



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
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Decision Rationale
Total Maximum Daily Loads
Birch Island Run Watershed
For Acid Mine Drainage Affected Segments
Clinton and Cameron Counties

signed

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Water Protection Division

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I. Introduction

The Clean Water Act (CWA) requires a Total Maximum Daily Load (TMDL) be developed for those waterbodies identified as impaired by the state where technology-based and other controls will not provide for attainment of water quality standards. A TMDL is a determination of the amount of a pollutant from point, nonpoint, and natural background sources, including a margin of safety, that may be discharged to a water quality-limited waterbody without violating water quality standards.

The Pennsylvania Department of the Environmental Protection (PADEP), Bureau of Watershed Conservation, submitted the *Birch Island Run Watershed TMDL*, dated September 9, 2004, (TMDL Report) electronically to EPA for final Agency review on October 5, 2004, followed by a printed copy which was received October 8, 2004. This report included Total Maximum Daily Loads (TMDLs) for three metals (aluminum, iron, and manganese) and pH, and addresses three segments on Pennsylvania's 1996 Section 303(d) list of impaired waters including Amos Branch, Birch Island Run, and Little Birch Island Run, which had decreases in stream mileage lengths on the 2002 and the proposed 2004 Section 303(d) lists of impaired waters.

EPA's rationale is based on the TMDL Report and information contained in the attachments to the report. EPA's review determined that the TMDL meets the following eight regulatory requirements pursuant to 40 CFR Part 130.

1. The TMDLs are designed to implement the applicable water quality standards.
2. The TMDLs include a total allowable load as well as individual Wasteload Allocations (WLAs) and Load Allocations (LAs).
3. The TMDLs consider the impacts of background pollutant contributions.
4. The TMDLs consider critical environmental conditions.
5. The TMDLs consider seasonal environmental variations.
6. The TMDLs include a Margin Of Safety (MOS).
7. There is reasonable assurance that the proposed TMDLs can be met.
8. The TMDLs have been subject to public participation.

II. Summary

Table 1 presents the 1996, 1998, and 2002 Section 303(d) listing information for the water quality limited segments listed in 1996.

¹TMDL
Birch Island Run Watershed
Clinton County, Pennsylvania

Table 1. 303(d) Sub-List

State Water Plan (SWP) Subbasin: 08-D Birch Island Run

Year	Miles	Segment ID	DEP Stream Code	Stream Name	Designated Use	Data Source	Source	EPA 305(b) Cause Code
1996	1.6	7150	25544	Amos Branch	HQ-CWF	305(b) Report	RE	Metals
1998	1.54	7150	25544	Amos Branch	HQ-CWF	SWMP	AMD	Metals
2002	0.5	7150	25544	Amos Branch	HQ-CWF	SWMP	AMD	Metals
1996	6.2	7148	25529	Birch Island Run	HQ-CWF	305(b) Report	RE	Metals
1998	6.16	7148	25529	Birch Island Run	HQ-CWF	SWMP	AMD	Metals
2002	2.1	7148	25529	Birch Island Run	HQ-CWF	SWMP	AMD	Metals
1996	4.3	7149	25530	Little Birch Island Run	HQ-CWF	305(b) Report	RE	Metals
1998	4.21	7149	25530	Little Birch Island Run	HQ-CWF	SWMP	AMD	Metals
2002	1.5	7149	25530	Little Birch Island Run	HQ-CWF	SWMP	AMD	Metals

High Quality Cold Water Fishes=HQ-CWF

Surface Water Monitoring Program = SWMP

Resource Extraction = RE

Abandoned Mine Drainage = AMD

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

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

The TMDLs were developed using a statistical procedure to ensure that water quality criteria are met 99 percent of the time as required by Pennsylvania's water quality standards at Pennsylvania Code Title 25, Chapter 96.3(c). Table 3 shows the TMDLs for Amos Branch, Birch Island Run, and Little Birch Island Run.

TMDLs are defined as the summation of the point source waste load allocations (WLAs) plus the summation of the nonpoint source load allocations (LAs) plus a margin of safety (MOS) and are often shown as:

$$\text{TMDL} = \sum \text{WLAS} + \sum \text{LAS} + \text{MOS}$$

The TMDL is a written plan and analysis established to ensure that a waterbody will attain and maintain water quality standards. The TMDL is a scientifically-based strategy which considers current and foreseeable conditions, the best available data, and accounts for uncertainty with the inclusion of a MOS value. Conditions, available data, and the understanding of the natural processes can change more than anticipated by the MOS. The option is always available to refine the TMDL for resubmittal to EPA for approval.

Pennsylvania's Unassessed Waters Protocol, PADEP's method of conducting biological assessments of Pennsylvania's waters, was developed in 1996 and implementation began in 1997. PADEP's goal is a statewide assessment of surface waters in Pennsylvania. After completion of the initial assessments, the long-range goal is to reassess all waters on a five-year cycle. Therefore, while the TMDL should not be modified at the expense of achieving water quality standards expeditiously, the TMDL may be modified when warranted by additional data or other information.

III. Background

The Birch Island Run watershed is located in North Central Pennsylvania, in the southwestern portion of Clinton County and the southeastern portion of Cameron County. The area within the Birch Island Run watershed covers approximately 15.3 square miles with land use dominated by forestland, including portions of Sproul State Forest, and previously mined land. The watershed is sparsely populated. The Birch Island Run watershed includes Birch Island Run (8.7 square miles), Little Branch Island Run (6.6 square miles), and Amos Branch (2.3 square miles) which is located in the Birch Island Run headwaters. The streams in the Birch Island Run watershed flow from the northwest to the southeast. Birch Island Run flows from an elevation of 2000 feet above sea level in the headwaters to its confluence with the West Branch of the Susquehanna River. Birch Island Run, Little Birch Island Run, and Amos Branch are designated as cold-water fisheries in PA Title 25 Chapter 93.91.

Multiple seams of coal have been extensively mined in the Birch Island Run watershed by numerous operators over many decades. Several permits were issued for surface mining on the Lower, Middle, and Upper Kittanning coal seams. All of these mining operations were

abandoned in the late 1980s. Much of the affected area was left unreclaimed and several mine discharges resulted.

The Hanslovan Keating Operation (SMP 18840101) permit was issued in February 1985 for the mining of the Middle Kittanning (31 acres), Middle Kittanning rider (15 acres), and Upper Kittanning (10 acres) coal seams on 77 acres of permitted area. Mining was initiated in April 1985 and backfilling and revegetation was completed in September 1997. The Keating Operation is a hilltop site that involved previous mining. Although the Keating Operation has been backfilled and revegetated since 1987, the site remains an active site due to the acid mine drainage discharges that have occurred. There are five point source discharges including K5, K6, K8, K14, and K29 for which Hanslovan Keating Operation has incurred liability. These discharge point sources are shown on the map in Attachment A. As of winter 2003, two treatment systems (vertical flow ponds) have been constructed to treat four of the discharges onsite. One treatment system completed in the Fall of 2000 treats the K5 discharge which is the only discharge flowing into the Birch Island Run watershed. K5 was assigned a WLA in this TMDL. Another treatment system completed in the fall of 2001 treats the K6, K8, and K14 discharges which flow into the Black Stump Run watershed. A treatment system for the K29 discharge is currently being proposed. Each vertical flow pond treatment system consists of a primary treatment pond, a secondary treatment pond, and a flushing pond.

Mining is complete on this permit; however, the Keating Operation is actively treating post-mining discharges. Since liability exists for these discharges, they are point-source discharges and are assigned waste load allocations. All other discharges in the watershed are from abandoned mines and are treated as non-point sources.

For purposes of these TMDLs only, point sources are identified as permitted discharge points and nonpoint sources are identified as other discharges from abandoned mine lands which can include tunnel discharges, seeps, and surface runoff. Abandoned and reclaimed mine lands are treated in the allocations as nonpoint sources because there are no National Pollutant Discharge Elimination System (NPDES) permits associated with these areas. As such, the discharges associated with these landuses were assigned LAs (as opposed to WLAs). The decision to assign LAs to abandoned and reclaimed mine lands does not reflect any determination by EPA as to whether there are unpermitted point source discharges within these landuses. In addition, by approving these TMDLs with mine drainage discharges treated as LAs, EPA is not determining that these discharges are exempt from NPDES permitting requirements. PADEP treats each segment defined by the sampling points as a separate TMDL. The TMDLs are expressed as long-term averages. See the *Birch Island Run Watershed TMDL* report, Attachment C, for TMDL calculations.

The Surface Mining Control and Reclamation Act of 1977 (SMCRA, Public Law 95-87) and its subsequent revisions were enacted to establish a nationwide program to, among other things, protect the beneficial uses of land or water resources, and public health and safety from the adverse effects of current surface coal mining operations, as well as promote the reclamation of mined areas left without adequate reclamation prior to August 3, 1977. SMCRA requires a

permit for the development of new, previously mined, or abandoned sites for the purpose of surface mining. Permittees are required to post a performance bond that will be sufficient to ensure the completion of reclamation requirements by the regulatory authority in the event that the applicant forfeits. Mines that ceased operating by the effective date of SMCRA (often called “pre-law” mines), are not subject to the requirements of SMCRA.

These TMDLs were completed by PADEP to meet the eighth year (2005) TMDL milestone commitment under the requirements of the 1997 TMDL lawsuit settlement agreement. Eighth year milestones include the development of TMDLs for 40 percent of the waters listed on Pennsylvania’s 1996 Section 303(d) list of impaired waters by the effects of Acid Mine Drainage or 81 waters since 2003, and 80 percent of waters listed impaired by non-AMD related impacts or 33 waters since 2003. Delisted waters may count for 20 percent of the requirement.

Computational Procedure

The TMDLs were developed using a statistical procedure to ensure that water quality criteria are met 99 percent of the time as required by Pennsylvania’s water quality standards. The Birch Island Run TMDL allocates loadings to four sampling sites along the Birch Island Run (BIR03, K33, BIR01, and BIR02), two sampling sites along Little Birch Island Run (LBIR02 and LBIR01), one sampling site along Amos Branch (AB01), and a point source discharge (K5). Between May 1999 and October 2002, seven to ten samples were collected in the Birch Island Run watershed at each of the sampling points.

A critical flow was not identified, and the reductions specified in this TMDL apply at all flow conditions. Regression and correlation analyses between flow and concentration almost always produce little or no correlation and disclose no critical condition.

TMDLs for each parameter were determined using a Monte Carlo simulation, @RISK,¹ with the measured, or existing, pollutant concentration data. For each source and pollutant, it was assumed that the observed data are lognormally distributed. Each pollutant was evaluated separately using @RISK.

Using the collected sample concentration parameters, mean and standard deviation, the simulation performs 5000 iterations and predicts an existing long-term average concentration and this analysis shows whether or not the existing data is from a population where water quality standards are exceeded more than one percent of the time. A second simulation of 5000 iterations is performed to calculate the percent reduction necessary to meet the criteria 99 percent of the time. Finally, using the calculated percent reductions, a final simulation is run to confirm that the target value for a long-term average concentration will result in meeting water quality criteria 99 percent of the time.

¹@RISK - Risk Analysis and Simulation Add-in for Microsoft Excel®, Palisade Corporation, Newfield, NY.

The existing and allowable long-term average loads were computed using the mean concentration from @RISK multiplied by the average flow. The TMDL Report points out 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. WLAs are calculated by multiplying the average measured flow and the best available technology (BAT) permit limits for each parameter.

IV. Discussions of Regulatory Requirements

EPA has determined that these TMDLs are consistent with statutory and regulatory requirements and EPA policy and guidance.

1. *The TMDLs are designed to implement the applicable water quality standards.*

Water quality standards are state regulations that define the water quality goals of a waterbody. Standards are comprised of three components, including: (1) designated uses, (2) criteria necessary to protect those uses, and (3) antidegradation provisions that prevent the degradation of water quality. All of the stream segments evaluated in the Birch Island Run watershed have been designated by Pennsylvania as Cold Water Fisheries with criteria to protect the aquatic life uses. The designations for these stream segments can be found at Pennsylvania Title 25 § 93.91. To protect the designated uses, as well as the existing uses, the water quality criteria shown in Table 2 apply to all evaluated segments. The table includes the instream numeric criterion for each parameter and any associated specifications.

Table 2. Applicable Water Quality Criteria

Parameter	Criterion Value (mg/l)	Duration	Total Recoverable/ Dissolved
Aluminum (Al)	0.75	Maximum	Total Recoverable
Iron (Fe)	1.5 0.3	30-day Average Maximum	Total Recoverable Dissolved
Manganese (Mn)	1.0	Maximum	Total Recoverable
pH	6.0 - 9.0	Inclusive	N/A

Pennsylvania Title 25 § 96.3(c) requires that water quality criteria be achieved at least 99 percent of the time, and TMDLs expressed as long-term average concentrations, are expected to meet these requirements. That is, the statistical Monte Carlo simulation used to develop TMDLs and LAs for each parameter results in a determination that any required percent pollutant reduction assures that the water quality criteria will be met instream at least 99 percent

of the time. The Monte Carlo simulation used 5000 iterations where each iteration was independent of all other iterations, and the observed data were assumed to be lognormally distributed for each source and pollutant.

EPA finds that these TMDLs will attain and maintain the applicable narrative and numerical water quality standards.

The pH values shown in Table 2 were used as the TMDL endpoints for these TMDLs. In the case of freestone streams with little or no buffering capacity, the allowable TMDL endpoint for pH may be the natural background water quality; these values can get as low as 5.4 (Pennsylvania Fish and Boat Commission). However, PADEP chose to set the pH standard between 6.0 to 9.0, inclusive, which is presumed to be met when the net alkalinity is maintained above zero. This presumption is based on the relationship between net alkalinity and pH, on which PADEP based its methodology to addressing pH in the watershed. See the *Birch Island Run Watershed TMDL* report, Attachment B. A summary of the methodology is presented as follows.

The parameter of pH, a measurement of hydrogen ion acidity presented as a negative logarithm of effective hydrogen ion concentration, is not conducive to standard statistics. Additionally, pH does not measure latent acidity that can be produced from the hydrolysis of metals. PADEP is using the following approach to address the stream impairments noted on the Section 303(d) list due to pH. Because the concentration of acidity in a stream is partially dependent upon metals, it is extremely difficult to predict the exact pH values which would result from treatment of AMD. 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 able to measure the reduction of acidity. When acidity in a stream is neutralized or is restored to natural levels, pH will be acceptable (≥ 6.0). 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 used to calculate the required 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. EPA finds this approach to pH to be reasonable.

PADEP also has an alkalinity standard. Alkalinity (of a minimum 20 mg/l calcium carbonate except where natural conditions are less) is related to but not identical with pH. Alkalinity is a measure of the buffering capacity of the water. Adequate buffering prevents large swings in pH with additions of small amounts of acid. Although many of the AMD-impacted streams are naturally low in alkalinity, available monitoring data does not always include upstream waters unimpacted by AMD. As PADEP does not list waters for inadequate alkalinity, TMDLs are not being developed for alkalinity but PADEP should monitor the waters for alkalinity and if, after these TMDLs are implemented, alkalinity is less than 20 mg/l or natural conditions, PADEP should list the waters for alkalinity and develop TMDLs.

2. *The TMDLs include a total allowable load as well as individual WLAs and LAs.*

There is one permitted discharger treating post-mining discharges in the watershed which received WLAs. WLAs are calculated by multiplying the average measured flow and the BAT permit limits for each parameter. For purposes of these TMDLs only, point sources are identified as permitted discharge points and nonpoint sources are identified as other discharges from abandoned mine lands which can include, but are not limited to, tunnel discharges, seeps, and surface runoff. Abandoned and reclaimed mine lands were treated in the allocations as nonpoint sources because there are no NPDES permits associated with these areas. As such, the discharges associated with these landuses were assigned LAs (as opposed to WLAs). The decision to assign LAs to abandoned and reclaimed mine lands does not reflect any determination by EPA as to whether there are unpermitted point source discharges within these landuses. In addition, by approving these TMDLs with mine drainage discharges treated as LAs, EPA is not determining that these discharges are exempt from NPDES permitting requirements.

The TMDL for each sampling point was computed using water-quality data collected from that point. The instream TMDLs for sampling points LBIR02, BIR03, and AB01 consist of LAs made to the area above those points. The instream TMDLs for sampling points LBIR01 and BIR01 consist of LAs to the area between them and the upstream sample points and upstream load. Point K33 consists of a LA to the area between it and sample points AB01 and BIR03, the point source discharge at K5, and the upstream loads. Point BIR02 consists of the LA between it and BIR01 and the upstream loads. The sampling points are shown on the map in Attachment A.

Once PADEP determined the allowable concentration and load for each pollutant, a mass-balance accounting was performed starting at the top of the watershed and working down in sequence, see the flow diagram in Attachment A. 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 a guide for expected changes in the allowable loads.

PADEP used two basic rules for the load tracking between two ends of a stream segment; (1) if the measured upstream loads are less than the downstream loads, it is indicative that there is an increase in load between the points being evaluated and no instream processes are assumed. (2) 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 points, and the ratio of the decrease shall be applied to the allowable load being tracked from the upstream point.

Tracking loads through the watershed provides a picture of how the pollutants are affecting the watershed, based on the available information. The analysis is done to insure that water quality standards will be met at all points in the stream. EPA finds this approach reasonable.

Table 3 presents a summary of the allowable loads for the Birch Island Run watershed. Note the reduction identified for sampling points LBIR01, BIR03, K33, BIR01, and BIR02 are the reductions necessary after upstream reductions have been made.

Table 3. Summary Table for Birch Island Run Watershed

Station	Parameter	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	Load Reduction (lbs/day)	Reduction Identified* %
LBIR02	Al	ND					
	Fe	ND					
	Mn	ND					
	Acidity	124.91	61.21	0	61.21	63.70	51
	Alkalinity	113.0					
LBIR01	Al	26.13	12.54	0	12.54	13.59	52
	Fe	ND					
	Mn	21.2	21.2				
	Acidity	955.14	200.58	0	200.58	690.86	77
	Alkalinity	386.5					
BIR03	Al	ND					
	Fe	ND					
	Mn	ND					
	Acidity	238.43	35.76	0	35.76	202.67	85
	Alkalinity	161.7					
AB01	Al	ND					
	Fe	ND					
	Mn	ND					
	Acidity	143.84	48.91	0	48.91	94.93	66
	Alkalinity	126.1					
K33	Al	ND		0.40			
	Fe	ND		0.61			
	Mn	8.12	8.12	0.40	7.72	0.40	5
	Acidity	367.34	179.99	0.0	179.99	0	0
	Alkalinity	550.4					
BIR01	Al	ND					
	Fe	ND					
	Mn	17.5	17.5	0	17.5	0	0
	Acidity	948.51	313.01	0	313.01	0	0
	Alkalinity	581.2					
BIR02	Al	ND					
	Fe	ND					
	Mn	17.4	17.4	0	17.4	0	0
	Acidity	1254.69	589.71	0	589.71	29.48	5
	Alkalinity	887.5					

LTA = Long Term Average

WLA = point source loads

LA = total nonpoint loads entering segment, including any upstream loads
ND = non detectable
*Reduction required after upstream reductions are made

PADEP allocated WLAs to only one point source, the Hanslovan Keating Operation. Where there are active mining operations or post-mining discharge treatment in the watershed, Federal regulations require that subsequent to TMDL development and approval, point source permitted effluent limitations be water quality-based.² In addition, PA Title 25, Chapter 96, Section 96.4(d) requires that WLAs shall serve as the basis for determination of permit limits for point source discharges regulated under Chapter 92 (relating to NPDES permitting, monitoring and compliance). Therefore, no new mining may be permitted within the watershed without reallocation of the TMDL.

3. *The TMDLs consider the impacts of background pollutant contributions.*

Birch Island Run is located in an area that was extensively mined. The TMDLs were developed using instream data which account for existing background conditions.

4. *The TMDLs consider critical environmental conditions.*

The reductions specified in this TMDL apply at all flow conditions. A critical flow condition was not identified from the data used for this analysis. The average flow for each sampling site was used to derive loading values for the TMDL.

5. *The TMDLs consider seasonal environmental variations.*

All sample sets included data points from various seasons, which together with the lack of correlations between flow and concentration, indicate that PADEP considered seasonal variations to the extent that data was available.

6. *The TMDLs include a MOS.*

The CWA and Federal regulations require TMDLs to include a MOS to take into account any lack of knowledge concerning the relationship between effluent limitations and water quality. EPA guidance suggests two approaches to satisfy the MOS requirement. First, it can be met implicitly by using conservative model assumptions to develop the allocations. Alternately, it can be met explicitly by allocating a portion of the allowable load to the MOS.

PADEP used an implicit MOS in these TMDLs by assuming the treated instream concentration variability to be the same as the untreated stream's concentration variability. This is a more conservative assumption than the general assumption that a treated discharge has less

²It should be noted that technology-based permit limits may be converted to water quality-based limits according to EPA's *Technical Support Document For Water Quality-based Toxics Control*, March 1991, recommendations.

variability than an untreated discharge. By retaining variability in the treated discharge, a lower average concentration is required to meet water quality criteria 99 percent of the time than if the variability of the treated discharge is reduced.

With respect to iron, PADEP identified an additional implicit MOS in the analysis and TMDL development by treating the iron water quality criterion as if the 1.50 mg/l were a maximum value instead of a thirty-day average value.

7. *There is reasonable assurance that the proposed TMDLs can be met.*

Currently, the Hanslovan Keating Operation has constructed a passive treatment system to address the AMD problems discharging to the Birch Island Run watershed. This system is currently being evaluated at this time. One other passive treatment system has been built and another system is proposed to be built to address additional AMD problems created by the mining on the Hanslovan Keating Operation. These two additional treatment systems will treat AMD water that will not flow into the Birch Island Run watershed.

In addition, the *Recommendations* section highlights what can be done in the watershed to eliminate or treat pollutant sources. Aside from PADEP's primary efforts to improve water quality in the Birch Island Run watershed through reclamation of abandoned mine lands and through the NPDES permit program, additional opportunities for reasonable assurance exist. PADEP expects activities, such as research conducted by its Bureau of Abandoned Mine Reclamation (BAMR), funding from EPA's 319 grant program, and Pennsylvania's Growing Greener program will also help remedy abandoned mine drainage impacts. PADEP also has in place an initiative that aims to maximize reclamation of Pennsylvania's abandoned mineral extraction lands. Through Reclaim PA, Pennsylvania's goal is to accomplish complete reclamation of abandoned mine lands and plugging of orphaned wells. Pennsylvania strives to achieve this objective through legislative and policy land management efforts, and activities described in the TMDL report.

8. *The TMDLs have been subject to public participation.*

A 60-day public comment period was held from June 12, 2004 to August 11, 2004. PADEP public noticed the draft TMDLs in the *Pennsylvania Bulletin* on June 12, 2004, and in the *Clearfield Progress*. A public meeting was held on July 14, 2004, at the Multiservice Center in Clearfield, Pennsylvania, to discuss the proposed TMDLs.

Although not specifically stated in the TMDL Report, PADEP routinely posts the approved TMDL report their web site: www.dep.state.pa.us/watermanagement_apps/tmdl/.

Attachment A

Birch Island Run Watershed Maps





