuse reprocessing and disposal operation. A preparation plant is also on site.
40980104	Milnesville No. 7 Mine, JMW Enterprises, Inc.	Active strip-mining operation.
40663026	Jeddo No. 2 Mine, Pacton Corp.	Active coal ash and refuse disposal, and refuse reprocession operation.
40850101	Derringer No. 2 Mine, Coal Contractor 1991, Inc.	Affected areas are being reclaimed.
40663025	Jeddo Area No. 1 Mine, Pacton Corp.	Active refuse reprocessing and disposal operation.
40663027	Jeddo Basin West Mine, Jeddo Highland Coal, Co.	Active strip-mining operation.
54793009	Gowen Mine, Coal Contractors 1991, Inc.	Strip mining is being reclaimed.
54000103	Midport Mine, Joe Kuperavage Coal Co.	Active strip mining operation

Permit No.	*Operation and Company Name*	*Operation Status*
40840203	Penneys Mine, Rossi Excavating, Co.	Affected areas are in Stage I (regraded) reclamation.
40930201	Milnesville Mine, Lonzetta Trucking & Excavating Co.	Affected areas are being reclaimed.
40793211	Cranberry Colliery Bank, Jeddo Highland Coal Co.	Active refuse reprocessing operation. A project to restore a part of the Cranberry Creek channel is ongoing.

AMD Methodology

A two-step approach is used for the TMDL analysis of 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 non-point sources, the equations shown below are applied using data for a point in the stream. The load allocation made at that point will be for all of the watershed area that is above that point. For situations where there are point-source impacts alone, or in combination with non-point sources, the evaluation will use the point-source data and perform a mass balance with the receiving water to determine the impact of the point source.

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

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

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

PR = required percent reduction for the current iteration

Cc = criterion in mg/l

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

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

Mean = average observed concentration

Standard Deviation = standard deviation of observed data

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

LTA = Mean * (1 – PR99) where (2)

LTA = allowable LTA source concentration in mg/l

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

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

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

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

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. 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 represent 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 comparison between observed instream conditions and conditions that are expected to restore designated uses. The endpoint is based on either the narrative or numeric criteria available in water quality standards.

Because all of the pollution sources in the watershed are nonpoint sources, the 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
Manganese (Mn)	1.00	Total Recoverable
pH *	6.0-9.0	N/A

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

TMDL Elements (WLA, LA, MOS)

$$TMDL = WLA + LA + MOS$$

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 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. Table 4 contains the TMDL component summary for each point evaluated in the watershed. Refer to the maps in Attachment A.

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 also 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 margin of safety (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 and each TMDL includes upstream loads.

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 currently are no permitted discharges in the Black Creek, Little Nescopeck Creek and Little Nescopeck Creek (UNT) Watershed. The difference between the TMDL and the WLA 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 to the area upstream of the point 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. Black Creek, Little Nescopeck Creek and Little Nescopeck Creek (UNT) Watershed Summary Table

Parameter	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	Load Reduction (lbs/day)	% Reduction
BLCK26						
Aluminum (lbs/day)	19.19	3.13	0	3.13	16.06	84%
Iron (lbs/day)	5.28	5.28	0	NA	NA	NA
Manganese(lbs/day)	4.42	4.42	0	NA	NA	NA
Acidity (lbs/day)	170.37	1.31	0	1.31	169.06	99%
BLCK25						
Aluminum (lbs/day)	1.04	0.90	0	0.90	0.14	13%
Iron (lbs/day)	0.81	0.81	0	NA	NA	NA
Manganese(lbs/day)	1.07	1.07	0	NA	NA	NA
Acidity (lbs/day)	4.99	2.48	0	2.48	2.51	50%
BLCK24						
Aluminum (lbs/day)	12.88	5.34	0	5.34	0	0%*
Iron (lbs/day)	31.88	16.54	0	16.54	15.34	48%
Manganese(lbs/day)	7.74	7.74	0	NA	NA	NA
Acidity (lbs/day)	90.94	24.91	0	24.91	0	0%*
BLCK23						
Aluminum (lbs/day)	1.73	1.73	0	NA	NA	NA
Iron (lbs/day)	4.56	4.56	0	NA	NA	NA
Manganese(lbs/day)	1.96	1.96	0	NA	NA	NA
Acidity (lbs/day)	28.07	16.41	0	16.41	11.66	42%
BLCK22						
Aluminum (lbs/day)	12.68	9.68	0	9.68	0	0%*
Iron (lbs/day)	41.11	41.11	0	NA	NA	NA
Manganese(lbs/day)	20.25	20.25	0	NA	NA	NA
Acidity (lbs/day)	107.58	69.84	0	69.84	0	0%*
BLCK21						
Aluminum (lbs/day)	8.87	8.87	0	NA	NA	NA
Iron (lbs/day)	6.26	6.26	0	NA	NA	NA
Manganese(lbs/day)	2.02	2.02	0	NA	NA	NA
Acidity (lbs/day)	271.07	12.77	0	12.77	258.30	95%
BLCK20						
Aluminum (lbs/day)	1.64	1.47	0	1.47	0.17	10%
Iron (lbs/day)	0.68	0.68	0	NA	NA	NA
Manganese(lbs/day)	0.76	0.76	0	NA	NA	NA
Acidity (lbs/day)	26.59	0.90	0	0.90	25.69	97%
BLCK18						
Aluminum (lbs/day)	17.32	1.96	0	1.96	15.36	89%
Iron (lbs/day)	33.02	3.41	0	3.41	29.61	90%

Parameter	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	Load Reduction (lbs/day)	% Reduction
Manganese(lbs/day)	4.24	4.24	0	NA	NA	NA
Acidity (lbs/day)	125.93	19.25	0	19.25	106.68	85%
BLCK19						
Aluminum (lbs/day)	22.55	22.55	0	NA	NA	NA
Iron (lbs/day)	16.06	16.06	0	NA	NA	NA
Manganese(lbs/day)	5.67	5.67	0	NA	NA	NA
Acidity (lbs/day)	499.32	13.37	0	13.37	95.28	88%
BLCK17						
Aluminum (lbs/day)	53.82	53.82	0	NA	NA	NA
Iron (lbs/day)	120.87	120.87	0	NA	NA	NA
Manganese(lbs/day)	58.38	58.38	0	NA	NA	NA
Acidity (lbs/day)	0.00	0.00	0	NA	NA	NA
BLCK16						
Aluminum (lbs/day)	76.26	76.26	0	NA	NA	NA
Iron (lbs/day)	185.64	185.64	0	NA	NA	NA
Manganese(lbs/day)	88.13	88.13	0	NA	NA	NA
Acidity (lbs/day)	0.00	0.00	0	NA	NA	NA
BLCK15						
Aluminum (lbs/day)	66.88	66.88	0	NA	NA	NA
Iron (lbs/day)	149.69	149.69	0	NA	NA	NA
Manganese(lbs/day)	78.35	78.35	0	NA	NA	NA
Acidity (lbs/day)	0.00	0.00	0	NA	NA	NA
BLCK14						
Aluminum (lbs/day)	70.60	70.60	0	NA	NA	NA
Iron (lbs/day)	146.43	146.43	0	NA	NA	NA
Manganese(lbs/day)	72.56	72.56	0	NA	NA	NA
Acidity (lbs/day)	0.00	0.00	0	NA	NA	NA
BLCK13						
Aluminum (lbs/day)	297.18	20.67	0	20.67	276.51	93%
Iron (lbs/day)	22.94	22.94	0	NA	NA	NA
Manganese(lbs/day)	170.67	26.77	0	26.77	143.90	84%
Acidity (lbs/day)	8182.05	0.00	0	0.00	8182.05	100%
BLCK12						
Aluminum (lbs/day)	846.58	173.06	0	173.06	397.01	70%
Iron (lbs/day)	260.77	260.77	0	NA	NA	NA
Manganese(lbs/day)	530.86	241.81	0	241.81	145.15	38%
Acidity (lbs/day)	5816.18	389.98	0	389.98	0	0%*
BLCK11						
Aluminum (lbs/day)	809.18	324.68	0	324.68	0	0%*

Parameter	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	Load Reduction (lbs/day)	% Reduction
Iron (lbs/day)	281.99	281.99	0	NA	NA	NA
Manganese(lbs/day)	520.51	448.23	0	448.23	0	0%*
Acidity (lbs/day)	5823.65	607.81	0	607.81	0	0%*
BLCK10						
Aluminum (lbs/day)	636.98	366.86	0	366.86	0	0%*
Iron (lbs/day)	269.19	269.19	0	NA	NA	NA
Manganese(lbs/day)	457.05	450.35	0	450.35	0	0%*
Acidity (lbs/day)	4332.93	555.82	0	555.82	0	0%*
LNESC9						
Aluminum (lbs/day)	2.79	2.79	0	NA	NA	NA
Iron (lbs/day)	11.33	11.33	0	NA	NA	NA
Manganese(lbs/day)	2.55	2.55	0	NA	NA	NA
Acidity (lbs/day)	0.00	0.00	0	NA	NA	NA
JEDDO8						
Aluminum (lbs/day)	2968.02	244.44	0	244.44	2723.58	92%
Iron (lbs/day)	1004.94	475.74	0	475.74	529.20	53%
Manganese(lbs/day)	1355.30	317.69	0	317.69	1037.61	77%
Acidity (lbs/day)	17941.87	0.00	0	0.00	17941.87	100%
LNESC7						
Aluminum (lbs/day)	3175.09	252.91	0	252.91	198.60	44%
Iron (lbs/day)	1126.10	515.56	0	515.56	81.34	14%
Manganese(lbs/day)	1431.68	349.84	0	349.84	44.23	11%
Acidity (lbs/day)	19114.42	0.00	0	0.00	1172.55	100%
LNESC6						
Aluminum (lbs/day)	2871.17	262.38	0	262.38	0	0%*
Iron (lbs/day)	858.97	546.60	0	546.60	0	0%*
Manganese(lbs/day)	1349.93	339.01	0	339.01	0	0%*
Acidity (lbs/day)	16671.02	27.59	0	27.59	0	0%*
LNESC5						
Aluminum (lbs/day)	2974.03	275.76	0	275.76	89.48	24%
Iron (lbs/day)	985.40	530.72	0	530.72	142.31	21%
Manganese(lbs/day)	1417.52	348.82	0	348.82	57.78	14%
Acidity (lbs/day)	16501.51	58.61	0	58.61	0	0%*
NESCO4						
Aluminum (lbs/day)	33.83	33.83	0	NA	NA	NA
Iron (lbs/day)	169.13	169.13	0	NA	NA	NA

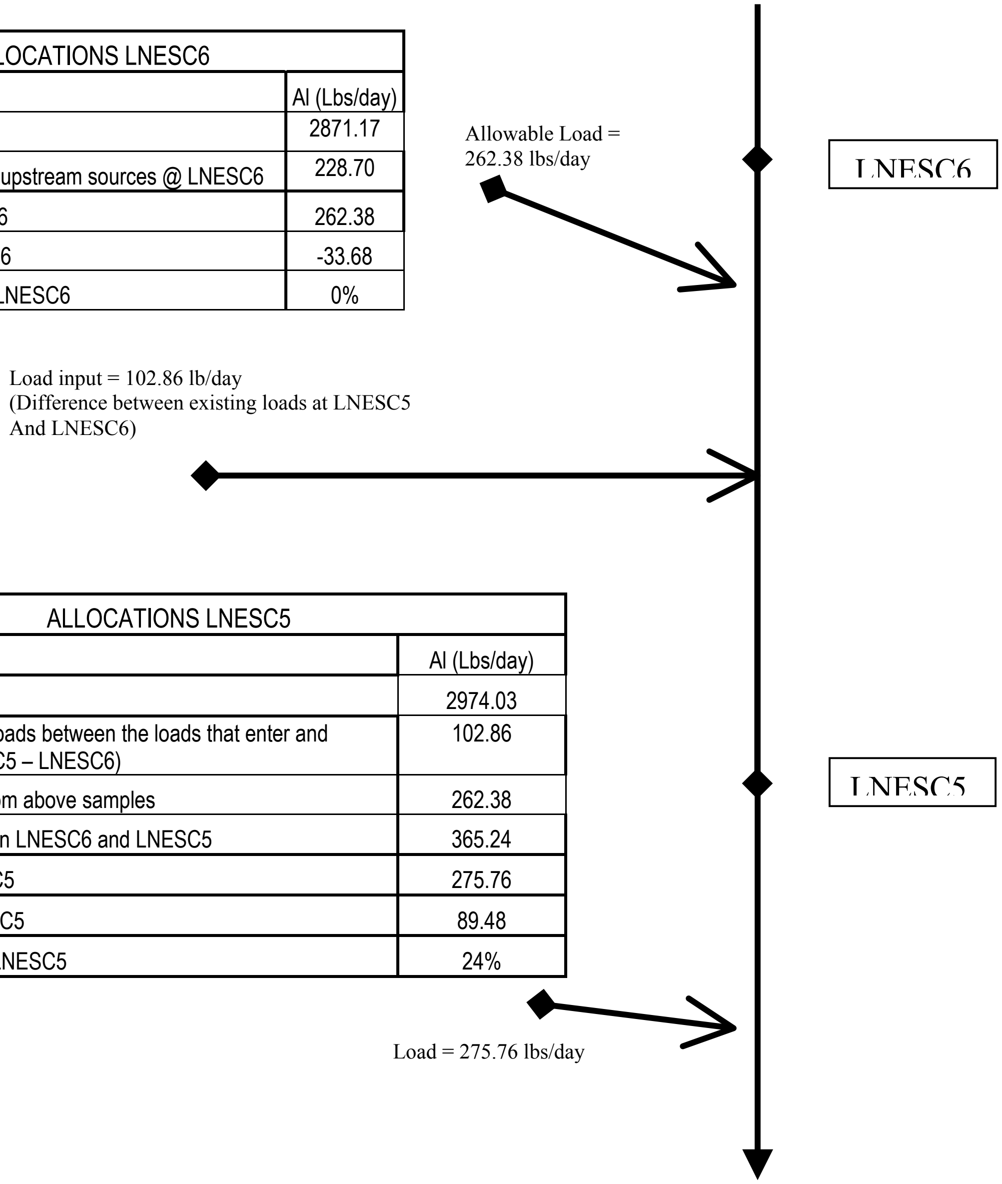
Parameter	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	Load Reduction (lbs/day)	% Reduction
Manganese(lbs/day)	18.04	18.04	0	NA	NA	NA
Acidity (lbs/day)	0.00	0.00	0	NA	NA	NA
NESCO2						
Aluminum (lbs/day)	2982.16	572.99	0	572.99	0	0%*
Iron (lbs/day)	1085.64	1085.64	0	NA	NA	NA
Manganese(lbs/day)	1534.64	705.96	0	705.96	0	0%*
Acidity (lbs/day)	15786.45	744.03	0	744.03	0	0%*
NESCO1						
Aluminum (lbs/day)	3357.51	914.93	0	914.93	0	0%*
Iron (lbs/day)	1285.01	1285.01	0	NA	NA	NA
Manganese(lbs/day)	1894.57	1127.30	0	1127.30	0	0%*
Acidity (lbs/day)	18619.52	1564.24	0	1564.24	0	0%*

* Total of loads affecting this segment is less than the allowable load calculated at this point, therefore no reduction is necessary.
NA = not applicable

In the instance that the allowable load is equal to the measured load (e.g. iron at BLCK25, 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. This is denoted as "NA" in the above table.

Following is an example of how the allocations, presented in Table 4, for a stream segment are calculated. For this example, aluminum allocations for LNESC5 of Little Nescopeck Creek 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 maps of the sampling point locations for reference.

ALLOCATIONS LNESC6	
LNESC6	Al (Lbs/day)
Existing Load @ LNESC6	2871.17
Total load tracked from upstream sources @ LNESC6	228.70
Allowable load @ LNESC6	262.38
Load reduction @ LNESC6	-33.68
% Reduction required @ LNESC6	0%



ALLOCATIONS LNESC5	
LNESC5	Al (Lbs/day)
Existing Load @ LNESC5	2974.03
Difference in measured Loads between the loads that enter and existing LNESC5 (LNESC5 – LNESC6)	102.86
Additional load tracked from above samples	262.38
Total load tracked between LNESC6 and LNESC5	365.24
Allowable Load @ LNESC5	275.76
Load Reduction @ LNESC5	89.48
% Reduction required at LNESC5	24%

The allowable load tracked from LNESC6 was 262.38 lbs/day. The existing load at LNESC6 was subtracted from the existing load at LNESC5 to show the actual measured increase of aluminum load that has entered the stream between these two sample points (102.86 lbs/day). This increased value was then added to the allowable load at LNESC6 to calculate the total load that was tracked between LNESC6 and LNESC5 (allowable load @ LNESC6 + the difference in existing load between LNESC6 and LNESC5). This total load tracked was then subtracted from the calculated allowable load at LNESC5 to determine the amount of load to be reduced at LNESC5. This value was found to be 365.24 lbs/day; it was 89.48 lbs/day greater then the LNESC5 allowable load of 275.76 lbs/day. Therefore, a 24% aluminum reduction at LNESC5 is necessary. From this point, the allowable load at LNESC5 will be tracked to the next downstream point, NESCO2.

Recommendations

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

Additional opportunities for water quality improvement are both ongoing and anticipated. Historically, a great deal of research into mine drainage has been conducted by BAMR, 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 319 Grant program, and Pennsylvania's Growing Greener program have 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; and administers a loan program for bonding anthracite underground mines and for mine subsidence and administers the EPA Watershed Assessment Grant Program, the Small Operator's Assistance Program (SOAP), and the Remining Operators Assistance Program (ROAP).

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

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

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

Reclaim PA is DEP's initiative designed to maximize reclamation of the state's quarter million acres of abandoned mineral extraction lands. Abandoned mineral extraction lands in

Pennsylvania constituted a significant public liability – more than 250,000 acres of abandoned surface mines, 2,400 miles of streams polluted with mine drainage, over 7,000 orphaned and abandoned oil and gas wells, widespread subsidence problems, numerous hazardous mine openings, mine fires, abandoned structures and affected water supplies – representing as much as one third of the total problem nationally.

The Friends of the Nescopeck is a watershed association devoted to the protection and preservation of the Nescopeck Creek Watershed. The group lists the following three goals:

- To educate the public about the importance of conservation, maintenance of quality fish and wildlife habitat, and natural diversity.
- To develop and assist in programs that identify, assess and monitor areas of impact within the watershed.
- To develop and assist in programs for the maintenance and improvement of the watershed.

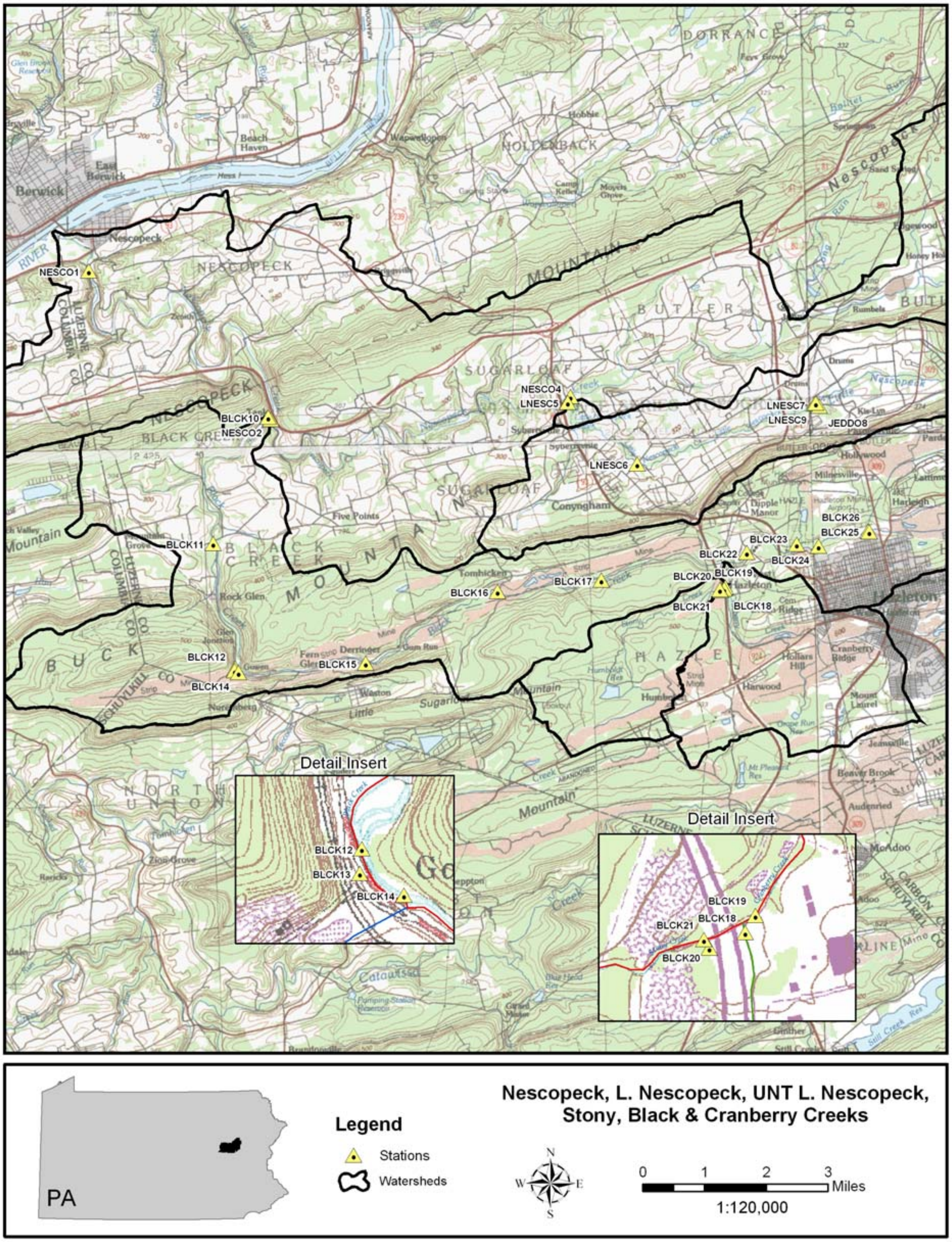
The Eastern Middle Anthracite Region Recovery (EMARR) project was formed to utilize a regional watershed approach to environmental reclamation, community and economic growth, natural resource development and management of within the Jeddo Tunnel drainage area. Current scope of work includes an interactive GIS database of mine data and other digital information and an assessment of the hydrology and hydrogeology of surface and groundwater resources. Future work will include the identification and prioritization of reclamation areas and conceptual designs for high priority areas.

Public Participation

Public notice of the draft TMDL was published in the *Pennsylvania Bulletin* and The Standard Speaker, Hazleton PA, to foster public comment on the allowable loads calculated. A public meeting was held on March 9, 2005 at the Freeland Borough Building, to discuss the proposed TMDL.

Attachment A

Black Creek, Little Nescopeck Creek and UNT Little Nescopeck Creek Watershed Maps


Nescopeck, L. Nescopeck, UNT L. Nescopeck,
Stony, Black & Cranberry Creeks
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Stations
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NESCO1
NESCO2
NESCO4
LNESC5
LNESC6
LNESC7
LNESC9
JEDDO8
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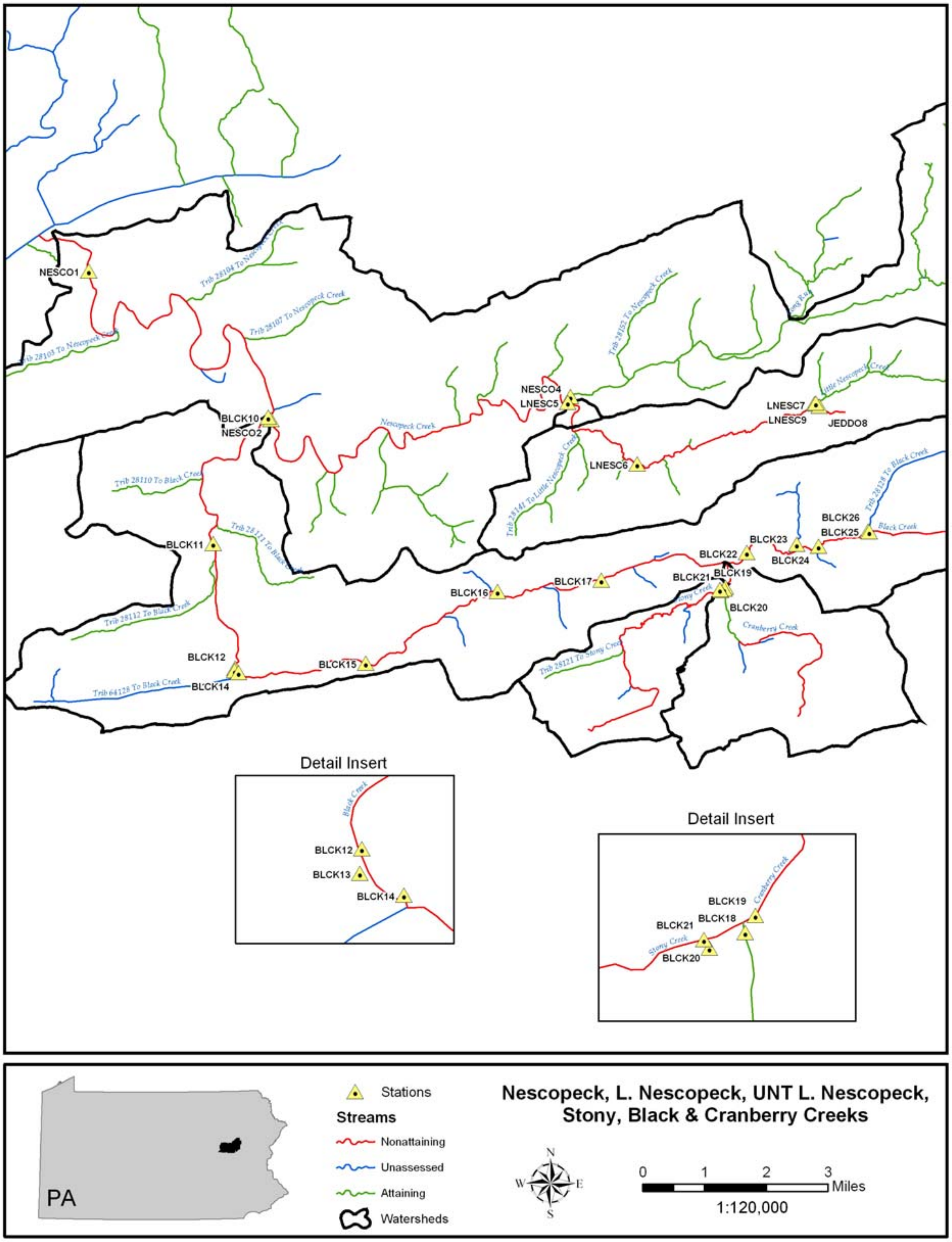
BLCK25
BLCK26



NESCO1
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BLCK24
BLCK25
BLCK26
Nescopeck Creek
Black Creek
Stony Creek
Cranberry Creek
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BLCK18
BLCK21
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Stations
Streams
Nonattaining
Unassessed
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Watersheds
Nescopeck, L. Nescopeck, UNT L. Nescopeck, Stony, Black & Cranberry Creeks
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Attachment B

Method for Addressing Section 303(d) Listings for pH and *Surface Mining Control and Reclamation Act*

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

The pH, a measurement of hydrogen ion acidity presented as a negative logarithm, is not conducive to standard statistics. Additionally, pH does not measure latent acidity. For this reason, and based on the above information, Pennsylvania is using the following approach to address the stream impairments noted on the 303(d) list due to pH. The concentration of acidity in a stream is at least partially chemically dependent upon metals. For this reason, it is extremely difficult to predict the exact pH values, which would result from treatment of abandoned mine drainage. 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. The same statistical procedures that have been described for use in the evaluation of the metals is applied, using the average value for total alkalinity at that point as the target to specify a reduction in the acid concentration. By maintaining a net alkaline stream, the pH value will be in the range between six and eight. This method negates the need to specifically compute the pH value, which for mine waters is not a true reflection of acidity. This method assures that Pennsylvania's standard for pH is met when the acid concentration reduction is met.

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

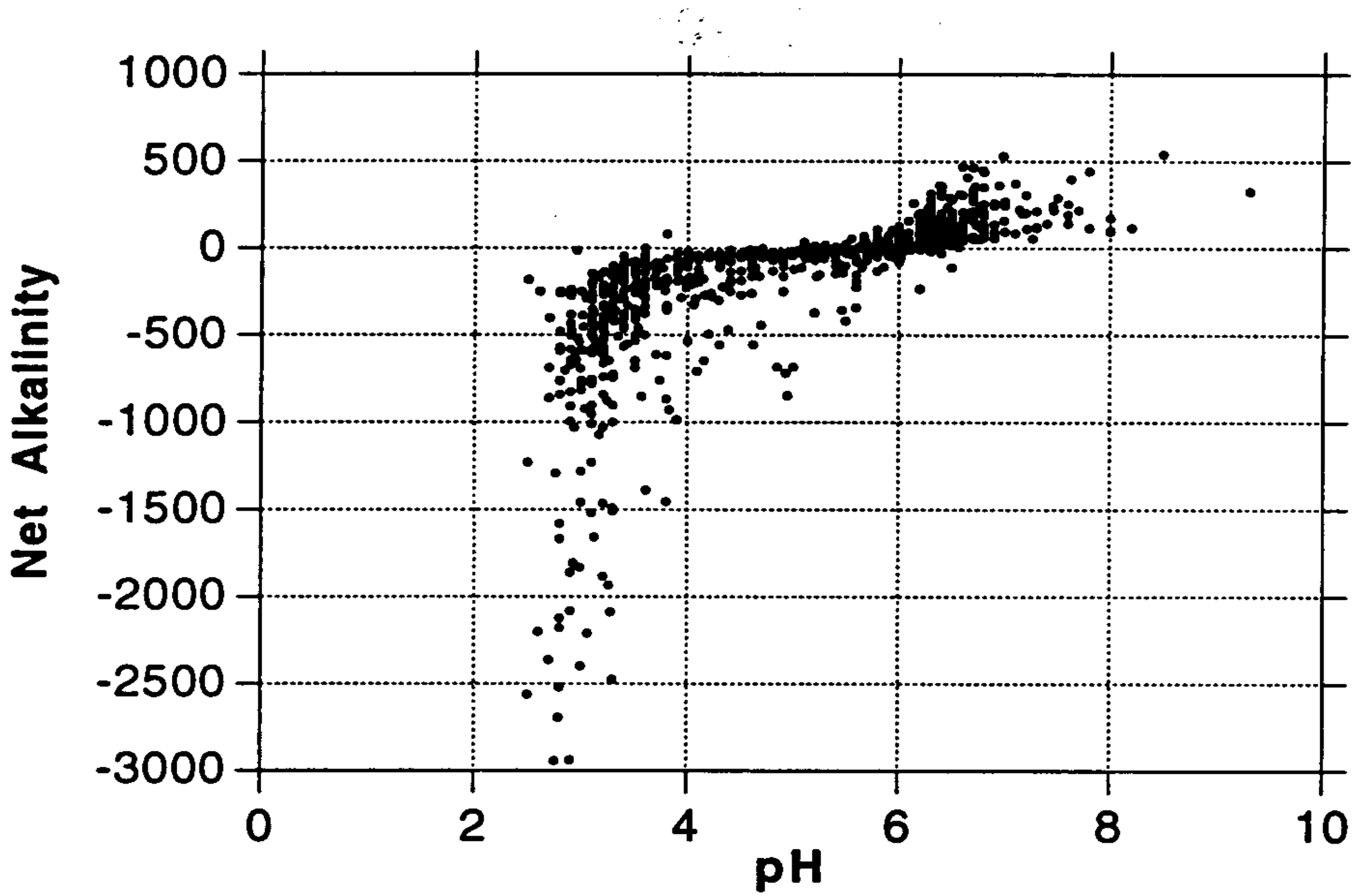


Figure 1. Net Alkalinity vs. pH. Taken from Figure 1.2 Graph C, pages 1-5, of Coal Mine Drainage Prediction and Pollution Prevention in Pennsylvania

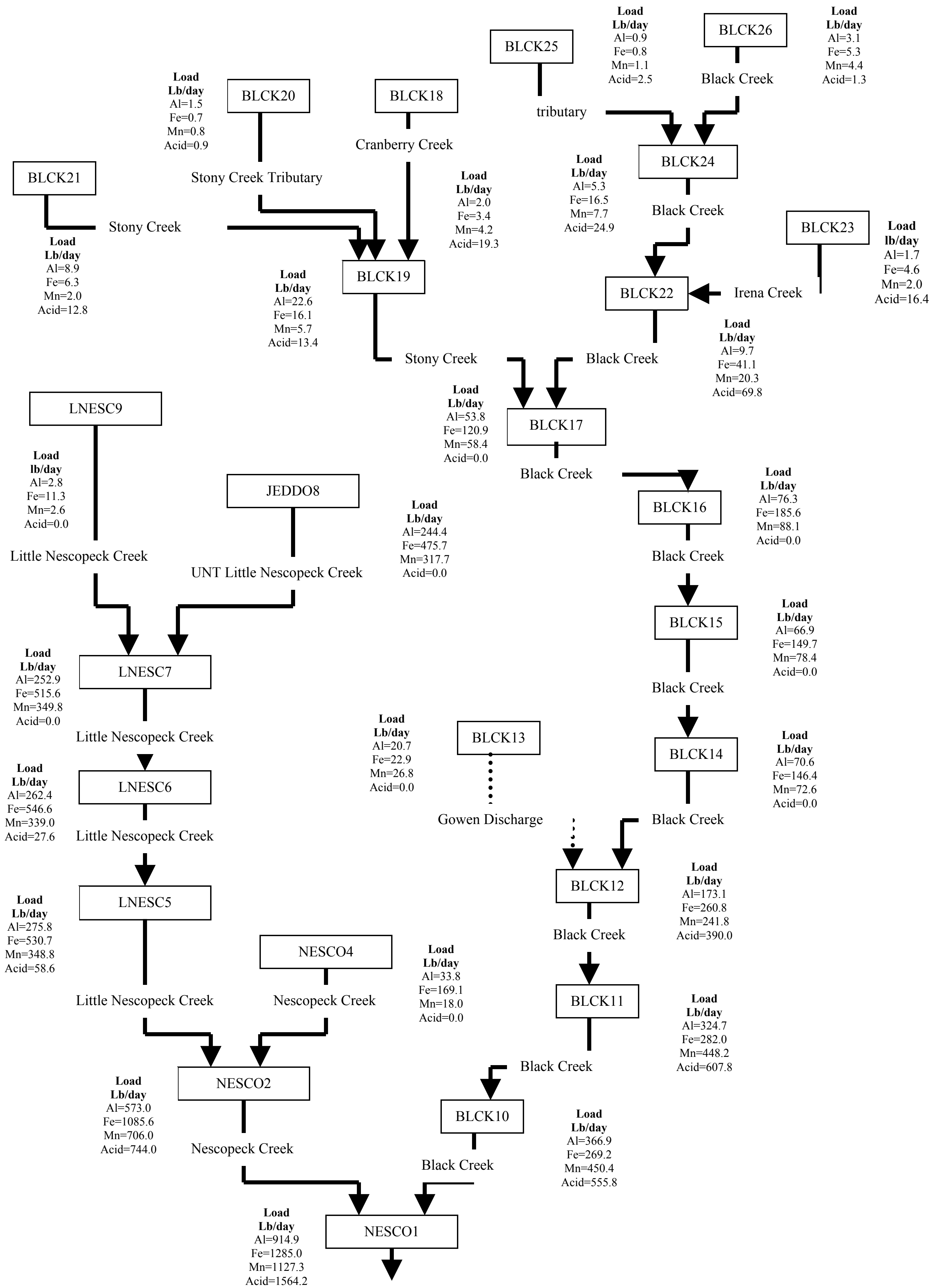
Attachment C
TMDLs By Segment

Black Creek, Little Nescopeck Creek and UNT Little Nescopeck Creek

The TMDL for Black Creek, Little Nescopeck Creek and UNT Little Nescopeck Creek consists of load allocations to four sampling sites along Little Nescopeck Creek (LNESC9, LNESC7, LNESC6 and LNESC5), 1 sampling site on the unnamed tributary of Little Nescopeck Creek (JEDDO8 (Jeddo Tunnel)). There are 3 sites along Nescopeck Creek (NESCO4, NESCO2 and NESCO1). There are 10 sample sites on Black Creek (BLCK10, BLCK11, BLCK12, BLCK14, BLCK15, BLCK16, BLCK17, BLCK22, BLCK24 and BLCK26). There is one discharge into Black Creek (BLCK13). There are also 2 sample sites on Stony Creek (BLCK19 and BLCK21) as well as 2 sample sites on tributaries to Stony Creek (BLCK20 and BLCK18). There is a sample site on Irena Creek (BLCK 23) and a site on an unnamed tributary to Black Creek (BLCK25). Sample data sets were collected during 2003 and 2004. All sample points are shown on the maps included in Attachment A as well as on the allowable loading schematic presented on the following page.

Black Creek, Little Nescopeck Creek and UNT Little Nescopeck Creek are listed on the 1996 PA Section 303(d) list for metals from AMD, pH and other inorganics as being the causes of the degradation to these streams. Although this TMDL will focus primarily on metals analysis to the Black Creek, Little Nescopeck Creek and UNT Little Nescopeck Creek watersheds, pH and reduced acid loading will be performed. 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 3). The method and rationale for addressing pH is contained in Attachment B.

An allowable long-term average in-stream concentration was determined at each sample point for metals 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 log normally 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. Following is an explanation of the TMDL for each allocation point.


BLCK25
tributary
Load Lb/day Al=0.9 Fe=0.8 Mn=1.1 Acid=2.5
BLCK26
Black Creek
Load Lb/day Al=3.1 Fe=5.3 Mn=4.4 Acid=1.3
BLCK20
Load Lb/day Al=1.5 Fe=0.7 Mn=0.8 Acid=0.9
Stony Creek Tributary
BLCK18
Cranberry Creek
Load Lb/day Al=2.0 Fe=3.4 Mn=4.2 Acid=19.3
BLCK21
Stony Creek
Load Lb/day Al=8.9 Fe=6.3 Mn=2.0 Acid=12.8
BLCK24
Load Lb/day Al=5.3 Fe=16.5 Mn=7.7 Acid=24.9
Black Creek
BLCK23
Load lb/day Al=1.7 Fe=4.6 Mn=2.0 Acid=16.4
Irena Creek
BLCK22
Load Lb/day Al=9.7 Fe=41.1 Mn=20.3 Acid=69.8
BLCK19
Load Lb/day Al=22.6 Fe=16.1 Mn=5.7 Acid=13.4
Stony Creek
Black Creek
BLCK17
Load Lb/day Al=53.8 Fe=120.9 Mn=58.4 Acid=0.0
Black Creek
BLCK16
Load Lb/day Al=76.3 Fe=185.6 Mn=88.1 Acid=0.0
Black Creek
BLCK15
Load Lb/day Al=66.9 Fe=149.7 Mn=78.4 Acid=0.0
Black Creek
BLCK14
Load Lb/day Al=70.6 Fe=146.4 Mn=72.6 Acid=0.0
Black Creek
LNESC9
Load lb/day Al=2.8 Fe=11.3 Mn=2.6 Acid=0.0
Little Nescopeck Creek
JEDDO8
UNT Little Nescopeck Creek
Load Lb/day Al=244.4 Fe=475.7 Mn=317.7 Acid=0.0
LNESC7
Load Lb/day Al=252.9 Fe=515.6 Mn=349.8 Acid=0.0
Little Nescopeck Creek
LNESC6
Load Lb/day Al=262.4 Fe=546.6 Mn=339.0 Acid=27.6
Little Nescopeck Creek
LNESC5
Load Lb/day Al=275.8 Fe=530.7 Mn=348.8 Acid=58.6
Little Nescopeck Creek
BLCK13
Load Lb/day Al=20.7 Fe=22.9 Mn=26.8 Acid=0.0
Gowen Discharge
BLCK12
Load Lb/day Al=173.1 Fe=260.8 Mn=241.8 Acid=390.0
Black Creek
BLCK11
Load Lb/day Al=324.7 Fe=282.0 Mn=448.2 Acid=607.8
Black Creek
NESCO4
Nescopeck Creek
Load Lb/day Al=33.8 Fe=169.1 Mn=18.0 Acid=0.0
NESCO2
Load Lb/day Al=573.0 Fe=1085.6 Mn=706.0 Acid=744.0
Nescopeck Creek
BLCK10
Load Lb/day Al=366.9 Fe=269.2 Mn=450.4 Acid=555.8
Black Creek
NESCO1
Load Lb/day Al=914.9 Fe=1285.0 Mn=1127.3 Acid=1564.2

TMDL calculations- BLCK26-Most Upstream sample point on main stem Black Creek

The TMDL for sample point BLCK26 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this headwaters segment of Black Creek was computed using water-quality sample data collected at point BLCK26. The average flow, measured at the sampling point BLCK26 (1.11 MGD), is used for these computations. This is the most upstream point of this segment and the allowable load allocations calculated at BLCK26 will directly affect the downstream point BLCK24.

Sample data at point BLCK26 shows that this headwaters section of Black Creek has a pH ranging between 4.1 and 4.8. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

A TMDL for aluminum and acidity at BLCK26 have been calculated. The measured sample data for iron and manganese were above detection limits but fell below applicable water quality criteria limits. Because water quality standards are met, a TMDL for these parameters isn't necessary and is not calculated.

Table C1 shows the measured and allowable concentrations and loads at BLCK26. Table C2 shows percent reductions for aluminum and acidity required at this point.

Table C1		Measured		Allowable	
Flow (gpm)=	769.33	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	2.08	19.2	0.34	3.1
	Iron	0.57	5.3	0.57	5.3
	Manganese	0.48	4.4	0.48	4.4
	Acidity	18.44	170.4	0.14	1.3
	Alkalinity	0.26	2.4		

Table C2. Allocations BLCK26		
BLCK26	Al (Lbs/day)	Acidity (Lbs/day)
Existing Load @ BLCK26	19.19	170.37
Allowable Load @ BLCK26	3.13	1.31
Load Reduction @ BLCK26	16.06	169.06
% Reduction required @BLCK26	84%	99%

TMDL calculations- BLCK25-Unnamed Tributary to Black Creek

The TMDL for sample point BLCK25 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this tributary to upper Black Creek was computed using water-quality sample data collected at point BLCK25. The average flow, measured at the sampling point BLCK25 (0.57 MGD), is used for these computations. The allowable load allocations calculated at BLCK25 will directly affect the downstream point BLCK24.

Sample data at point BLCK25 shows that this tributary of Black Creek has a pH ranging between 5.8 and 6.4. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

A TMDL for aluminum and acidity at BLCK25 have been calculated. The measured sample data for iron and manganese were above detection limits but fell below applicable water quality criteria limits. Because water quality standards are met, a TMDL for these parameters isn't necessary and is not calculated.

Table C3 shows the measured and allowable concentrations and loads at BLCK25. Table C4 shows percent reductions for aluminum and acidity required at this point.

Table C3		Measured		Allowable	
Flow (gpm)=	395.50	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.22	1.0	0.19	0.9
	Iron	0.17	0.8	0.17	0.8
	Manganese	0.23	1.1	0.23	1.1
	Acidity	1.05	5.0	0.52	2.5
	Alkalinity	4.85	23.0		

Table C4. Allocations BLCK25		
BLCK25	Al (Lbs/day)	Acidity (Lbs/day)
Existing Load @ BLCK25	1.04	4.99
Allowable Load @ BLCK25	0.90	2.48
Load Reduction @ BLCK25	0.14	2.51
% Reduction required @BLCK25	13%	50%

TMDL calculations-BLCK24- Main stem of Black Creek behind Hazleton High School

The TMDL for sampling point BLCK24 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this segment was computed using water-quality sample data collected at point BLCK24. The average flow, measured at the sampling point BLCK24 (3.25 MGD), is used for these computations. The allowable loads calculated at BLCK24 will directly affect the downstream point BLCK22.

Sample data at point BLCK24 shows pH ranging between 4.9 and 6.0; pH will be addressed as part of this TMDL. There currently is not an entry for this segment on the Section Pa 303(d) list for impairment due to pH.

The measured and allowable loading for point BLCK24 for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from points BLCK26 and BLCK25 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points BLCK26 and BLCK25 and BLCK24 to determine a total load tracked for the segment of stream between BLCK24 and BLCK26/BLCK25. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at BLCK24.

A TMDL for aluminum, iron and acidity at BLCK24 has been calculated. The measured sample data for manganese was above detection limits but fell below applicable water quality criteria limits. Because water quality standards are met, a TMDL for this parameter isn't necessary and is not calculated.

Table C5 shows the measured and allowable concentrations and loads at BLCK24. Table C6 shows the percent reduction for aluminum, iron and acidity needed at BLCK24.

Table C5		Measured		Allowable	
Flow (gpm)=	2253.60	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.48	12.9	0.20	5.3
	Iron	1.18	31.9	0.61	16.5
	Manganese	0.29	7.7	0.29	7.7
	Acidity	3.36	90.9	0.92	24.9
	Alkalinity	4.86	131.4		

Table C6. Allocations BLCK24			
BLCK24	Al (Lbs/day)	Fe (Lbs/day)	Acidity (Lbs/day)
Existing Load @ BLCK24	12.88	31.88	90.94
Difference in measured Loads between the loads that enter and existing BLCK24	-7.35	25.79	-84.42
Percent loss due calculated at BLCK24	36.3%	NA	48.1%
Additional load tracked from above samples	4.03	6.09	3.79
Percentage of upstream loads that reach the BLCK24	63.7%	NA	51.9%
Total load tracked between BLCK26/BLCK25 and BLCK24	2.57	31.88	1.97
Allowable Load @ BLCK24	5.34	16.54	24.91
Load Reduction @ BLCK24	-2.77	15.34	-22.94
% Reduction required at BLCK24	0%	48%	0%

The existing aluminum load was measured to be 12.88 lbs/day. This was 7.35 lbs/day less than the upstream contributing loads, a 36.3% loss. This decrease in load was possibly due to natural processes in this segment of stream. The total aluminum load tracked was 2.57 lbs/day; this was 2.77 lbs/day less than the allowable load of 5.34 lbs/day, resulting in no reduction necessary for aluminum at this sample point. The existing iron load was measured to be 31.88 lbs/day. A reduction of 15.34 lbs/day is needed to achieve the calculated allowable load of 16.54 lbs/day. A

48% reduction is required. The existing acidic load was measured to be 90.94 lbs/day. This was 84.42 lbs/day less than the upstream contributing loads, a 48.1% loss, this decrease in load was possibly due to natural processes in this segment of stream. The total load tracked was 1.97 lbs/day, which was 22.94 lbs/day less than the calculated allowable acidic load of 24.91 lbs/day, resulting in no reduction necessary for acidity at this sample point.

TMDL calculations- BLCK23-Irena Creek under old railroad bridge

The TMDL for sample point BLCK23 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for Irena Creek, a tributary of Black Creek, was computed using water-quality sample data collected at point BLCK23. The average flow, measured at the sampling point BLCK23 (1.66 MGD), is used for these computations. The allowable loads calculated at BLCK23 will directly affect the downstream point BLCK22.

Sample data at point BLCK23 shows that Irena Creek has a pH ranging between 5.8 and 6.1. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

A TMDL for acidity at BLCK23 has been calculated. Sampling at BLCK23 showed the measured sample data for aluminum, iron and manganese were above detection limits but fell below applicable water quality criteria limits. Because water quality standards are met, a TMDL for these parameters isn't necessary and is not calculated.

Table C7 shows the measured and allowable concentrations and loads at BLCK23. Table C8 shows the percent reduction for acidity needed at BLCK23.

Table C7		Measured		Allowable	
Flow (gpm)=	1149.33	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.13	1.7	0.13	1.7
	Iron	0.33	4.6	0.33	4.6
	Manganese	0.14	2.0	0.14	2.0
	Acidity	2.03	28.1	1.19	16.4
	Alkalinity	3.86	53.2		

Table C8. Allocations BLCK23	
BLCK23	Acidity (Lbs/day)
Existing Load @ BLCK23	28.07
Allowable Load @ BLCK23	16.41
Load Reduction @ BLCK23	11.66
% Reduction required @BLCK23	42%

TMDL calculations-BLCK22- Main stem of Black Creek at entrance to Hazleton Wastewater Treatment Plant

The TMDL for sampling point BLCK22 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this segment was computed using water-quality sample data collected at point BLCK22. The average flow, measured at the sampling point BLCK22 (7.36 MGD), is used for these computations. The allowable loads calculated at BLCK22 will directly affect the downstream point BLCK17.

Sample data at point BLCK22 shows pH ranging between 5.5 and 6.0; pH will be addressed as part of this TMDL. There currently is not an entry for this segment on the Section Pa 303(d) list for impairment due to pH.

The measured and allowable loading for point BLCK22 for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from points BLCK24/ BLCK23 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points BLCK24/ BLCK23 and BLCK22 to determine a total load tracked for the segment of stream between BLCK22 and BLCK24/ BLCK23. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at BLCK22.

A TMDL for aluminum and acidity at BLCK22 has been calculated. The measured sample data for iron and manganese were above detection limits but fell below applicable water quality criteria limits. Because water quality standards are met, a TMDL for these parameters isn't necessary and is not calculated.

Table C9 shows the measured and allowable concentrations and loads at BLCK22. Table C10 shows the percent reduction for aluminum and acidity needed at BLCK22.

Table C9		Measured		Allowable	
Flow (gpm)=	5109.00	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.21	12.7	0.16	9.7
	Iron	0.67	41.1	0.67	41.1
	Manganese	0.33	20.3	0.33	20.3
	Acidity	1.75	107.6	1.14	69.8
	Alkalinity	4.70	288.1		

Table C10. Allocations BLCK22		
BLCK22	Al (Lbs/day)	Acidity (Lbs/day)
Existing Load @ BLCK22	12.68	107.58
Difference in measured Loads between the loads that enter and existing BLCK22	-1.93	-11.43

Percent loss due calculated at BLCK22	13.2%	9.6%
Additional load tracked from above samples	7.07	41.32
Percentage of upstream loads that reach the BLCK22	86.8%	90.4%
Total load tracked between BLCK24/BLCK23 and BLCK22	6.14	37.35
Allowable Load @ BLCK22	9.68	69.84
Load Reduction @ BLCK22	-3.54	-32.49
% Reduction required at BLCK22	0%	0%

There is a 1.6% loss of aluminum between BLCK24/BLCK23 and BLCK22. The total aluminum load tracked at BLCK22 was found to be 6.14 lbs/day, which was 3.54 lbs/day less then the calculated allowable load of 9.68 lbs/day. Therefore, there is no aluminum reduction necessary at this sample point. An existing acidic load of 107.58 lbs/day was measured at BLCK22. There was a loss of 11.43 lbs/day or 9.6% of acidity in this segment of Black Creek. This loss of aluminum and acidity can be attributed to dilution factors or natural stream processes. The total acidic load tracked between BLCK24/BLCK23 and BLCK22 was 37.35lbs/day. This was 32.49 lbs/day less than the calculated allowable load of 69.84 lbs/day. Therefore no reduction of acidity was necessary at BLCK22.

TMDL calculations- BLCK21-Main stem of Stony Creek upstream of I-81 overpass

The TMDL for sample point BLCK21 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for Stony Creek was computed using water-quality sample data collected at point BLCK21. The average flow, measured at the sampling point BLCK21 (4.62 MGD), is used for these computations. The allowable loads calculated at BLCK21 will directly affect the downstream point BLCK19.

Sample data at point BLCK21 shows that Stony Creek has a pH ranging between 4.5 and 4.7. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

A TMDL for acidity at BLCK21 has been calculated. Sampling at BLCK21 showed the measured sample data for aluminum, iron and manganese were above detection limits but fell below applicable water quality criteria limits. Because water quality standards are met, a TMDL for these parameters isn't necessary and is not calculated.

Table C11 shows the measured and allowable concentrations and loads at BLCK21. Table C12 shows the percent reduction for acidity at BLCK21.

Table C11		Measured		Allowable	
Flow (gpm)=	3209.50	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.23	8.9	0.23	8.9
	Iron	0.16	6.3	0.16	6.3
	Manganese	0.05	2.0	0.05	2.0
	Acidity	7.03	271.1	0.33	12.8
	Alkalinity	0.40	15.2		

Table C12. Allocations BLCK21	
BLCK21	Acidity (Lbs/day)
Existing Load @ BLCK21	271.07
Allowable Load @ BLCK21	12.77
Load Reduction @ BLCK21	258.30
% Reduction required @BLCK21	95%

TMDL calculations- BLCK20-Unnamed Tributary to Stony Creek just upstream of I-81 overpass

The TMDL for sample point BLCK20 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this tributary to Stony Creek was computed using water-quality sample data collected at point BLCK20. The average flow, measured at the sampling point BLCK20 (0.39 MGD), is used for these computations. The allowable loads calculated at BLCK20 will directly affect the downstream point BLCK19.

Sample data at point BLCK20 shows that this tributary of Stony Creek has a pH ranging between 4.3 and 4.8. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

A TMDL for aluminum and acidity at BLCK20 has been calculated. Sampling at BLCK20 showed the measured sample data for iron and manganese were above detection limits but fell below applicable water quality criteria limits. Because water quality standards are met, a TMDL for these parameters isn't necessary and is not calculated.

Table C13 shows the measured and allowable concentrations and loads at BLCK20. Table C14 shows the percent reduction for aluminum and acidity at BLCK20.

Table C13		Measured		Allowable	
Flow (gpm)=	271.25	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.50	1.6	0.45	1.5
	Iron	0.21	0.7	0.21	0.7
	Manganese	0.23	0.8	0.23	0.8
	Acidity	8.16	26.6	0.28	0.9
	Alkalinity	0.29	1.0		

Table C14. Allocations BLCK20		
BLCK20	Al (Lbs/day)	Acidity (Lbs/day)
Existing Load @ BLCK20	1.64	26.59
Allowable Load @ BLCK20	1.47	0.90
Load Reduction @ BLCK20	0.17	25.69
% Reduction required @BLCK20	10%	97%

TMDL calculations- BLCK18-Main stem of Cranberry Creek, just upstream of Stony Creek confluence

The TMDL for sample point BLCK18 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for Cranberry Creek was computed using water-quality sample data collected at point BLCK18. The average flow, measured at the sampling point BLCK18 (2.16 MGD), is used for these computations. The allowable loads calculated at BLCK18 will directly affect the downstream point BLCK19.

Sample data at point BLCK18 shows that Cranberry Creek has a pH ranging between 4.8 and 5.6. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

A TMDL for aluminum, iron and acidity at BLCK18 has been calculated. Sampling at BLCK18 showed that the measured sample data for manganese was above detection limits but fell below applicable water quality criteria limits. Because water quality standards are met, a TMDL for these parameters isn't necessary and is not calculated.

Table C15 shows the measured and allowable concentrations and loads at BLCK18. Table C16 shows the percent reduction for aluminum, iron and acidity at BLCK18.

Table C15		Measured		Allowable	
Flow (gpm)=	1502.67	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.96	17.3	0.11	2.0
	Iron	1.83	33.0	0.19	3.4
	Manganese	0.24	4.2	0.24	4.2
	Acidity	6.98	125.9	1.07	19.3
	Alkalinity	1.34	24.1		

Table C16. Allocations BLCK18			
BLCK18	Al (Lbs/day)	Fe (Lbs/day)	Acidity (Lbs/day)
Existing Load @ BLCK18	17.32	33.02	125.93
Allowable Load @ BLCK18	1.96	3.41	19.25
Load Reduction @ BLCK18	15.36	29.61	106.68
% Reduction required @BLCK18	89%	90%	85%

TMDL calculations-BLCK19- Main stem of Stony Creek just downstream of confluence with Cranberry Creek

The TMDL for sampling point BLCK19 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this segment was computed using water-quality sample data collected at point BLCK19. The average flow, measured at the sampling point BLCK19 (8.49 MGD), is used for these computations. The allowable loads calculated at BLCK19 will directly affect the downstream point BLCK17.

Sample data at point BLCK19 shows pH ranging between 4.3 and 4.8; pH will be addressed as part of this TMDL. There currently is not an entry for this segment on the Section Pa 303(d) list for impairment due to pH.

The measured and allowable loading for point BLCK19 for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from points BLCK21/ BLCK20/ BLCK18 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points BLCK21/ BLCK20/ BLCK18 and BLCK19 to determine a total load tracked for the segment of stream between BLCK19 and BLCK21/ BLCK20/ BLCK18. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at BLCK19.

A TMDL for acidity at BLCK19 has been calculated. The measured sample data for aluminum, iron and manganese were above detection limits but fell below applicable water quality criteria limits. Because water quality standards are met, a TMDL for these parameters isn't necessary and is not calculated.

Table C17 shows the measured and allowable concentrations and loads at BLCK19. Table C18 shows the percent reduction for acidity needed at BLCK19.

Table C17		Measured		Allowable	
Flow (gpm)=	5898.83	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.32	22.6	0.32	22.6
	Iron	0.23	16.1	0.23	16.1
	Manganese	0.08	5.7	0.08	5.7
	Acidity	7.05	499.3	0.19	13.4
	Alkalinity	0.24	17.1		

Table C18. Allocations BLCK19	
BLCK19	Acidity (Lbs/day)
Existing Load @ BLCK19	499.32
Difference in measured Loads between the loads that enter and existing BLCK19	75.73
Additional load tracked from above samples	32.92
Total load tracked between BLCK21/BLCK20/BLCK18 and BLCK19	108.65
Allowable Load @ BLCK19	13.37
Load Reduction @ BLCK19	95.28
% Reduction required at BLCK19	88%

There is a 75.73 lbs/day increase of acidity at this sample point compared to the sum of measured loads from upstream segments. This acidic increase entered Stony Creek in this segment of stream between BLCK21/BLCK20/BLCK18 and BLCK19. The total acidic load measured was 95.28 lbs/day greater than the calculated allowable acidic load of 13.37 lbs/day, resulting in a required 88% acidic reduction.

TMDL calculations- BLCK17-Main stem of Black Creek downstream of wastewater treatment plant behind reclamation sites

The TMDL for sampling point BLCK17 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this segment was computed using water-quality sample data collected at point BLCK17. The average flow, measured at the sampling point BLCK17 (32.81 MGD), is used for these computations. The allowable loads calculated at BLCK17 will directly affect the downstream point BLCK16.

Sample data at point BLCK17 shows pH ranging between 6.4 and 7.0; pH will be addressed as part of this TMDL. There currently is not an entry for this segment on the Section Pa 303(d) list for impairment due to pH.

The measured and allowable loading for point BLCK17 for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from points BLCK22/ BLCK19 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points BLCK22/ BLCK19 and BLCK17 to determine a total load tracked for the segment of stream between BLCK17 and BLCK22/ BLCK19. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at BLCK17.

The measured sample data for aluminum, iron and manganese were above detection limits but fell below applicable water quality criteria limits. Because water quality standards are met, a TMDL for these parameters isn't necessary and is not calculated. There were no observed acidic values in the data set for BLCK17.

The existing and allowable loads for acidity values at BLCK17 in Table C19 will be denoted as "NA".

Table C19		Measured		Allowable	
Flow (gpm)=	22787.50	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.20	53.8	0.20	53.8
	Iron	0.44	120.9	0.44	120.9
	Manganese	0.21	58.4	0.21	58.4
ND = non detection	Acidity	ND	NA		

NA = not applicable	Alkalinity	15.76	4313.9		

The measured sample data for aluminum, iron and manganese were above detection limits but fell below applicable water quality criteria limits. Because water quality standards are met, no TMDL is necessary, resulting in no reductions at sample point BLCK17. Dilution, high pH and other instream processes are possible explanations for the good water quality observed at this segment.

TMDL calculations- BLCK16-Main stem of Black Creek located at bridge at Tomhicken

The TMDL for sampling point BLCK16 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this segment was computed using water-quality sample data collected at point BLCK16. The average flow, measured at the sampling point BLCK16 (44.97 MGD), is used for these computations. The allowable loads calculated at BLCK16 will directly affect the downstream point BLCK15.

Sample data at point BLCK16 shows pH ranging between 6.1 and 6.7; pH will be addressed as part of this TMDL. There currently is not an entry for this segment on the Section Pa 303(d) list for impairment due to pH.

The measured and allowable loading for point BLCK16 for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from point BLCK17 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points BLCK17 and BLCK16 to determine a total load tracked for the segment of stream between BLCK16 and BLCK17. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at BLCK16. In this segment of Black Creek, between BLCK17 and BLCK16, there were no metals above detection limits; therefore no excess upstream loads have reached BLCK16.

The measured sample data for aluminum, iron and manganese were above detection limits but fell below applicable water quality criteria limits. Because water quality standards are met, a TMDL for these parameters isn't necessary and is not calculated. There were no observed acidic values in the data set for BLCK16.

Table C20 shows the measured and allowable loads calculated for BLCK16.

Table C20		Measured		Allowable	
Flow (gpm)=	31227.33	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.20	76.3	0.20	76.3
	Iron	0.50	185.6	0.50	185.6
	Manganese	0.24	88.1	0.24	88.1

ND = non detection	Acidity	ND	NA		
NA = not applicable	Alkalinity	10.85	4068.4		

The measured sample data for aluminum, iron and manganese were above detection limits but fell below applicable water quality criteria limits. Because water quality standards are met, no TMDL is necessary, resulting in no reductions at sample point BLCK16. Dilution, high pH and other instream processes are possible explanations for the good water quality observed at this segment.

TMDL calculations- BLCK15-Main stem of Black Creek just below SR3020 Bridge

The TMDL for sampling point BLCK15 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this segment was computed using water-quality sample data collected at point BLCK15. The average flow, measured at the sampling point BLCK15 (45.83 MGD), is used for these computations. The allowable loads calculated at BLCK15 will directly affect the downstream point BLCK14.

Sample data at point BLCK15 shows pH ranging between 6.2 and 6.8; pH will be addressed as part of this TMDL. There currently is not an entry for this segment on the Section Pa 303(d) list for impairment due to pH.

The measured and allowable loading for point BLCK15 for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from point BLCK16 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points BLCK16 and BLCK15 to determine a total load tracked for the segment of stream between BLCK15 and BLCK16. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at BLCK15. In this segment of Black Creek, between BLCK16 and BLCK15, there were no metals above detection limits; therefore no excess upstream loads have reached BLCK15.

The measured sample data for aluminum, iron and manganese were above detection limits but fell below applicable water quality criteria limits. Because water quality standards are met, a TMDL for these parameters isn't necessary and is not calculated. There were no observed acidic values in the data set for BLCK15.

Table C21 shows the measured and allowable concentrations and loads at BLCK15.

Table C21		Measured		Allowable	
Flow (gpm)=	31824.17	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.18	66.9	0.18	66.9
	Iron	0.39	149.7	0.39	149.7

	Manganese	0.21	78.4	0.21	78.4
ND = non detection	Acidity	ND	NA		
NA = not applicable	Alkalinity	8.11	3099.0		

The measured sample data for aluminum, iron and manganese were above detection limits but fell below applicable water quality criteria limits. Because water quality standards are met, no TMDL is necessary, resulting in no reductions at sample point BLCK15. Dilution, high pH and other instream processes are possible explanations for the good water quality observed at this segment.

TMDL calculations- BLCK14-Main stem of Black Creek just upstream of Gowen Discharge

The TMDL for sampling point BLCK14 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this segment was computed using water-quality sample data collected at point BLCK14. The average flow, measured at the sampling point BLCK14 (47.03 MGD), is used for these computations. The allowable loads calculated at BLCK14 will directly affect the downstream point BLCK12.

Sample data at point BLCK14 shows pH ranging between 6.3 and 6.8; pH will be addressed as part of this TMDL. There currently is not an entry for this segment on the Section Pa 303(d) list for impairment due to pH.

The measured and allowable loading for point BLCK14 for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from point BLCK15 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points BLCK14 and BLCK15 to determine a total load tracked for the segment of stream between BLCK15 and BLCK14. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at BLCK14. In this segment of Black Creek, between BLCK14 and BLCK15, there were no metals above detection limits; therefore no excess upstream loads have reached BLCK14.

The measured sample data for aluminum, iron and manganese were above detection limits but fell below applicable water quality criteria limits. Because water quality standards are met, a TMDL for these parameters isn't necessary and is not calculated. There were no observed acidic values in the data set for BLCK14. Dilution, high pH and other instream processes are possible explanations for the good water quality observed at this segment.

Table C22 shows the measured and allowable concentrations and loads at BLCK14. The existing loads for acidity were too low to be calculated at BLCK14. In Table C22, measured acidity load will be denoted as "NA".

Table C22		Measured		Allowable	
Flow (gpm)=	32659.33	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day

	Aluminum	0.18	70.6	0.18	70.6
	Iron	0.37	146.4	0.37	146.4
	Manganese	0.19	72.6	0.19	72.6
ND = non detection	Acidity	ND	NA		
NA = not applicable	Alkalinity	7.18	2815.5		

TMDL calculations- BLCK13-Gowen Discharge

The TMDL for sample point BLCK13 consists of a load allocation to the Gowen Discharge, this point is shown in Attachment A. The load allocation for this discharge was computed using water-quality sample data collected at point BLCK13. The average flow, measured at the sampling point BLCK13 (16.44 MGD), is used for these computations. The allowable loads calculated at BLCK13 will directly affect the downstream point BLCK12.

Sample data at point BLCK13 shows that the Gowen Discharge has a pH ranging between 3.9 and 4.2. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

A TMDL for aluminum, manganese and acidity at BLCK13 has been calculated. Sampling at BLCK13 showed that the measured sample data for iron was above detection limits but fell below applicable water quality criteria limits. Because water quality standards are met, a TMDL for this parameter isn't necessary and is not calculated.

Table C23 shows the measured and allowable concentrations and loads at BLCK13. Table C24 shows the percent reduction for aluminum, iron and acidity at BLCK13.

Table C23		Measured		Allowable	
Flow (gpm)=	11419.27	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	2.17	297.2	0.15	20.7
	Iron	0.17	22.9	0.17	22.9
	Manganese	1.24	170.7	0.20	26.8
	Acidity	59.66	8182.1	0.00	0.00
	Alkalinity	0.00	0.00		

Table C24. Allocations BLCK13			
BLCK13	Al (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ BLCK13	297.18	170.67	8182.05
Allowable Load @ BLCK13	20.67	26.77	0.00
Load Reduction @ BLCK13	276.51	143.90	8182.05
% Reduction required @BLCK13	93%	84%	100%

TMDL calculations- BLCK12-Main stem of Black Creek just below Gowen Discharge

The TMDL for sampling point BLCK12 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this segment was computed using water-quality sample data collected at point BLCK12. The average flow, measured at the sampling point BLCK12 (67.00 MGD), is used for these computations. The allowable loads calculated at BLCK12 will directly affect the downstream point BLCK11.

Sample data at point BLCK12 shows pH ranging between 4.6 and 6.2; pH will be addressed as part of this TMDL. There currently is not an entry for this segment on the Section Pa 303(d) list for impairment due to pH.

The measured and allowable loading for point BLCK12 for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from points BLCK14/ BLCK13 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points BLCK14/ BLCK13 and BLCK12 to determine a total load tracked for the segment of stream between BLCK12 and BLCK14/ BLCK13. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at BLCK12.

A TMDL for aluminum, manganese and acidity at BLCK12 has been calculated. Sampling at BLCK12 showed that the measured sample data for iron was above detection limits but fell below applicable water quality criteria limits. Because water quality standards are met, a TMDL for this parameter isn't necessary and is not calculated.

Table C25 shows the measured and allowable concentrations and loads at BLCK12. Table C26 shows the percent reduction for aluminum, manganese and acidity needed at BLCK12.

Table C25		Measured		Allowable	
Flow (gpm)=	46529.50	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	1.52	846.6	0.31	173.1
	Iron	0.47	260.8	0.47	260.8
	Manganese	0.95	530.9	0.43	241.8
	Acidity	10.41	5816.2	0.70	390.0
	Alkalinity	1.94	1085.9		

Table C26. Allocations BLCK12			
BLCK12	Al (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ BLCK12	846.58	530.86	5816.18
Difference in measured Loads between the loads that enter and existing BLCK12	478.80	287.63	-2365.87
Percent loss due calculated at BLCK12	NA	NA	28.9%

Additional load tracked from above samples	91.27	99.33	0.00
Percentage of upstream loads that reach the BLCK12	NA	NA	71.1%
Total load tracked between BLCK14/BLCK13 and BLCK12	570.07	386.96	0.00
Allowable Load @ BLCK12	173.06	241.81	389.98
Load Reduction @ BLCK12	397.01	145.15	0.00
% Reduction required at BLCK12	70%	38%	0%

The total aluminum load tracked between BLCK14/BLCK13 and sample point BLCK12 was found to be 397.01 lbs/day greater than the calculated allowable load of 173.06 lbs/day. This requires a 70% reduction of aluminum to achieve water quality standards. A 38% manganese reduction is required at BLCK12 to get the total load tracked at BLCK14/BLCK13 down to the calculated allowable load of 241.81 lbs/day. There were no upstream loads tracked between BLCK14/BLCK13 and BLCK12. Therefore, no acidic reduction is required at this sample point.

TMDL calculations- BLCK11-Main stem of Black Creek just upstream of SR 3018 Bridge

The TMDL for sampling point BLCK11 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this segment was computed using water-quality sample data collected at point BLCK11. The average flow, measured at the sampling point BLCK11 (80.19 MGD), is used for these computations. The allowable loads calculated at BLCK11 will directly affect the downstream point BLCK10.

Sample data at point BLCK11 shows pH ranging between 4.6 and 6.3; pH will be addressed as part of this TMDL. There currently is not an entry for this segment on the Section Pa 303(d) list for impairment due to pH.

The measured and allowable loading for point BLCK11 for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from point BLCK12 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points BLCK12 and BLCK11 to determine a total load tracked for the segment of stream between BLCK11 and BLCK12. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at BLCK11.

A TMDL for aluminum, manganese and acidity at BLCK11 has been calculated. The measured sample data for iron was above detection limits but fell below applicable water quality criteria limits. Because water quality standards are met, a TMDL for this parameter isn't necessary and is not calculated.

Table C27 shows the measured and allowable concentrations and loads at BLCK11. Table C28 shows the percent reduction for aluminum, manganese and acidity needed at BLCK11.

Table C27		Measured		Allowable	
Flow (gpm)=	55684.17	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day

	Aluminum	1.21	809.2	0.49	324.7
	Iron	0.42	282.0	0.42	282.0
	Manganese	0.78	520.5	0.67	448.2
	Acidity	8.71	5823.7	0.91	607.8
	Alkalinity	1.75	1167.00		

Table C28. Allocations BLCK11			
BLCK11	Al (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ BLCK11	809.18	520.51	5823.65
Difference in measured Loads between the loads that enter and existing BLCK11	-37.40	-10.35	7.47
Percent loss due calculated at BLCK11	4.4%	1.9%	NA
Additional load tracked from above samples	173.06	241.81	389.98
Percentage of upstream loads that reach the BLCK11	95.6%	98.1%	NA
Total load tracked between BLCK12 and BLCK11	165.41	237.10	397.45
Allowable Load @ BLCK11	324.68	448.23	607.81
Load Reduction @ BLCK11	-159.27	-211.13	-210.36
% Reduction required at BLCK11	0%	0%	0%

The total aluminum load tracked between BLCK12 and BLCK11 was shown to be 165.41 lbs/day. This was 159.27 lbs/day less than the calculated allowable load of 324.68 lbs/day; therefore no aluminum reduction is required. The total manganese load tracked was measured to be 237.10 lbs/day. This was 211.13 lbs/day less than the calculated allowable manganese load of 448.23 lbs/day. This resulted in no manganese reduction necessary. The total acidic load was 210.36 lbs/day less than the allowable load of 607.81 lbs/day. Therefore, no acidic reduction is required at BLCK11.

TMDL calculations- BLCK10-Main stem of Black Creek, just before confluence with Nescopeck Creek

The TMDL for sampling point BLCK10 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this segment was computed using water-quality sample data collected at point BLCK10. The average flow, measured at the sampling point BLCK10 (77.67 MGD), is used for these computations. The allowable loads calculated at BLCK10 will directly affect the downstream point NESCO1.

Sample data at point BLCK10 shows pH ranging between 4.8 and 6.8; pH will be addressed as part of this TMDL. There currently is not an entry for this segment on the Section Pa 303(d) list for impairment due to pH.

The measured and allowable loading for point BLCK10 for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from point BLCK11 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points BLCK11 and BLCK10 to determine a total load tracked for the segment of stream between

BLCK10 and BLCK11. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at BLCK10.

A TMDL for aluminum, manganese and acidity at BLCK10 has been calculated. The measured sample data for iron was above detection limits but fell below applicable water quality criteria limits. Because water quality standards are met, a TMDL for this parameter isn't necessary and is not calculated.

Table C29 shows the measured and allowable concentrations and loads at BLCK10. Table C30 shows the percent reduction for aluminum, manganese and acidity needed at BLCK10.

Table C29		Measured		Allowable	
Flow (gpm)=	53938.56	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.98	636.98	0.57	366.9
	Iron	0.42	269.2	0.42	269.2
	Manganese	0.71	457.05	0.70	450.4
	Acidity	6.69	4332.93	0.86	555.8
	Alkalinity	2.21	1433.75		

Table C30. Allocations BLCK10			
BLCK10	Al (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ BLCK10	636.98	457.05	4332.93
Difference in measured Loads between the loads that enter and existing BLCK10	-172.20	-63.46	-1490.72
Percent loss due calculated at BLCK10	21.3%	12.2%	25.6%
Additional load tracked from above samples	324.68	448.23	607.81
Percentage of upstream loads that reach the BLCK10	78.7%	87.8%	74.4%
Total load tracked between BLCK11 and BLCK10	255.59	393.58	452.22
Allowable Load @ BLCK10	366.86	450.35	555.82
Load Reduction @ BLCK10	-111.27	-56.77	-103.60
% Reduction required at BLCK10	0%	0%	0%

There is a 21.3% loss of aluminum between BLCK11 and BLCK10. The measured aluminum load at BLCK10 was found to be 636.98 lbs/day. A possible explanation for the loss of aluminum in this segment of Black Creek is dilution or natural stream processes. An existing manganese load of 457.05 lbs/day was measured at BLCK10. There was a loss of 63.46 lbs/day or 12.2% of manganese in this segment of Black Creek. This loss of manganese can also be attributed to dilution factors or natural stream processes. The total manganese load tracked between BLCK11 and BLCK10 was 393.58 lbs/day. This was 56.77 lbs/day less than the calculated allowable load of 450.35 lbs/day. Therefore no reduction of manganese was necessary at BLCK10. The same loss of load occurred for acidity as well. There was a 25.6% loss of acidity measured at BLCK10. The total acidic load tracked between BLCK11 and BLCK10 was 452.22 lbs/day. This was 103.60 lbs/day less than the calculated acidic load of 555.82 lbs/day. Therefore, no acidic reduction was necessary at BLCK10.

TMDL calculations- LNESC9-Main stem of Little Nescopeck Creek just upstream of confluence with Jeddo Tunnel Discharge

The TMDL for sample point LNESC9 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this segment of Little Nescopeck Creek was computed using water-quality sample data collected at point LNESC9. The average flow, measured at the sampling point LNESC9 (4.92 MGD), is used for these computations. The allowable loads calculated at LNESC9 will directly affect the downstream point LNESC7.

Sample data at point LNESC9 shows that this segment of Little Nescopeck Creek has a pH ranging between 6.7 and 6.9. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

Sampling at LNESC9 showed that the measured sample data for aluminum, iron and manganese were above detection limits but fell below applicable water quality criteria limits. Because water quality standards are met, a TMDL for these parameters isn't necessary and is not calculated. There were no observed acidic values in the data set for LNESC9. No reductions are necessary for any of the parameters at this sample point.

Table C31 shows the measured and allowable concentrations and loads at LNESC9.

Table C31		Measured		Allowable	
Flow (gpm)=	3418.00	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.07	2.8	0.07	2.8
	Iron	0.28	11.3	0.28	11.3
	Manganese	0.06	2.6	0.06	2.6
ND = non detection	Acidity	ND	NA		
NA = not applicable	Alkalinity	14.76	605.8		

TMDL calculations- JEDDO8-Jeddo Tunnel Discharge (below the outfall)

The TMDL for sample point JEDDO8 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this extremely large discharge was computed using water-quality sample data collected at point JEDDO8. The average flow, measured at the sampling point JEDDO8 (48.10 MGD), is used for these computations. The allowable loads calculated at JEDDO8 will directly affect the downstream point LNESC7.

Sample data at point JEDDO8 shows that this discharge has a pH ranging between 4.3 and 4.4. There currently is an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

A TMDL for aluminum, iron, manganese and acidity at JEDDO8 has been calculated.

Table C32 shows the measured and allowable concentrations and loads at JEDDO8. Table C33 shows the percent reduction for aluminum, iron, manganese and acidity at JEDDO8.

Table C32		Measured		Allowable	
Flow (gpm)=	33404.50	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	7.40	2968.0	0.61	244.4
	Iron	2.51	1004.9	1.19	475.7
	Manganese	3.38	1355.3	0.79	317.7
	Acidity	44.72	17941.9	0.00	0.0
	Alkalinity	0.00	0.0		

Table C33. Allocations JEDDO8				
JEDDO8	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ JEDDO8	2968.02	1004.94	1355.30	17941.87
Allowable Load @ JEDDO8	244.44	475.74	317.69	0.00
Load Reduction @ JEDDO8	2723.58	529.20	1037.61	17941.87
% Reduction required @ JEDDO8	92%	53%	77%	100%

TMDL calculations- LNESC7-Main stem of Little Nescopeck Creek, downstream of confluence with Jeddo Tunnel Discharge

The TMDL for sampling point LNESC7 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this segment was computed using water-quality sample data collected at point LNESC7. The average flow, measured at the sampling point LNESC7 (55.38 MGD), is used for these computations. The allowable loads calculated at LNESC7 will directly affect the downstream point LNESC6.

Sample data at point LNESC7 shows pH ranging between 4.3 and 4.5; pH will be addressed as part of this TMDL. There currently is an entry for this segment on the Section Pa 303(d) list for impairment due to pH.

The measured and allowable loading for point LNESC7 for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from points LNESC9/ JEDDO8 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points LNESC9/ JEDDO8 and LNESC7 to determine a total load tracked for the segment of stream between LNESC7 and LNESC9/ JEDDO8. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at LNESC7.

A TMDL for aluminum, iron, manganese and acidity at LNESC7 has been calculated. Table C34 shows the measured and allowable concentrations and loads at LNESC7. Table C35 shows the percent reduction for aluminum, iron, manganese and acidity needed at LNESC7.

Table C34		Measured		Allowable	
Flow (gpm)=	38455.17	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	6.88	3175.1	0.55	252.9
	Iron	2.44	1126.1	1.12	515.6
	Manganese	3.10	1431.7	0.76	349.8
	Acidity	41.39	19114.4	0.00	0.0
	Alkalinity	0.00	0.0		

Table C35. Allocations LNESC7				
LNESC7	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ LNESC7	3175.09	1126.10	1431.68	19114.42
Difference in measured Loads between the loads that enter and existing LNESC7	204.28	109.83	73.83	1172.55
Additional load tracked from above samples	247.23	487.07	320.24	0.00
Total load tracked between LNESC9/JEDDO8 and LNESC7	451.51	596.90	394.07	1172.55
Allowable Load @ LNESC7	252.91	515.56	349.84	0.00
Load Reduction @ LNESC7	198.60	81.34	44.23	1172.55
% Reduction required at LNESC7	44%	14%	11%	100%

An increase of 204.28 lbs/day of aluminum enters the stream at this segment between LNESC9/JEDDO8 and LNESC7. The total aluminum load tracked was 451.51 lbs/day. This was 198.60 lbs/day greater than the calculated allowable aluminum load of 252.91 lbs/day. A 44% reduction of aluminum is necessary to achieve water quality. The total iron load measured at LNESC7 is 596.90 lbs/day. To achieve the calculated allowable iron load at LNESC7, a reduction of 81.34 lbs/day (14%) is necessary. 44.23 lbs/day of manganese needs to be reduced to achieve water quality standards. The total manganese load measured at LNESC7 needs to be reduced by 11% in order to reach the allowable calculated manganese load of 349.84 lbs/day. 100% of aluminum or 1172.55 lbs/day needs to be reduced at LNESC7.

TMDL calculations- LNESC6-Main stem of Little Nescopeck Creek at Conyngham Bridge

The TMDL for sampling point LNESC6 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this segment was computed using water-quality sample data collected at point LNESC6. The average flow, measured at the sampling point LNESC6 (57.06 MGD), is used for these computations. The allowable loads calculated at LNESC6 will directly affect the downstream point LNESC5.

Sample data at point LNESC6 shows pH ranging between 4.3 and 4.6; pH will be addressed as part of this TMDL. There currently is an entry for this segment on the Section Pa 303(d) list for impairment due to pH.

The measured and allowable loading for point LNESC6 for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from point LNESC7 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points LNESC7 and LNESC6 to determine a total load tracked for the segment of stream between LNESC6 and LNESC7. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at LNESC6.

A TMDL for aluminum, iron, manganese and acidity at LNESC6 has been calculated. Table C36 shows the measured and allowable concentrations and loads at LNESC6. Table C37 shows the percent reduction for aluminum, iron, manganese and acidity needed at LNESC6.

Table C36		Measured		Allowable	
Flow (gpm)=	39625.33	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	6.03	2871.2	0.55	262.4
	Iron	1.81	859.0	1.15	546.6
	Manganese	2.84	1349.9	0.71	339.0
	Acidity	35.03	16671.0	0.06	27.6
	Alkalinity	0.08	36.5		

Table C37. Allocations LNESC6				
LNESC6	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ LNESC6	2871.17	858.97	1349.93	16671.02
Difference in measured Loads between the loads that enter and existing LNESC6	-303.92	-267.13	-81.75	-2443.40
Percent loss due calculated at LNESC6	9.6%	23.7%	5.7%	12.8%
Additional load tracked from above samples	252.91	515.56	349.84	0.00
Percentage of upstream loads that reach the LNESC6	90.4%	76.3%	94.3%	87.2%
Total load tracked between LNESC7 and LNESC6	228.70	393.26	329.86	0.00
Allowable Load @ LNESC6	262.38	546.60	339.01	27.59
Load Reduction @ LNESC6	-33.68	-153.34	-9.15	-27.59
% Reduction required at LNESC6	0%	0%	0%	0%

There was a 9.6% loss of aluminum at LNESC6 compared to the load at LNESC7. The total aluminum load tracked at LNESC6 was 228.70 lbs/day. This was 33.68 lbs/day less than the calculated allowable aluminum load of 262.70 lbs/day. Since the total load measured was less than the calculated allowable load, no reduction is necessary. There was a 23.7% loss of iron in the segment of stream between LNESC7 and LNESC6. This loss can be attributed to natural stream processes including dilution. The total load tracked in this segment was 153.34 lbs/day less than the calculated allowable iron load. Therefore, no iron reduction is necessary. The existing manganese load at LNESC6 was 5.7% less than that measured at LNESC7. The total manganese load tracked was less than the calculated allowable manganese load; therefore, no reduction is necessary at this sample point. There was no aluminum load tracked from upstream, therefore there is no reduction necessary to reach the allowable aluminum load.

TMDL calculations- LNESC5-Main stem of Little Nescopeck Creek, just above confluence with Nescopeck Creek

The TMDL for sampling point LNESC5 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this segment was computed using water-quality sample data collected at point LNESC5. The average flow, measured at the sampling point LNESC5 (64.10 MGD), is used for these computations. The allowable loads calculated at LNESC5 will directly affect the downstream point NESCO2.

Sample data at point LNESC5 shows pH ranging between 4.4 and 4.6; pH will be addressed as part of this TMDL. There currently is an entry for this segment on the Section Pa 303(d) list for impairment due to pH.

The measured and allowable loading for point LNESC5 for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from point LNESC6 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points LNESC6 and LNESC5 to determine a total load tracked for the segment of stream between LNESC5 and LNESC6. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at LNESC5.

A TMDL for aluminum, iron, manganese and acidity at LNESC5 has been calculated. Table C38 shows the measured and allowable concentrations and loads at LNESC5. Table C39 shows the percent reduction for aluminum, iron, manganese and acidity needed at LNESC5.

Table C38		Measured		Allowable	
Flow (gpm)=	44512.50	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	5.56	2974.0	0.52	275.8
	Iron	1.84	985.4	0.99	530.7
	Manganese	2.65	1417.5	0.65	348.8
	Acidity	30.87	16501.5	0.11	58.6
	Alkalinity	0.16	84.6		

Table C39. Allocations LNESC5				
LNESC5	Al (Lbs/day)	Fe (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ LNESC5	2974.03	985.40	1417.52	16501.51
Difference in measured Loads between the loads that enter and existing LNESC5	102.86	126.43	67.59	-169.51
Percent loss due calculated at LNESC5	NA	NA	NA	1.0%
Additional load tracked from above samples	262.38	546.60	339.01	27.59

Percentage of upstream loads that reach the LNESC5	NA	NA	NA	99.0%
Total load tracked between LNESC6 and LNESC5	365.24	673.03	406.60	27.31
Allowable Load @ LNESC5	275.76	530.72	348.82	58.61
Load Reduction @ LNESC5	89.48	142.31	57.78	-31.30
% Reduction required at LNESC5	24%	21%	14%	0%

102.86 lbs/day of aluminum entered Little Nescopeck Creek between sample sites LNESC6 and LNESC5. The total load tracked in this segment of stream was measured to be 365.24 lbs/day. This was 89.48 lbs/day greater than the calculated allowable aluminum load of 275.76 lbs/day. To attain the allowable load, a 24% reduction of aluminum is necessary. The measured existing iron load at LNESC5 was 126.43 lbs/day greater than the iron load measured at LNESC6. The total iron load tracked in this segment of stream was 142.31 lbs/day greater than the calculated allowable load of 530.72 lbs/day. A 21% reduction is necessary to achieve iron water quality standards. The total manganese load tracked between LNESC6 and LNESC5 was measured at 406.60 lbs/day. The calculated allowable manganese load was found to be 348.82lbs/day. Therefore a 14% reduction or 57.78 lbs/day is needed. One percent of the upstream acidic load has been lost in this segment of stream. The total load tracked is 31.30 lbs/day less than the calculated allowable acidic load of 31.30 lbs/day. No acidic reduction is needed at LNESC5.

TMDL calculations- NESCO4-Main stem of Nescopeck Creek just above confluence with Little Nescopeck Creek

The TMDL for sample point NESCO4 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this section of main stem of Nescopeck Creek was computed using water-quality sample data collected at point NESCO4. The average flow, measured at the sampling point NESCO4 (81.12 MGD), is used for these computations. The allowable loads calculated at NESCO4 will directly affect the downstream point NESCO2.

Sample data at point NESCO4 shows that this main stem segment of Nescopeck Creek has a pH ranging between 6.2 and 6.8. There currently is not an entry for this segment on the Pa Section 303(d) list for impairment due to pH.

The measured sample data for aluminum, iron and manganese were above detection limits but fell below applicable water quality criteria limits. Because water quality standards are met, a TMDL for these parameters isn't necessary and is not calculated. There were no observed acidic values in the data set for NESCO4, therefore existing loads for acidity in Table C40 will be denoted as "NA".

Table C40 shows the measured and allowable concentrations and loads at NESCO4.

Table C40		Measured		Allowable	
Flow (gpm)=	56333.17	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	0.05	33.8	0.05	33.8

	Iron	0.25	169.1	0.25	169.1
	Manganese	0.03	18.0	0.03	18.0
ND = non detection	Acidity	ND	NA		
NA = not applicable	Alkalinity	7.04	4761.7		

TMDL calculations- NESCO2-Main stem of Nescopeck Creek just upstream of confluence with Black Creek

The TMDL for sampling point NESCO2 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this segment was computed using water-quality sample data collected at point NESCO2. The average flow, measured at the sampling point NESCO2 (160.71 MGD), is used for these computations. The allowable loads calculated at NESCO2 will directly affect the downstream point NESCO1.

Sample data at point NESCO2 shows pH ranging between 4.9 and 5.4; pH will be addressed as part of this TMDL. There currently is not an entry for this segment on the Section Pa 303(d) list for impairment due to pH.

The measured and allowable loading for point NESCO2 for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from points LNESC5/ NESCO4 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points LNESC5/ NESCO4 and NESCO2 to determine a total load tracked for the segment of stream between NESCO2 and LNESC5/ NESCO4. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at NESCO2.

A TMDL for aluminum, manganese and acidity at NESCO2 has been calculated. The measured sample data for iron was above detection limits but fell below applicable water quality criteria limits. Because water quality standards are met, a TMDL for this parameter isn't necessary and is not calculated.

Table C41 shows the measured and allowable concentrations and loads at NESCO2. Table C42 shows the percent reduction for aluminum, manganese and acidity needed at NESCO2.

Table C41		Measured		Allowable	
Flow (gpm)=	111602.00	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	2.23	2982.16	0.43	573.0
	Iron	0.81	1085.6	0.81	1085.6
	Manganese	1.15	1534.6	0.53	706.0
	Acidity	11.78	15786.5	0.56	744.0

	Alkalinity	1.00	1342.5		

Table C42. Allocations NESCO2			
NESCO2	Al (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ NESCO2	2982.16	1534.64	15786.45
Difference in measured Loads between the loads that enter and existing NESCO2	8.13	117.12	-715.06
Percent loss due calculated at NESCO2	NA	NA	4.3%
Additional load tracked from above samples	275.76	348.82	58.61
Percentage of upstream loads that reach the NESCO2	NA	NA	95.7%
Total load tracked between NESCO4/LNESC5 and NESCO2	283.89	465.94	56.07
Allowable Load @ NESCO2	572.99	705.96	744.03
Load Reduction @ NESCO2	-289.10	-240.02	-687.96
% Reduction required at NESCO2	0%	0%	0%

The total aluminum load tracked between LNESC5/NESCO4 and NESCO2 was 283.89 lbs/day. This was 289.10 lbs/day less than the calculated allowable aluminum load of 572.99 lbs/day. Since the total load tracked is less than the allowable aluminum load, no reduction is necessary. The existing manganese load is greater than the sum of upstream manganese loads. There was an increase of 117.12 lbs/day. The total load tracked was 465.94 lbs/day; this is less than the calculated allowable load of 705.96 lbs/day, resulting in no reduction necessary for manganese. The existing acidic load at NESCO2 was less than the sum of acidic loads from LNESC5 and NESCO4. There was a 4.3% loss of acidity in this segment of stream. Natural stream processes including dilution can possibly explain this. Because the total acidic load tracked was much less than the calculated allowable load, no acidic reduction is necessary at NESCO2.

TMDL calculations- NESCO1-Main stem of Nescopeck Creek approximately 1/3 way from mouth of confluence with Black Creek

The TMDL for sampling point NESCO1 consists of a load allocation to all of the area at and above this point shown in Attachment A. The load allocation for this segment was computed using water-quality sample data collected at point NESCO1. The average flow, measured at the sampling point NESCO1 (237.04 MGD), is used for these computations.

Sample data at point NESCO1 shows pH ranging between 4.7 and 6.2; pH will be addressed as part of this TMDL. There currently is not an entry for this segment on the Section Pa 303(d) list for impairment due to pH.

The measured and allowable loading for point NESCO1 for aluminum, iron, manganese and acidity was computed using water-quality sample data collected at the point. This was based on the sample data for the point and did not account for any loads already specified from upstream sources. The additional load from points NESCO2/BLCK10 shows the total load that was permitted from upstream sources. This value was added to the difference in existing loads between points NESCO2/BLCK10 and NESCO1 to determine a total load tracked for the segment of stream between NESCO1 and NESCO2/BLCK10. This load will be compared to the allowable load to determine if further reductions are needed to meet the calculated TMDL at NESCO1.

A TMDL for aluminum, manganese and acidity at NESCO1 has been calculated. The measured sample data for iron was above detection limits but fell below applicable water quality criteria limits. Because water quality standards are met, a TMDL for this parameter isn't necessary and is not calculated.

Table C43 shows the measured and allowable concentrations and loads at NESCO1. Table C44 shows the percent reduction for aluminum, manganese and acidity needed at NESCO1.

Table C43		Measured		Allowable	
Flow (gpm)=	164613.66	Concentration	Load	Concentration	Load
		mg/L	lbs/day	mg/L	lbs/day
	Aluminum	1.70	3357.5	0.46	914.9
	Iron	0.65	1285.0	0.65	1285.0
	Manganese	0.96	1894.6	0.57	1127.3
	Acidity	9.42	18619.5	0.79	1564.2
	Alkalinity	1.50	2968.7		

Table C44. Allocations NESCO1			
NESC01	Al (Lbs/day)	Mn (Lbs/day)	Acidity (Lbs/day)
Existing Load @ NESC01	3357.51	1894.57	18619.52
Difference in measured Loads between the loads that enter and existing NESC01	-261.63	-97.12	-1499.86
Percent loss due calculated at NESCO1	7.2%	4.9%	7.5%
Additional load tracked from above samples	939.85	1156.31	1299.85
Percentage of upstream loads that reach the NESCO1	92.8%	95.1%	92.5%
Total load tracked between BLCK10/NESC02 and NESC01	871.91	1099.93	1202.95
Allowable Load @ NESC01	914.93	1127.30	1564.24
Load Reduction @ NESC01	-43.02	-27.37	-361.29
% Reduction required at NESC01	0%	0%	0%

In the segment of stream between BLCK10/NESCO2 and NESCO1, 261.63 lbs/day or 7.2% of aluminum was lost due to possible instream processes. The total aluminum load tracked in this segment was 871.91 lbs/day; this was 43.02 lbs/day less than the calculated allowable aluminum load at NESCO1. Because the total load measured was less than the calculated allowable load, no aluminum reduction is necessary. 4.9% of the existing manganese load was lost in this segment of stream. The total load tracked between BLCK10/NESCO2 and NESCO1 was measured to be 1099.93 lbs/day. This was 27.37 lbs/day less than the allowable manganese load; therefore no manganese reduction is necessary. There was a 7.5% loss of existing acidic load in this segment of stream. The total load tracked was 361.29 lbs/day less than the calculated allowable acidic load of 1564.24 lbs/day. There was no acidic reduction necessary at NESCO1.

Margin of Safety

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:

- 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.

- A MOS is also the fact that 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 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, 2002 and 2004 Section 303(d) Lists

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

In the 1996 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 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 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

*less than detects are calculated as zero in the data sets.

Site	Site Name	Date-time	Flow (gpm)	pH	Acidity (mg/L)	Alkalinity (mg/L)	Al (ppm)	Fe (ppm)	Mn (ppm)	SO4 (mg/L)
26	BLCK	030926-1815	722.00	4.12	28.20	0	3.5	0.93	0.70	66.6
26		031010-1615	101.00	4.29	13.52	0.0	1.1	0.45	0.43	35.5
26		031031-1540	1896.00	4.10	19.66	0	2.3	0.49	0.45	47.3
26		031122-1500	577.00	4.37	16.46	0	1.7	0.53	0.42	39.8
26		040321-1510	786.00	4.81	14.92	1.28	1.96	0.52	0.41	43.9
26		040501-1540	534.00	4.58	17.88	0.28	1.9	0.51	0.46	42.7
average			**769.33**	**4.38**	**18.44**	**0.26**	**2.08**	**0.57**	**0.48**	**45.97**
st dev			**601.82**	**0.28**	**5.25**	**0.51**	**0.80**	**0.18**	**0.11**	**10.86**

Site	Site Name	Date-time	Flow (gpm)	pH	Acidity (mg/L)	Alkalinity (mg/L)	Al (ppm)	Fe (ppm)	Mn (ppm)	SO4 (mg/L)
25	BLCK	030926-1805	332.00	6.30	0.54	4.58	0.15	0.15	0.28	13.0
25	Trib	031010-1630	124.00	6.52	-3.03	7.80	0	0.09	0.18	10.0
25		031031-1530	663.00	5.78	4.34	2.62	0.37	0.12	0.24	14.2
25		031122-1500	214.00	6.03	1.75	4.03	0.23	0.13	0.22	12.9
25		040321-1510	747.00	6.30	1.28	4.94	0.46	0.37	0.22	14.1
25		040501-1530	293.00	6.40	1.42	5.12	0.10	0.16	0.21	11.5
average			**395.50**	**6.22**	**1.05**	**4.85**	**0.22**	**0.17**	**0.23**	**12.62**
st dev			**251.52**	**0.27**	**2.38**	**1.70**	**0.17**	**0.10**	**0.03**	**1.61**

Site	Site Name	Date-time	Flow (gpm)	pH	Acidity (mg/L)	Alkalinity (mg/L)	Al (ppm)	Fe (ppm)	Mn (ppm)	SO4 (mg/L)
24	BLCK	031010-1350	493.00	5.79	0.38	6.60	0.2	2.0	0.27	15.5
24		031031-1450	4469.00	4.90	9.05	1.38	1.1	0.72	0.33	29.9
24		031122-1430	1197.00	5.71	3.29	4.62	0.43	1.0	0.28	22.0
24		040321-1440	3683.00	6.01	-0.03	7.48	0.28	0.8	0.23	16.1
24		040501-1450	1426.00	5.62	4.11	4.2	0.37	1.37	0.32	19.9
average			**2253.60**	**5.61**	**3.36**	**4.86**	**0.48**	**1.18**	**0.29**	**20.68**
st dev			**1721.35**	**0.42**	**3.65**	**2.37**	**0.36**	**0.52**	**0.04**	**5.81**

Site	Site Name	Date-time	Flow (gpm)	pH	Acidity (mg/L)	Alkalinity (mg/L)	Al (ppm)	Fe (ppm)	Mn (ppm)	SO4 (mg/L)
23	BLCK	030926-1730	958.00	6.06	0.05	5.05	0.12	0.50	0.13	4.2
23	Irena Creek	031010-1550	400.00	6.10	0.91	4.69	0	0.25	0.07	4.5
23		031031-1510	1717.00	5.78	2.71	3.45	0.23	0.32	0.08	5.0
23		031122-1430	959.00	5.79	3.08	3.54	0.20	0.35	0.12	4.9
23		040321-1435	1878.00	5.97	2.22	3.46	0.12	0.33	0.25	6.4
23		040501-1450	984.00	5.87	3.23	2.94	0.08	0.23	0.20	5.9
average			**1149.33**	**5.93**	**2.03**	**3.86**	**0.13**	**0.33**	**0.14**	**5.15**
st dev			**550.43**	**0.14**	**1.28**	**0.82**	**0.08**	**0.10**	**0.07**	**0.84**

Site	Site Name	Date-time	Flow (gpm)	pH	Acidity (mg/L)	Alkalinity (mg/L)	Al (ppm)	Fe (ppm)	Mn (ppm)	SO4 (mg/L)
22	BLCK	030926-1600	4390.00	5.88	0.62	4.74	0.14	0.77	0.37	14.8
22	WWTP site	031010-1500	1660.00	5.94	0.18	5.49	0	0.62	0.35	9.7
22		031031-1340	8711.00	5.54	4.14	2.89	0.58	0.69	0.27	17.1
22		031122-1315	3862.00	5.86	1.55	4.77	0.22	0.65	0.28	10.9
22		040321-1340	7861.00	5.97	1.34	5.91	0.21	0.66	0.33	12.1
22		040501-1400	4170.00	5.92	2.69	4.37	0.09	0.63	0.38	11.6
average			**5109.00**	**5.85**	**1.75**	**4.70**	**0.21**	**0.67**	**0.33**	**12.70**
st dev			**2660.72**	**0.16**	**1.45**	**1.05**	**0.20**	**0.05**	**0.05**	**2.74**

Site	Site Name	Date-time	Flow (gpm)	pH	Acidity (mg/L)	Alkalinity (mg/L)	Al (ppm)	Fe (ppm)	Mn (ppm)	SO4 (mg/L)
21	BLCK	031010-1535	1051.00	4.61	6.32	0.51	0.20	0.19	0.05	8.4
21	Stony	031122-1405	2880.00	4.51	7.52	0	0.26	0.14	0.06	7.5
21		040321-1400	3916.00	4.73	6.91	0.49	0.26	0.14	0.05	8.2
21		040501-1400	4991.00	4.69	7.38	0.58	0.20	0.18	0.05	7.3
average			**3209.50**	**4.64**	**7.03**	**0.40**	**0.23**	**0.16**	**0.05**	**7.85**
st dev			**1677.36**	**0.10**	**0.54**	**0.27**	**0.03**	**0.03**	**0.00**	**0.53**

Site	Site Name	Date-time	Flow (gpm)	pH	Acidity (mg/L)	Alkalinity (mg/L)	Al (ppm)	Fe (ppm)	Mn (ppm)	SO4 (mg/L)
20	BLCK	031010-1535	89.00	4.33	8.15	0	0.37	0.15	0.17	16.4
20	Stony Trib	031122-1410	243.00	4.40	8.40	0	0.55	0.22	0.23	14.6
20		040321-1405	331.00	4.76	7.95	0.68	0.64	0.25	0.27	14.9
20		040501-1420	422.00	4.63	8.15	0.49	0.45	0.22	0.26	16.8
average			**271.25**	**4.53**	**8.16**	**0.29**	**0.50**	**0.21**	**0.23**	**15.68**
st dev			**141.78**	**0.20**	**0.18**	**0.35**	**0.12**	**0.04**	**0.04**	**1.09**

Site	Site Name	Date-time	Flow (gpm)	pH	Acidity (mg/L)	Alkalinity (mg/L)	Al (ppm)	Fe (ppm)	Mn (ppm)	SO4 (mg/L)
18	BLCK	030926-1650	1776.00	4.84	5.92	1.23	0.30	0.59	0.22	11.4
18	Cranberry	031010-1510	501.00	5.61	7.35	2.63	3.9	8.58	0.38	8.5
18		031031-1400	2841.00	4.79	7.15	0.69	0.51	0.61	0.13	12.1
18		031122-1330	1123.00	5.08	6.40	1.20	0.31	0.42	0.19	10.4
18		040321-1355	1646.00	5.03	7.23	1.34	0.40	0.31	0.25	12.1
18		040501-1400	1129.00	4.82	7.82	0.92	0.34	0.47	0.24	13.9
average			**1502.67**	**5.03**	**6.98**	**1.34**	**0.96**	**1.83**	**0.24**	**11.40**
st dev			**796.68**	**0.31**	**0.69**	**0.68**	**1.44**	**3.31**	**0.08**	**1.82**

Site	Site Name	Date-time	Flow (gpm)	pH	Acidity (mg/L)	Alkalinity (mg/L)	Al (ppm)	Fe (ppm)	Mn (ppm)	SO4 (mg/L)
19	BLCK	030926-1430	7624.00	4.50	6.52	0	0.24	0.17	0.07	7.9
19	Stony	031010-1530	1375.00	4.62	6.46	0.25	0.22	0.19	0.09	10.1
19		031031-1420	10971.00	4.31	8.55	0	0.57	0.47	0.06	8.5
19		031122-1400	3768.00	4.43	6.85	0	0.30	0.16	0.08	8.5

Site	Site Name	Date-time	Flow (gpm)	pH	Acidity (mg/L)	Alkalinity (mg/L)	Al (ppm)	Fe (ppm)	Mn (ppm)	SO4 (mg/L)
19		040321-1350	5124.00	4.69	7.09	0.43	0.34	0.18	0.09	9.2
19		040501-1415	6531.00	4.75	6.82	0.77	0.24	0.19	0.09	8.9
average			**5898.83**	**4.55**	**7.05**	**0.24**	**0.32**	**0.23**	**0.08**	**8.85**
st dev			**3307.83**	**0.17**	**0.77**	**0.31**	**0.13**	**0.12**	**0.01**	**0.75**

Site	Site Name	Date-time	Flow (gpm)	pH	Acidity (mg/L)	Alkalinity (mg/L)	Al (ppm)	Fe (ppm)	Mn (ppm)	SO4 (mg/L)
17	BLCK	030926-1345	28723.00	6.63	-4.80	10.26	0.09	0.56	0.14	10.1
17		031010-1700	8233.00	7.03	-17.75	26.28	0.10	0.43	0.21	13.0
17		031031-1200	41722.00	6.36	-0.37	6.88	0.37	0.33	0.20	11.4
17		031122-1150	16060.00	6.74	-11.54	19.32	0.28	0.41	0.21	11.8
17		040321-1610	21899.00	6.63	-5.86	15.38	0.20	0.46	0.28	10.8
17		040501-1620	20088.00	6.78	-6.42	16.46	0.14	0.46	0.24	10.0
average			**22787.50**	**6.70**	**-7.79**	**15.76**	**0.20**	**0.44**	**0.21**	**11.18**
st dev			**11479.68**	**0.22**	**6.05**	**6.83**	**0.11**	**0.08**	**0.05**	**1.14**

Site	Site Name	Date-time	Flow (gpm)	pH	Acidity (mg/L)	Alkalinity (mg/L)	Al (ppm)	Fe (ppm)	Mn (ppm)	SO4 (mg/L)
16	BLCK	030926-1300	37980.00	6.46	-3.00	8.32	0.16	0.54	0.19	11.1
16		031010-1700	14659.00	6.63	-7.18	15.03	0.07	0.36	0.22	15.8
16		031031-1225	55569.00	6.13	1.42	5.12	0.33	0.35	0.23	12.2
16		031122-1145	23082.00	6.53	-4.74	11.31	0.28	0.50	0.23	11.4
16		040321-1630	31957.00	6.67	-4.89	12.89	0.15	0.46	0.28	11.8
16		040501-1605	24117.00	6.60	-2.85	12.42	0.23	0.76	0.26	11.3
average			**31227.33**	**6.50**	**-3.54**	**10.85**	**0.20**	**0.50**	**0.24**	**12.27**
st dev			**14353.12**	**0.20**	**2.89**	**3.56**	**0.10**	**0.15**	**0.03**	**1.78**

Site	Site Name	Date-time	Flow (gpm)	pH	Acidity (mg/L)	Alkalinity (mg/L)	Al (ppm)	Fe (ppm)	Mn (ppm)	SO4 (mg/L)
15	BLCK	030926-1440	39732.00	6.62	-1.74	6.94	0.11	0.32	0.13	10.7
15		031010-1730	13269.00	6.76	-2.28	9.46	0.05	0.30	0.17	14.1
15		031031-1115	56687.00	6.19	2.80	3.88	0.29	0.30	0.22	15.8
15		031122-1115	23030.00	6.59	-1.25	8.14	0.25	0.41	0.22	13.8
15		040321-1640	32160.00	6.81	-4.22	12.03	0.17	0.42	0.28	11.4
15		040501-1600	26067.00	6.81	-0.03	8.2	0.18	0.60	0.21	10.0
average			**31824.17**	**6.63**	**-1.12**	**8.11**	**0.18**	**0.39**	**0.21**	**12.63**
st dev			**15070.39**	**0.24**	**2.36**	**2.70**	**0.09**	**0.12**	**0.05**	**2.27**

Site	Site Name	Date-time	Flow (gpm)	pH	Acidity (mg/L)	Alkalinity (mg/L)	Al (ppm)	Fe (ppm)	Mn (ppm)	SO4 (mg/L)
14	BLCK	030926-1230	40313.00	6.70	-1.23	6.48	0.15	0.38	0.13	12.5
14		031010-1810	14297.00	6.78	-1.83	8.43	0.06	0.29	0.13	15.5
14		031031-1100	58971.00	6.34	2.34	3.80	0.30	0.30	0.20	12.0
14		031122-1100	24508.00	6.59	-0.23	6.95	0.25	0.36	0.19	14.8
14		040321-1645	33723.00	6.81	-4.20	11.23	0.16	0.40	0.27	10.9
14		040501-1725	24144.00	6.70	1.75	6.18	0.16	0.51	0.19	10.1

average			**32659.33**	**6.65**	**-0.57**	**7.18**	**0.18**	**0.37**	**0.19**	**12.63**
st dev			**15672.55**	**0.17**	**2.42**	**2.49**	**0.08**	**0.08**	**0.05**	**2.13**

Site	Site Name	Date-time	Flow (gpm)	pH	Acidity (mg/L)	Alkalinity (mg/L)	Al (ppm)	Fe (ppm)	Mn (ppm)	SO4 (mg/L)
13	BLCK	030926-1145	13600.29	3.93	78.86	0	12.0	1.0	7.5	350
13	Gowen Dis.	031010-1645	4563.68	3.88	77.38	0	11.0	0.82	6.8	409
13		031031-1030	21227.56	3.98	52.77	0	7.6	1.10	5.5	283
13		031122-1040	8901.39	4.01	49.29	0	7.6	0.84	4.8	250
13		040321-1710	10946.72	4.01	54.29	0	7.59	0.67	4.69	248
13		040501-1715	9276.00	4.17	45.38	0	6.59	0.94	4.15	223
average			**11419.27**	**4.00**	**59.66**	**0.00**	**2.17**	**0.17**	**1.24**	**69.92**
st dev			**5641.19**	**0.10**	**14.63**	**0.00**	**2.20**	**0.15**	**1.31**	**71.52**

Site	Site Name	Date-time	Flow (gpm)	pH	Acidity (mg/L)	Alkalinity (mg/L)	Al (ppm)	Fe (ppm)	Mn (ppm)	SO4 (mg/L)
12	BLCK	030926-1145	53596.00	4.77	10.05	1.29	1.5	0.41	0.98	61.6
12		031010-1640	16764.00	4.94	8.65	1.38	1.2	0.38	0.78	52.5
12		031031-1030	89918.00	4.68	10.35	0.75	1.1	0.49	0.67	42.7
12		031122-1040	38055.00	4.70	12.22	0.98	1.9	0.43	1.1	68.5
12		040321-1655	41116.00	6.19	2.15	6.68	0.77	0.42	0.54	26.2
12		040501-1715	39728.00	4.58	19.03	0.58	2.62	0.67	1.63	87.6
average			**46529.50**	**4.98**	**10.41**	**1.94**	**1.52**	**0.47**	**0.95**	**56.52**
stdev			**24355.15**	**0.61**	**5.46**	**2.34**	**0.66**	**0.11**	**0.39**	**21.27**

Site	Site Name	Date-time	Flow (gpm)	pH	Acidity (mg/L)	Alkalinity (mg/L)	Al (ppm)	Fe (ppm)	Mn (ppm)	SO4 (mg/L)
11	BLCK	030926-1050	65355.00	4.84	9.23	1.11	1.3	0.51	0.88	51.2
11		031010-1900	21038.00	4.89	9.77	1.11	1.4	0.31	0.91	58.2
11		031031-1000	101719.00	4.62	11.37	0.42	1.4	0.41	0.86	51.7
11		031122-1000	46973.00	4.94	9.25	1.23	1.3	0.36	0.79	47.6
11		040321-1720	52017.00	6.30	3.54	5.34	0.79	0.40	0.54	26.4
11		040501-1820	47003.00	5.05	9.09	1.26	1.07	0.54	0.69	44.2
average			**55684.17**	**5.11**	**8.71**	**1.75**	**1.21**	**0.42**	**0.78**	**46.55**
stdev			**26749.89**	**0.60**	**2.67**	**1.79**	**0.24**	**0.09**	**0.14**	**10.92**

Site	Site Name	Date-time	Flow (gpm)	pH	Acidity (mg/L)	Alkalinity (mg/L)	Al (ppm)	Fe (ppm)	Mn (ppm)	SO4 (mg/L)
10	BLCK	030926-1000	71140.00	5.03	7.38	1.26	1.1	0.43	0.77	44.3
10		031010-1040	22189.00	5.30	7.52	1.48	1.0	0.29	0.81	48.8
10		031024-0900	26235.00	5.17	7.43	1.31	1.1	0.19	0.83	44.7
10		031031-0925	122042.00	4.79	8.46	0.92	1.1	0.41	0.78	44.2
10		031122-0930	58469.00	5.34	7.09	1.38	1.0	0.32	0.63	35.5
10		040321-1000	61975.00	6.80	-1.42	8.97	0.71	0.41	0.46	22.4
10		040501-1015	55165.00	6.00	6.43	2.34	0.94	0.68	0.65	30.8
10		040512-1000	41967.00	5.20	7.54	1.32	0.94	0.51	0.73	38.10

Site	Site Name	Date-time	Flow (gpm)	pH	Acidity (mg/L)	Alkalinity (mg/L)	Al (ppm)	Fe (ppm)	Mn (ppm)	SO4 (mg/L)
10		040524-0950	26265.00	4.88	9.77	0.94	0.96	0.50	0.69	39.90
average			**53938.56**	**5.39**	**6.69**	**2.21**	**0.98**	**0.42**	**0.71**	**38.74**
st dev			**31034.75**	**0.63**	**3.18**	**2.57**	**0.12**	**0.14**	**0.12**	**8.21**

Site	Site Name	Date-time	Flow (gpm)	pH	Acidity (mg/L)	Alkalinity (mg/L)	Al (ppm)	Fe (ppm)	Mn (ppm)	SO4 (mg/L)
9	LNESC	031024-1150	1882.00	6.71	-11.94	16.12	0.19	0.18	0.06	9.8
9	U/S of Jeddo	040321-1140	6096.00	6.67	-6.06	11.85	0.07	0.33	0.07	10.2
9		040501-1140	4121.00	6.76	-6.77	13.08	0.07	0.28	0.05	10.2
9		040512-1250	3360.00	6.93	-9.72	15.29	0.01	0.30	0.05	10.1
9		040524-1220	1631.00	6.87	-11.85	17.45	0	0.29	0.08	9.7
average			**3418.00**	**6.79**	**-9.27**	**14.76**	**0.07**	**0.28**	**0.06**	**10.00**
st dev			**1818.10**	**0.11**	**2.76**	**2.27**	**0.08**	**0.06**	**0.01**	**0.23**

Site	Site Name	Date-time	Flow (gpm)	pH	Acidity (mg/L)	Alkalinity (mg/L)	Al (ppm)	Fe (ppm)	Mn (ppm)	SO4 (mg/L)
8	JEDDO	031010-1245	33426.00	4.27	46.92	0.00	8.0	2.3	3.7	406
8	DISCHARGE	031024-1215	28796.00	4.33	44.34	0.00	8.0	2.3	3.7	373
8		040321-1140	29225.00	4.28	49.32	0.00	7.62	2.42	3.26	344
8		040501-1145	41381.00	4.42	40.17	0.00	6.58	2.85	2.89	299
8		040512-1315	39799.00	4.39	42.62	0.00	6.52	2.34	3.09	322
8		040524-1250	27800.00	4.30	44.97	0.00	7.67	2.82	3.63	355
average			**33404.50**	**4.33**	**44.72**	**0.00**	**7.40**	**2.51**	**3.38**	**349.83**
st dev			**5909.85**	**0.06**	**3.20**	**0.00**	**0.68**	**0.26**	**0.35**	**37.71**

Site	Site Name	Date-time	Flow (gpm)	pH	Acidity (mg/L)	Alkalinity (mg/L)	Al (ppm)	Fe (ppm)	Mn (ppm)	SO4 (mg/L)
7	LNESC	031010-1245	36174.00	4.31	45.05	0.00	8.2	2.7	3.5	401
7	D/S of Jeddo	031024-1130	31163.00	4.33	41.89	0.00	7.5	2.1	3.4	352
7		040321-1200	40147.00	4.36	41.74	0.00	6.59	2.22	2.76	301
7		040501-1210	49519.00	4.46	37.62	0.00	5.75	2.83	2.70	279
7		040512-1225	43348.00	4.38	37.46	0.00	5.89	2.14	2.80	285
7		040524-1200	30380.00	4.32	44.57	0.00	7.32	2.64	3.44	339
average			**38455.17**	**4.36**	**41.39**	**0.00**	**6.88**	**2.44**	**3.10**	**326.17**
st dev			**7386.45**	**0.06**	**3.27**	**0.00**	**0.97**	**0.32**	**0.38**	**46.87**

Site	Site Name	Date-time	Flow (gpm)	pH	Acidity (mg/L)	Alkalinity (mg/L)	Al (ppm)	Fe (ppm)	Mn (ppm)	SO4 (mg/L)
6	LNESC	031010-1330	35170.00	4.34	41.08	0.00	7.1	1.84	3.2	356
6	Conyngham	031024-1300	31046.00	4.37	34.97	0.00	6.6	1.50	3.1	320
6		040321-1235	46299.00	4.60	29.86	0.46	5.04	1.60	2.24	257
6		040501-1235	50442.00	4.43	31.09	0.00	5.27	2.00	2.40	253
6		040512-1400	44527.00	4.46	34.25	0.00	5.66	1.86	2.82	277
6		040524-1410	30268.00	4.33	38.94	0.00	6.53	2.03	3.26	321

average			**39625.33**	**4.42**	**35.03**	**0.08**	**6.03**	**1.81**	**2.84**	**297.33**
st dev			**8562.47**	**0.10**	**4.35**	**0.19**	**0.83**	**0.21**	**0.43**	**41.28**

Site	Site Name	Date-time	Flow (gpm)	pH	Acidity (mg/L)	Alkalinity (mg/L)	Al (ppm)	Fe (ppm)	Mn (ppm)	SO4 (mg/L)
5	LNESC	031010-1145	37397.00	4.48	37.29	0.00	6.8	1.6	3.1	352
5	U/S of NESC	031024-1020	34749.00	4.48	32.95	0.00	6.20	2.5	3.0	304
5		040321-1100	53462.00	4.64	22.17	0.95	4.26	1.6	1.83	203
5		040501-1100	55776.00	4.44	28.86	0.00	5.0	1.87	2.27	233
5		040512-1110	50625.00	4.44	30.86	0.00	5.1	1.64	2.64	262
5		040524-1100	35066.00	4.44	33.08	0.00	6.02	1.85	3.07	291
average			**44512.50**	**4.49**	**30.87**	**0.16**	**5.56**	**1.84**	**2.65**	**274.17**
stdev			**9793.01**	**0.08**	**5.10**	**0.39**	**0.94**	**0.34**	**0.51**	**53.18**

Site	Site Name	Date-time	Flow (gpm)	pH	Acidity (mg/L)	Alkalinity (mg/L)	Al (ppm)	Fe (ppm)	Mn (ppm)	SO4 (mg/L)
4	NESC04	031010-1150	30656.00	6.77	-2.49	8.03	0.0	0.13	0.0	7.5
4	U/S of LNESC	031024-1042	37492.00	6.66	-3.22	7.54	0.10	0.13	0.01	5.6
4		040321-1100	86982.00	6.62	-0.98	6.43	0.08	0.21	0.05	6.4
4		040501-1100	68753.00	6.64	-0.23	6.03	0.05	0.55	0.03	5.7
4		040512-1140	81495.00	6.68	-0.05	6.08	0.03	0.20	0.04	6.6
4		040524-1120	32621.00	6.67	-2.34	8.12	0.04	0.28	0.03	6.8
average			**56333.17**	**6.67**	**-1.55**	**7.04**	**0.05**	**0.25**	**0.03**	**6.43**
st dev			**25703.29**	**0.05**	**1.31**	**0.97**	**0.04**	**0.16**	**0.02**	**0.71**

Site	Site Name	Date-time	Flow (gpm)	pH	Acidity (mg/L)	Alkalinity (mg/L)	Al (ppm)	Fe (ppm)	Mn (ppm)	SO4 (mg/L)
2	NESC02	031010-1030	70626.00	4.54	17.38	0.43	3.2	0.79	1.6	180
2		031024-0925	82962.00	4.75	11.23	0.85	2.4	0.60	1.3	136
2		040321-1010	149589.00	5.41	7.49	1.69	1.75	1.00	0.72	65.5
2		040501-0950	143953.00	4.88	10.94	1.42	1.9	0.87	0.92	87.1
2		040512-1025	149755.00	4.79	10.92	0.85	1.66	0.74	0.91	84.0
2		040524-1015	72727.00	4.70	12.71	0.77	2.44	0.86	1.42	133
average			**111602.00**	**4.85**	**11.78**	**1.00**	**2.23**	**0.81**	**1.15**	**114.27**
st dev			**39889.34**	**0.30**	**3.24**	**0.46**	**0.58**	**0.14**	**0.34**	**42.84**

Site	Site Name	Date-time	Flow (gpm)	pH	Acidity (mg/L)	Alkalinity (mg/L)	Al (ppm)	Fe (ppm)	Mn (ppm)	SO4 (mg/L)
1	NESC01	031010-0930	102624.00	4.66	13.17	0.80	2.3	0.55	1.3	147
1		031024-0820	110524.00	4.80	9.85	0.89	2.0	0.44	1.1	109
1		040321-0930	244886.00	6.20	4.43	3.85	1.5	1.01	0.64	53.6
1		040501-0925	217392.97	4.96	9.26	1.49	1.4	0.64	0.80	68.8
1		040512-0925	209318.00	4.94	9.31	0.95	1.36	0.64	0.80	67.8
1		040524-0910	102937.00	4.81	10.49	1.03	1.63	0.62	1.11	102
average			**164613.66**	**5.06**	**9.42**	**1.50**	**1.70**	**0.65**	**0.96**	**91.37**
st dev			**66030.60**	**0.57**	**2.84**	**1.18**	**0.37**	**0.19**	**0.25**	**34.67**

Attachment F
Comment and Response

Tom Stauffer, private consultant

Comment:
The fourth paragraph of Attachment B goes on to describe an approach for establishing a "natural net alkalinity level" for upper stream reaches not affected by mining activities. This approach would serve to lower the standard of quality to be attained, based on the current observable pH of the stream reach, with the assumption that if there is no mining activity in that reach, the stream is "pristine". This approach ignores other impacts, most notably atmospheric deposition. Whether or not a stream with pH less than 6.0 is listed under 303(d) of the Clean Water Act as "impaired," one cannot dismiss or ignore human impacts when preparing a water quality target to be attained. In the Nescopeck watershed, acid deposition depression of pH in headwater streams may be the rule, not the exception, and I believe this is due to atmospheric deposition impacts.

Response:
Early in 2004 the Department changed the methodology we use in tracking loads through a watershed. The fourth paragraph in Attachment B, Method for Addressing 303(d) Listings for pH, should have been removed because we do not, now, make use of the natural background in the manner indicated because it is less protective than using the sample point alkalinity as criterion for acidity. This ensures a more protective reduction of acidity at each sample point throughout the watershed. It is understood that acid deposition can cause pH depression in headwater reaches. The word "pristine" has been removed from Attachment B.

The natural background was always used sparingly because we, generally, did not have the necessary data.