FINAL

FERRIER RUN
WATERSHED TMDL
Indiana County

For Acid Mine Drainage Affected Segments

Prepared by:

Pennsylvania Department of Environmental Protection

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FINAL TMDL[1]
Ferrier Run Watershed
Indiana County, Pennsylvania

Introduction

This report presents the Total Maximum Daily Loads (TMDLs) developed for segments in the Ferrier Run Watershed (Attachments A). These were done to address the impairments noted on the 1996 Pennsylvania Section 303(d) list of impaired waters, required under the Clean Water Act, and covers one segment on this list. All impairments resulted from acid drainage from abandoned coalmines. The TMDL addresses the three primary metals associated with acid mine drainage (iron, manganese, aluminum) and pH.

Table 1. 303(d) Sub-List
State Water Plan (SWP) Subbasin: 18-D Two Lick Creek

Year	Miles	Segment ID	DEP Stream Code	Stream Name	Designated Use	Data Source	Source	EPA 305(b) Cause Code
1996	1.4	NA	44125	Ferrier Run	CWF	305(b) Report	RE	Metals
1998	1.4	Part C	44125	Ferrier Run	CWF	305(b) Report	AMD	Metals
2002	1.4	Section 4	44125	Ferrier Run	CWF	305(b) Report	AMD	Metals
2004	2.6	20040930-1500-CLW	44125	Ferrier Run	CWF	2004 Integrated List	AMD	Metals

Resource Extraction=RE
Cold Water Fishes = CWF
Surface Water Monitoring Program = SWMP
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.

Directions to the Ferrier Run Watershed

The Ferrier Run Watershed is located in Western Pennsylvania, occupying a south central portion of Indiana County in Brush Valley Township. The watershed area is found on United States Geological Survey Brush Valley 7.5-Minute Quadrangle. The area within the watershed consists of 2.1 square miles. Land uses within the watershed include abandoned mine lands, forestlands, and rural residential properties with small communities scattered throughout the area. The headwaters of Ferrier Run can be accessed by traveling approximately 1.8 miles north

[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 1997 lawsuit settlement of *American Littoral Society and Public Interest Group of Pennsylvania v. EPA.*

on T-694 from the village of Brush Valley. The mouth of the stream is on Yellow Creek approximately 1.5 miles above the road crossing at Rt. 954.

Hydrology and Geology

The stream develops in higher elevations in the east and flows westerly to discharge into Yellow Creek, which is a tributary of Two Lick Creek. The stream develops at approximate 1600 feet MSL and discharges at an approximate elevation 1140 feet MSL. The natural location of the mouth of Ferrier Run has been artificially diverted downstream approximately 2000 feet in order to bypass the intake of the Central Indiana County Water Authority.

The Ferrier Run watershed lies within the Appalachian Plateau Physiographic Province. The watershed area is comprised of Pennsylvanian aged rocks. The stream crosses the Chestnut Ridge Anticline at an approximate elevation of 1400 feet MSL or three fourths of the way downstream.

Pennsylvanian aged rocks of the Allegheny and Conemaugh Groups are exposed in the valleys of the watershed and on the hilltops. The members exposed are the Lower Kittanning through the Upper Freeport with the rocks of the Conemaugh Formation overlying the Upper Freeport outcrop area on the hilltops. The coals that are exposed are: the Lower Kittanning, Middle Kittanning, Upper Kittanning, Lower Freeport and Upper Freeport. The Lower Kittanning seam dips to elevations near drainage level in westernmost and below drainage in easternmost areas of the drainage basin due to the saddling effect of the anticline.

Segments addressed in this TMDL

There are two mining operations, one active deep mine and one completed surface mine, in the Ferrier Run Watershed. Mining is complete on the M.B. Energy, Gamelands 273 Mine, SMP 32990102, a surface mine involving the Upper Freeport coal seam. Because mining is complete and the site backfilled, there are no discharges from the site. The active deep mine is the AMFIRE Mining, Ondo Mine, SMP 32961302 (NPDES PA0214949), on the Lower Kittanning seam. There are two permitted treatment discharges from the site, Portal 1 and Portal 2; however, Portal 1 has been sealed and no longer discharges. The discharge from Portal 2 is assigned a waste load allocation.

All of the remaining discharges in the watershed are from abandoned mines and will be treated as non-point sources. Each segment on the Section 303(d) list is addressed as a separate TMDL. These TMDLs are expressed as long-term, average loadings. Due to the nature and complexity of mining effects on the watershed, expressing the TMDL as a long-term average gives a better representation of the data used for the calculations. See Attachment C for TMDL calculations.

Clean Water Act Requirements

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

Additionally, the federal Clean Water Act and the Environmental Protection Agency's (EPA) implementing regulations (40 CFR Part 130) require:

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

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

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

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

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

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

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

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

Section 303(d) Listing Process

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

The primary method adopted by the Pennsylvania Department of Environmental Protection (DEP) for evaluating waters changed between the publication of the 1996 and 1998 Section

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

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

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

Basic Steps for Determining a TMDL

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

1. Collection and summarization of pre-existing data (watershed characterization, inventory contaminant sources, determination of pollutant loads, etc.);
2. Calculating the TMDL for the waterbody using EPA approved methods and computer models;
3. Allocating pollutant loads to various sources;
4. Determining critical and seasonal conditions;
5. Public review and comment and comment period on draft TMDL;
6. Submittal of final TMDL; and
7. EPA approval of the TMDL.

Watershed History

The date of the earliest mining in the area is not known, however, certainly it preceded the turn of the century: 1800's into the 1900's. Mining villages sprung up around the mining within the watershed. Early mining involved digging shafts into the coal and mining it. Deep mining later gave way to strip mining of the coal. The deep mining and strip mining of the past have left

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

deep mine entries, refuse piles, subsidence and pooling areas, altered landscapes which were not reclaimed, and the exposure of acid bearing overburden to air and water. These sources have led to the pollution and degradation of the watershed.

Previous surface mining on the Lower Kittanning seam lines the valley walls for the full length of the stream. The surface mining resulted in several poor quality discharges in the upper reaches of the stream. Old Home Manor, Pelbro Fuel Co., Inc., C. E. Lauver and Sons, and Brush Valley Coal Company all mined the Lower Kittanning coal along Ferrier Run. Abandoned country bank deep mines exist which do not have discharges to the stream.

Surface mining of the Upper Freeport coal seam most recently was completed by M.B. Energy, Inc. on the south side of Ferrier Run. Other surface mining on the Upper Freeport was by Crichton Coal and Coke Company, Old Home Manor and Ace Drilling Coal Co., Inc. A limited amount of surface mining occurred on the north side on the Upper Freeport by Ragloni Coal Company and Pelbro Fuel Co., Inc.

No post mining discharges from the Upper Freeport surface mining exist on Ferrier Run.

AMD Methodology

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

The statistical analysis described below can be applied to situations where all of the pollutant loading is from non-point sources as well as those where there are both point and non-point sources. The following defines what are considered point sources and non-point sources for the purposes of our evaluation; point sources are defined as permitted discharges or a discharge that has a responsible party, non-point sources are then any pollution sources that are not point sources. For situations where all of the impact is due to non-point sources, the equations shown below are applied using data for a point in the stream. The load allocation made at that point will be for all of the watershed area that is above that point. For situations where there are point-source impacts alone, or in combination with non-point sources, the evaluation will use the point-source data and perform a mass balance with the receiving water to determine the impact of the point source.

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

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

PR = required percent reduction for the current iteration

Cc = criterion in mg/l

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

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

Mean = average observed concentration

Standard Deviation = standard deviation of observed data

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

LTA = Mean * (1 – PR99) where (2)

LTA = allowable LTA source concentration in mg/l

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

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

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

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

that if the sum of the measured loads from the upstream points is greater than the measured load at the downstream point this is indicative that there is a loss of instream load between the evaluation points, and the ratio of the decrease shall be applied to the load that is being tracked (allowable load(s)) from the upstream point.

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

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

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

TMDL Endpoints

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

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

Table 2. Applicable Water Quality Criteria

Parameter	*Criterion Value (mg/l)*	*Total Recoverable/Dissolved*
Aluminum (Al)	0.75	Total Recoverable
Iron (Fe)	1.50	30 day average; Total Recoverable
Manganese (Mn)	1.00	Total Recoverable
pH *	6.0-9.0	N/A

*The pH values shown will be used when applicable. In the case of freestone streams with little or no buffering capacity, the TMDL endpoint for pH will be the natural background water quality.

TMDL Elements (WLA, LA, MOS)

$$TMDL = WLA + LA + MOS$$

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

Allocation Summary

These TMDLs will focus remediation efforts on the identified numerical reduction targets for each watershed. The reduction schemes in Table 3 for each segment are based on the assumption that all upstream allocations are achieved and take into account all upstream reductions. Attachment C contains the TMDLs by segment analysis for each allocation point in a detailed discussion. As changes occur in the watershed, the TMDLs may be re-evaluated to reflect current conditions. An implicit MOS based on conservative assumptions in the analysis is included in the TMDL calculations.

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

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. The difference between the TMDL and the WLA at each point is the load allocation (LA) at the point. The LA at each point includes all loads entering the segment, including those from upstream allocation points. The percent reduction is calculated to show the amount of load that needs to be reduced within a segment in order for water quality standards to be met at the point.

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

In the instance that the allowable load is equal to the existing load (e.g. manganese point S8, Table 3), the simulation determined that water quality standards are being met instream 99% of the time and no TMDL is necessary for the parameter at that point. Although no TMDL is necessary, the loading at the point is considered at the next downstream point. In addition, when all measured values are below the method detection limit, denoted by ND (e.g. iron point S8, Table 3), no TMDL is necessary. In this case the accounting for upstream loads is not carried through to the next downstream point. Rather, there is a disconnect noted and the allowable load is considered to start over because the water quality standard is satisfied.

At point S8, water quality standards were met 99% of the time for all parameters under the current conditions. Although TMDLs are not necessary at S8, there is a permitted discharge within the segment requiring a waste load allocation. The actual allowable loads at the point are the criteria times the flow. The waste load and load allocations at S8 are based on these numbers.

Table 3. TMDL Component Summary for the Ferrier Run Watershed

Station	Parameter	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	Load Reduction (lbs/day)	Percent Reduction %
QB	*Ferrier Run headwaters*						
	Al	3.9	3.7	0.0	3.7	0.2	5
	Fe	5.4	3.8	0.0	3.8	1.6	30
	Mn	6.3	1.9	0.0	1.9	4.4	70
	Acidity	0.0	0.0	NA	NA	0.0	0
S8	*Mouth of Ferrier Run*						
	Al	ND	NA	2.1	3.6	0.0	0
	Fe	ND	NA	6.3	5.1	0.0	0
	Mn	1.9	1.9	4.2	3.4	0.0	0
	Acidity	8.5	8.5	NA	NA	0.0	0

ND, not detected; NA meets WQS. No TMDL necessary.

Following is a generic example of how the allocations, presented in Table 3 are calculated. As demonstrated in the example, all upstream contributing loads are accounted for at each point. Attachment C contains the TMDLs by segment analysis for each allocation point in a detailed discussion. These analyses follow the example. Attachment A contains a map of the sampling point locations for reference.

4	Load (lbs/day)
Existing Load	40.0
Allowable Load	10.0
Load Reduction	30.0
% Reduction	75

10.0

720.0 = 760.0 - 40.0

730.0 = 10.0 + 720.0

3	Load (lbs/day)
Existing Load	760.0
Difference in Existing Loads	720.0
Load tracked from upstream	10.0
Total Load tracked between points	730.0
Allowable Load	15.0
Load Reduction	715.0
% Reduction required	98

15.0

3.5

2	Load (lbs/day)
Existing Load	12.0
Allowable Load	3.5
Load Reduction	8.5
% Reduction	71

18.5 = 15.0 + 3.5

16.0 = 18.5 * 0.87

1	Load (lbs/day)
Existing Load	675.0
Difference in Existing Loads	-97.0
Load tracked from upstream	18.5
% Load lost	13
% Load tracked	87
Total Load tracked between points	16.0
Allowable Load	27.0
Load Reduction	0.0
% Reduction required	0

A waste load allocation is assigned to the permitted discharge from the AMFIRE Mining Company, LLC, Ondo Mine CMAP 32961302.

The Ondo Mine permit contains two treatment discharges, Portal 1 (002) and Portal 2 (004). Portal 1 has been sealed and no longer discharges, only Portal 2 discharges. Included in the permit are limits for iron, aluminum, and manganese. The average flow expected from the discharge is between 0 and 1 MGD. For the waste load allocation calculation, an average flow of 0.5 MGD is used. The WLA for 004 is evaluated at sample point S8.

Table 4 below contains the WLAs for the Ferrier Run Watershed permitted discharges.

Table 4. Waste Load Allocations of Permitted Discharges

Mine	Station	Parameter	Allowable Average Monthly Conc. (mg/L)	Average Flow (MGD)	WLA (lbs/day)
AMFIRE Mining Co. LLC	**004**	Al	0.5	0.5	2.1
Ondo Mine		Fe	1.5	0.5	6.3
SMP 32961302		Mn	1.0	0.5	4.2
NPDES PA0214949					

Waste load allocations for the existing mining operation were incorporated into the calculations at S8. This is the first downstream monitoring point that receives all the potential flow of treated water from the treatment site. No required reductions of this permit are necessary at this time because there are upstream non-point sources when reduced will meet the TMDL or there is available assimilation capacity.

Although TMDLs for aluminum, iron and manganese are not necessary at S8 because the water quality standards are met, WLAs are assigned to the AMFIRE Mining Co. LLC Ondo Mine SMP 32961302 permit. Because the standards are met for aluminum, iron and manganese at S8, the actual allowed load is the water quality standard times the flow and a conversion factor at the point. For S8 this equals 5.69 lbs/day for aluminum, 11.38 lbs/day for iron and 7.58 lbs/day for manganese. The aluminum WLA of 2.1 lbs/day, iron WLA of 6.3 lbs/day and manganese WLA of 4.2 lbs/day for the segment is acceptable and will not have a negative impact on water quality within the segment.

Recommendations

Currently there is a watershed assessment underway for the Kiski-Conemaugh drainage basin, which includes Blacklick Creek and its tributaries Two Lick Creek and Ferrier Run. All of the tributaries and sources of acid mine drainage will be evaluated and prioritized based on their severity and flow. The Kiski-Conemaugh Stream Team is an active watershed group and its efforts involve the Blacklick Creek Watershed Association. The group will use the watershed assessment to focus its attention on the top priorities for the watershed. Once the problem areas have been prioritized the group can then apply for funding to begin the process of cleaning up the watershed.

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

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

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

Mine reclamation and well plugging refers to the process of cleaning up environmental pollutants and safety hazards associated with a site and returning the land to a productive condition, similar to DEP's Brownfields program. Since the 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.

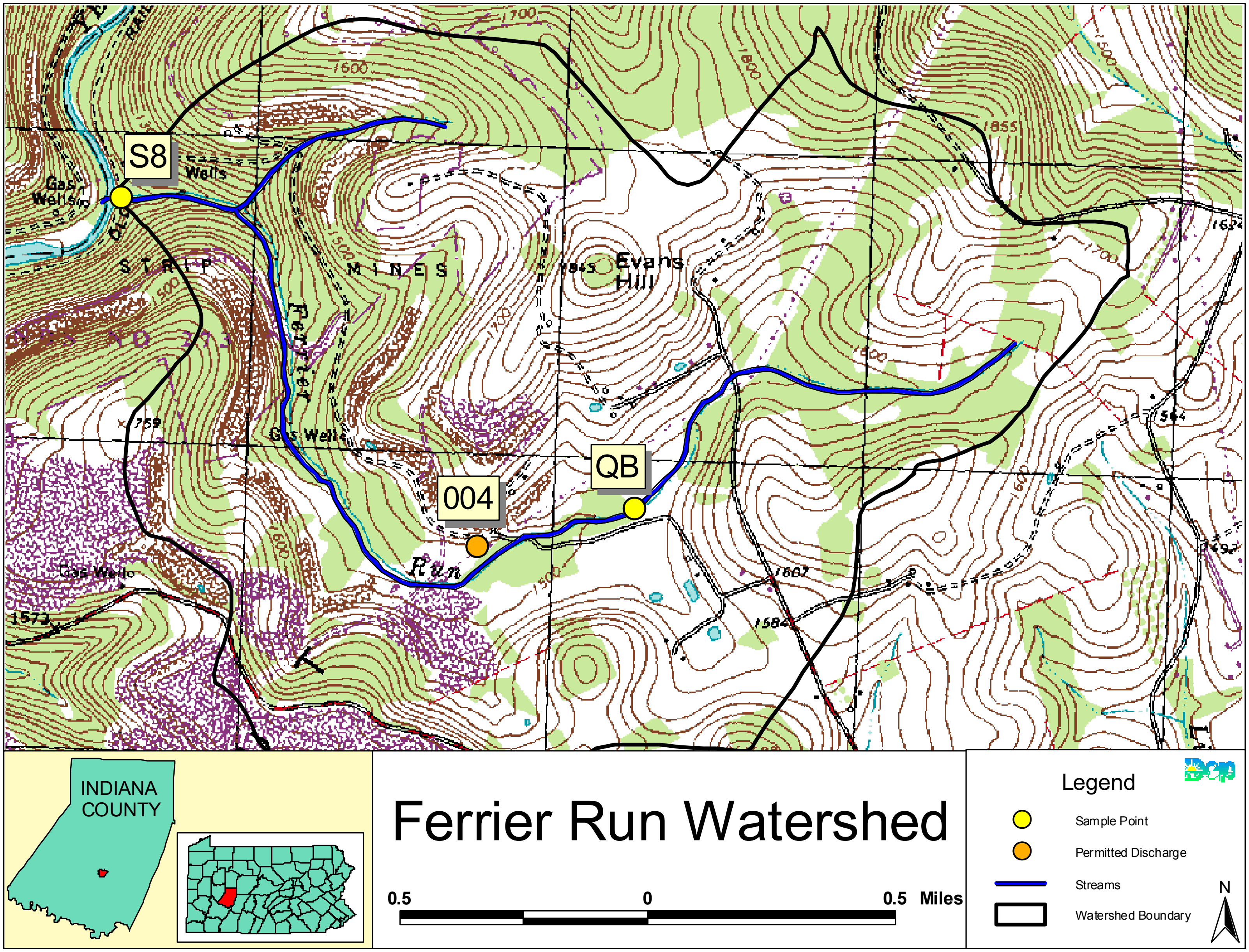
- To encourage private and public participation in abandoned mine reclamation efforts
- To improve reclamation efficiency through better communication between reclamation partners
- To increase reclamation by reducing remining risks
- To maximize reclamation funding by expanding existing sources and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

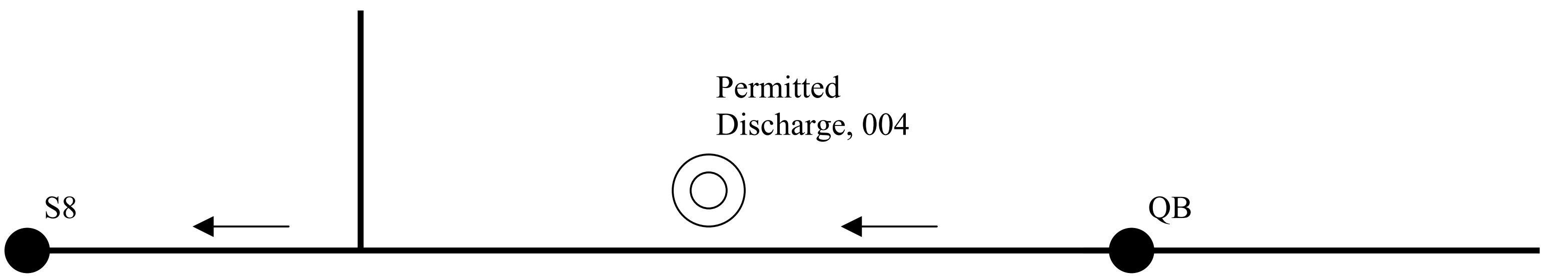
Public Participation

Public notice of the draft TMDL was published in the *Pennsylvania Bulletin* on March 25, 2006 and the Indiana Gazette, Indiana, PA to foster public comment on the allowable loads calculated. The public comment period on this TMDL was open from March 16, 2006 to May 15, 2006. A public meeting was held on March 16, 2006 at the Robert Shaw Building Conference Room, Indiana University, Indiana, Pennsylvania, to discuss the proposed TMDL.

Attachment A
Ferrier Run Watershed Maps


S8
004
QB
Evans Hill
STRIP MINES
Ferrier Run
Gas Wells
INDIANA COUNTY
Ferrier Run Watershed
0.5
0
0.5 Miles
Legend
Sample Point
Permitted Discharge
Streams
Watershed Boundary
N

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



Attachment B

Method for Addressing Section 303(d) Listings for pH

Method for Addressing Section 303(d) Listings for pH

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

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

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

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.*

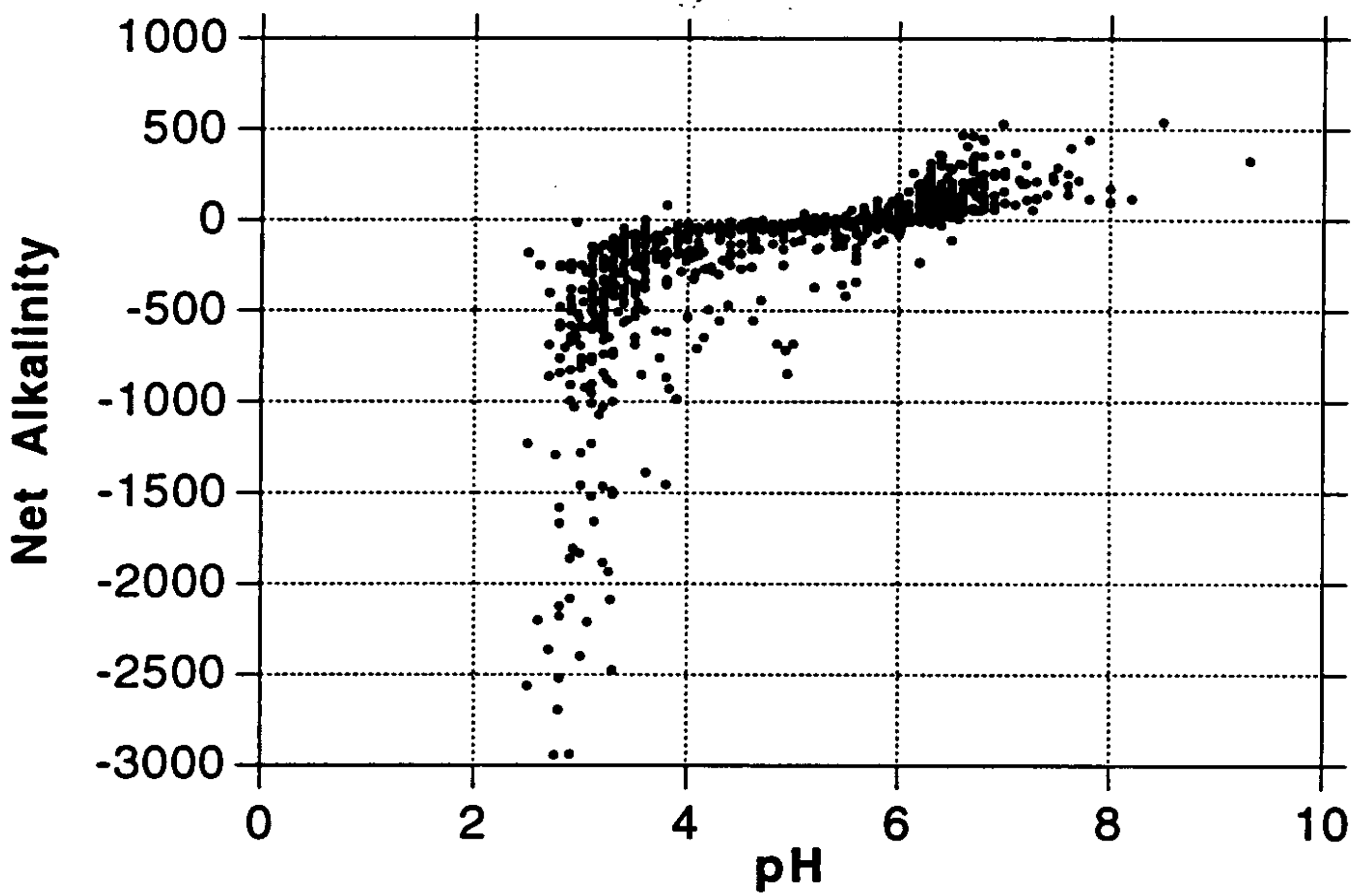


Figure 1. Net Alkalinity vs. pH. Taken from Figure 1.2 Graph C, pages 1-5, of Coal Mine Drainage Prediction and Pollution Prevention in Pennsylvania

Attachment C
TMDLs By Segment

Ferrier Run

The TMDL for the Ferrier Run Watershed consists of a waste load allocation of one permitted discharge and load allocations to two sampling sites along the stream.

Ferrier Run is listed as impaired on the PA Section 303(d) list by high metals from AMD as being the cause of the degradation to the stream. The stream is not listed for pH impairments. Data shows that the water quality standard is met at all points; therefore, pH is not addressed as part of the TMDL for Ferrier Run. The method and rationale for addressing pH is contained in Attachment B.

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

Waste Load Allocations– Permitted Discharges

The AMFIRE Mining Company, LLC CMAP 32961302, Ondo Mine has two permitted treatment discharges; of these, one discharges to Ferrier Run, 004. The waste load allocation for the discharge is calculated with average monthly permit limits and average flow. Included in the permit are limits for iron, manganese and aluminum. The WLA for 004 is evaluated at point S8.

The following table contains the waste load allocation for the permitted discharge.

Table C1. Waste Load Allocations for Permitted Discharges

Mine	Discharge Id	Parameter	Monthly Avg. Allowable Conc. (mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
AMFIRE Mining Co. LLC	004	Al	0.5	0.5	2.1
Ondo Mine		Fe	1.5	0.5	6.3
SMP 32961302		Mn	1.0	0.5	4.2
NPDES PA0214949					

TMDL Calculations - Sample Point QB, Headwaters of Ferrier Run

The TMDL for sample point QB consists of a load allocation to all of the area above the point (Attachment A). The load allocation for this segment was computed using water-quality sample data collected at point QB. The average flow of 0.75 MGD, measured at the point, is used for these computations.

There is currently an entry for this segment on the PA Section 303(d) list for metals impairments from AMD.

Table C2. TMDL Calculations at Point QB

	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	0.63	3.9	0.59	3.7
Fe	0.87	5.4	0.61	3.8
Mn	1.02	6.3	0.31	1.9
Acidity	0.00	0.0	0.00	0.0
Alkalinity	76.25	474.3		

Table C3. Calculation of Load Reduction Necessary at Point QB

	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	3.9	5.4	6.3	0.0
Allowable Load	3.7	3.8	1.9	0.0
Load Reduction	0.2	1.6	4.4	0.0
% Reduction required	5	30	70	0

TMDL Calculations - Sample Point S8, Mouth of Ferrier Run

The TMDL for sample point S8 consists of a waste load allocation to the Ondo Mine permitted discharge and a load allocation to all of the area between points S8 and QB (Attachment A). The load allocation for this segment was computed using water-quality sample data collected at point S8. The average flow of 0.91 MGD, measured at the point, is used for these computations.

This segment is included on the PA Section 303(d) list for metals impairments from AMD.

All values for iron and aluminum are below the method detection limits denoted by ND. Water quality analysis determined that the measured and allowable manganese loads are equal. Because water quality standards are met, TMDLs are not necessary for metals. Because standards are met, the actual allowable loadings at S8 are the criteria times the flow.

Table C4. TMDL Calculations at Point S8				
	Measured Sample Data		Allowable	
Parameter	Conc. (mg/l)	Load (lbs/day)	LTA Conc. (mg/l)	Load (lbs/day)
Al	ND	ND	NA	NA
Fe	ND	ND	NA	NA
Mn	0.24	1.9	0.24	1.9
Acidity	1.11	8.5	1.11	8.5
Alkalinity	35.51	270.6		

The calculated upstream load reductions for all the loads that enter point S8 must be accounted for in the calculated reductions at the sample point shown in Table C5. A comparison of measured loads between points S8 and QB shows that there is an increase in acidity loading and a decrease in manganese load. The total segment acidity load is the sum of the upstream loads and the additional load entering the segment. For loss of manganese loading, the percent of load lost within the segment is calculated and applied to the upstream loads to determine the amount of load that is tracked through the segment.

Table C5. Calculation of Load Reduction Necessary at Point S8				
	Al (lbs/day)	Fe (lbs/day)	Mn (lbs/day)	Acidity (lbs/day)
Existing Load	ND	ND	1.9	8.5
Difference in Existing Load between S8 & QB	-	-	-4.5	8.5
Load tracked from QB	-	-	1.9	0.0
Percent loss due to instream process	-	-	71	-
Percent Load tracked	-	-	29	-
Total Load tracked between points S8 & QB	-	-	0.6	8.5
Allowable Load at S8	NA	NA	1.9	8.5
Load Reduction at S8	0.0	0.0	0.00	0.0
% Reduction required at S8	0	0	0	0

Margin of Safety

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

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

- An additional MOS is provided because that the calculations were done with a daily Fe 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 Section 303(d) narratives that justify changes in listings between the 1996, 1998, and 2002 list. The Section 303(d) listing process has undergone an evolution in Pennsylvania since the development of the 1996 list.

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

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

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

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

Attachment E
Water Quality Data Used In TMDL Calculations

Station	Date	Flow	pH	Alkalinity	Acidity	Iron	Manganese	Aluminum
		gpm		mg/L	mg/L	mg/L	mg/L	mg/L
QB	7/8/2002	316	7.8	100	0	1.43	1.81	0.671
Latitude:	8/21/2002	188	8.3	104	0	0.489	0.421	0.579
40-33-47	6/18/2003	866	7.6	43.8	0	0.851	0.53	<0.5
Longitude:	8/7/2003	702	7.5	57.2	0	0.714	1.31	<0.5
079-04-59								
	Average	518.00000	7.80000	76.25000	0.00000	0.87100	1.01775	0.62500
Ferrier Run headwaters	St Dev	318.67643	0.35590	30.27667	0.00000	0.40144	0.66007	0.06505
S8	4/24/2002		7	32	0	<0.3	0.365	<0.5
Latitude:	7/8/2002	353	7	44	0	<0.3	0.228	<0.5
40-34-11	8/21/2002	220	7.6	50	0	<0.3	0.384	<0.5
Longitude:	1/9/2003		7	20.8	0	<0.3	0.241	<0.5
079-06-30	6/19/2003	981.7	7.4	39.8	0	<0.3	0.099	<0.5
	8/7/2003	983	7.5	35.2	0	<0.3	0.127	<0.5
Mouth of Ferrier Run	3/1/2004		7.1	26.8	7.8	<0.3	0.265	<0.5
	Average	634.42500	7.22857	35.51429	1.11429	ND	0.24414	ND
	St Dev	405.40209	0.26277	10.04248	2.94812	NA	0.10775	NA

Attachment F
Comment and Response

No comments received.