



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION III  
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**Decision Rationale  
Total Maximum Daily Loads  
Beaver Run Watershed  
For Acid Mine Drainage Affected Segments**

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Water Protection Division**

**Date: \_\_\_\_\_ Decision Rationale**



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**I. Introduction**

The Clean Water Act (CWA) requires a Total Maximum Daily Load (TMDL) be developed by the state for those waterbodies identified as impaired 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 *Beaver Run Watershed TMDL*, dated February 21, 2003 (TMDL Report), to EPA for final Agency review on March 14, 2003. This report included Total Maximum Daily Loads (TMDLs) for three metals (aluminum, iron, and manganese) and pH, and addresses one segment on Pennsylvania's 1996 Section 303(d) list of impaired waters, Beaver Run.

EPA's rationale is based on the TMDL Report and information contained in the attachments to the report. Our 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 (WLA) and load allocations (LA).
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 proposed 2002 Section 303(d) listing information for the one water quality limited segment.

<b>Table 1. 303(d) Sub-List</b>								
<b>State Water Plan (SWP) Subbasin: 17-C Redbank Creek Watershed</b>								
<b>Year</b>	<b>Miles</b>	<b>Segment ID</b>	<b>DEP Stream Code</b>	<b>Stream Name</b>	<b>Designated Use</b>	<b>Data Source</b>	<b>Source</b>	<b>EPA 305(b) Cause Code</b>
1996	3.0	5318	48447	Beaver Run	HQ-CWF/ CWF	305(b) Report	RE	Other Inorganics
1996	3.0	5318	48447	Beaver Run	HQ-CWF/ CWF	305(b) Report	RE	Metals
1998	6.27	5318	48447	Beaver Run	HQ-CWF/ CWF	SWMP	AMD	Metals
2000	6.36	5318	48447	Beaver Run	HQ-CWF/ CWF	SWMP	AMD	Metals
2002	7.3	20010516- 1000-JJM	48447	Beaver Run	HQ-CWF/ CWF	SWMP	AMD	Metals

Resource Extraction = RE

Cold Water Fishes = CWF

High Quality = HQ

Surface Water Monitoring Program = SWMP

Abandoned Mine Drainage = AMD

See Attachment E, *Excerpts Justifying Changes Between the 1996, 1998 and Draft 2000 Section 303(d) Lists.*

The use designations for the stream segments in this TMDL can be found in PA Code 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 criteria Pennsylvania Code Title 25, Chapter 96.3(c). Table 2 summarizes the TMDLs for Beaver Run as determined by PADEP.

**Table 2. TMDL Summary**

Segment	Parameter	TMDL (lbs/day)	WLA <sup>1</sup> (lbs/day)	LA <sup>2</sup> (lbs/day)	MOS <sup>3</sup> (lbs/day)
BR08 In-stream monitoring point	Al	3.8	0	3.8	implicit
	Fe	2.9	0	2.9	implicit
	Mn	3.5	0	3.5	implicit
	Acidity	0.0	0	0.0	implicit
BR02 In-stream monitoring point	Al	2.9	0	2.9	implicit
	Fe	9.2	0	9.2	implicit
	Mn	7.0	0	7.0	implicit
	Acidity	6.5	0	6.5	implicit
BR04 In-stream monitoring point	Al	9.0	0	9.0	implicit
	Fe	19.4	0	19.4	implicit
	Mn	19.1	0	19.1	implicit
	Acidity	6.5	0	6.5	implicit
BR05 In-stream monitoring point	Al	0.0	0	0.0	implicit
	Fe	20.4	0	20.4	implicit
	Mn	15.1	0	15.1	implicit
	Acidity	4.1	0	4.1	implicit

<sup>1</sup> WLA = Waste Load Allocation,  
<sup>3</sup> MOS = Margin of Safety

<sup>2</sup> LA = Load Allocation

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 margin of safety. 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

Beaver Run is located in the north central most area of the main bituminous coal field where coal is generally found in flattened horizontal layers. Coal mining was the primary land use from the 19<sup>th</sup> through half of the 21<sup>st</sup> century. The Brookville deep mine complex was active until the early 1940s and is the the primary cause of impairment in Beaver Run.

The Beaver Run Watershed is affected by pollution from Acid Mine Drainage (AMD). This pollution has caused high levels of metals and low pH in the mainstem of Beaver Run. From a site visit to the watershed it was determined that a large portion of the AMD degradation in the watershed is due to abandoned deep mines. Each segment on the Section 303(d) list will be addressed as a separate TMDL. 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 includes deep mine discharges, and surface runoff. Abandoned and reclaimed mine lands were 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. There are no permitted dischargers in the watershed, therefore, the allocations are to nonpoint sources only. The TMDL are expressed as long-term averages. See TMDL Report, Attachment D, for TMDL calculations.

The Surface Mining Control and Reclamation Act of 1977 (SMCRA, Public Law 95-87) and its subsequent revisions were enacted to established 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 sixth year TMDL milestone commitments under the requirements of the 1997 TMDL lawsuit settlement agreement. Sixth year milestones include the development of TMDLs for 20% of the waters listed on Pennsylvania’s 1996 Section 303(d) list impaired waters by the effects of acid mine drainage (AMD) or 40 waters since 2001, and 60% of waters listed impaired by non-AMD related impacts or 27 waters since 2001. Delisted waters may count for 20% 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. Within the Beaver Run watershed, data sets ranged from a low of 41 data points to a high of 63 for Beaver Run. TMDLs for each parameter were determined using a Monte Carlo simulation,

@RISK.<sup>1</sup> For each source and pollutant, it was assumed that the observed data are lognormally distributed. Each pollutant source was evaluated separately using @RISK.

The existing and allowable long-term average loads were computed using the mean concentration from @RISK multiplied by the average flow. Using the sample parameters, mean and standard deviation, based on collected data, the simulation performs 5000 iterations and predicts an existing long-term average concentration. 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 concentrations will result in meeting water quality criteria 99 percent of the time.

#### 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 designated uses, criteria necessary to protect those uses, and antidegradation provisions that prevent the degradation of water quality. The Beaver Run Watershed has been designated by Pennsylvania as high quality cold water fisheries with criteria for protecting the aquatic life uses. The designations for these stream segments can be found at Pennsylvania Title 25 § 93.9. To protect the designated uses, as well as the existing uses, the water quality criteria shown in Table 3 apply to all evaluated segments. The table includes the instream numeric criterion for each parameter and any associated specifications.

**Table 3. 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

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

Parameter	Criterion Value (mg/l)	Duration	Total Recoverable/ Dissolved
Sulfate (SO <sub>4</sub> )	250*	Maximum	N/A

\*Applicable at potable water supply

Pennsylvania Code 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. For iron, the TMDL endpoint was expressed as total recoverable iron because on all monitoring data it was expressed as total recoverable iron.

The pH values shown in Table 2 were used as the TMDL endpoints for these TMDLs. All pH data for Beaver Run Watershed meets the pH water quality criterion.

Although segments are listed for other “inorganics” (*i.e.*, sulfate), PADEP recently modified Pennsylvania Title 25 § 96.3 to include (d) to limit the application of the sulfate criterion to the point of all existing or planned surface potable water supply. Where sulfate concentrations exceed 250 mg/l, this TMDL makes the demonstration that no potable water supply withdrawal points are affected. The nearest potable water supply is 10 miles downstream of the mouth at Hawthorn Area Water Authority. Water samples taken 20 miles downstream of the mouth of Beaver Run show that the sulfate criteria of 250 mg/L is not exceeded. The average sulfate concentration was 108.45mg/l, calculated from five years of WQN data collected from WQN0820 located on Redbank Creek.

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

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 includes deep mine discharges, 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. There are no permitted dischargers in the watershed, therefore, the allocations are to nonpoint sources only.

The instream TMDLs were calculated from the sampling point located downstream of all mining influences. PADEP assumes that the portion of the stream located downstream of that sampling point will achieve water quality standards once the instream TMDLs are achieved.

PADEP assumed that if all tributaries achieve water quality standards, then Beaver Run itself will achieve water quality standards. PADEP performed a Monte Carlo simulation on Beaver Run to determine the allowable load for each parameter that would meet water quality criteria 99 percent of the time. Then, the allowable loads for Beaver Run and its unnamed tributary were summed. This load was compared to the calculated allowable load for Beaver Run. If this load was less than the calculated load for Beaver Run, a reduction was identified for Beaver Run. Table 4 presents a summary of the allowable loads for the Beaver Run Watershed. Note the reduction identified for Beaver Run is the reduction necessary after upstream reductions have been made.

**Table 4 - Summary Table for Beaver Run Watershed**

Station	Parameter	Measured Sample Data		Allowable		Reduction Identified %
		Conc (mg/L)	load (lbs/day)	LTA Conc (mg/L)	load (lbs/day)	
BR08	Al	0.28	3.8	0.28	3.8	NA
	Fe	0.21	2.9	0.21	2.9	NA
	Mn	0.26	3.5	0.26	3.5	NA
	Acidity	---	---	---	---	NA
	Alkalinity	86.67	1190.2			
BR02						
	Al	0.84	13.2	0.18	2.9	78%
	Fe	2.43	38.4	0.58	9.2	76%
	Mn	1.39	22.0	0.44	7.0	68%
	Acidity	0.41	6.5	0.41	6.5	NA
	Alkalinity	62.45	989.7			
BR04	Al	0.35	12.5	0.25	9.0	NA
	Fe	3.91	138.8	0.55	19.4	82%
	Mn	1.53	54.5	0.54	19.1	52%
	Acidity	1.09	38.8	1.09	38.8	0.8%
		Alkalinity	35.87	1273.9		
BR05						
	Al	0.00	0.0	0.00	0.0	NA
	Fe	0.72	31.9	0.46	20.4	NA
	Mn	0.52	22.9	0.34	15.1	NA
	Acidity	0.09	4.1	0.09	4.1	NA
	Alkalinity	37.27	1654.1			

LTA = Long Term average

At monitoring point BR02, one set of observations indicated the stream to be impaired for both manganese and aluminum in addition to iron, and at monitoring point BR04 the one available data point indicated an impairment for manganese. PADEP assumes that best management practices (BMPs) used to reduce iron loads will also reduce manganese and

aluminum. Percent reductions required at monitoring points BR02 and BR04 are additional reductions required after upstream reductions have been made.

It is important to note that PADEP calculated the TMDLs using pollutant concentrations instead of loadings and determined the long-term average concentration that could occur, and still attain and maintain water quality standards. The resultant concentration was converted to a long-term average load by multiplying by the 50<sup>th</sup> percentile flow. Assuming the sample set is lognormally distributed, the long-term average is related to the LA (or WLA) by the coefficient of variation of the sample set. EPA finds this approach reasonable.

PADEP allocated only to nonpoint sources as there are no current mining operations within the watershed. Federal regulations require that subsequent to TMDL development and approval, point sources permitted effluent limitations be water quality-based.<sup>2</sup> 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.*

Beaver 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 could not be 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.*

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

6. *The TMDLs include a MOS.*

The Clean Water Act and federal regulations require TMDLs to include an 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

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<sup>2</sup>It 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.

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 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 the fact that the calculations were performed on daily iron averages instead of the 30-day average.

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

The *Recommendations* section highlights what can be done in the watershed to eliminate and or treat pollutant sources. The PADEP Bureau of Mining and Reclamation is striving to complete reclamation of its abandoned mines and plugging of its orphaned wells. Realizing this is no small task, PADEP 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 and 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 remaining risks; and
- To maximize reclamation funding by expanding existing sources and exploring new sources.

Remediation efforts began in August 1998 with construction of a 3000-ton anoxic limestone drain and wetland complex at the most upstream discharge. A trust fund has been established for the Redbank Creek Watershed and Growing Greener grants have been awarded for additional passive treatment systems. Implementation of this TMDL can be achieved. Each project will have before and after monitoring to determine remediation technique efficiency.

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

PADEP public noticed the draft TMDLs in the *Jefferson Democrat* newspaper and in the *Pennsylvania Bulletin* on January 2, 2003. A public meeting with watershed residents was held on January 13, 2003, at the Jefferson County Conservation District Office in Brookville, PA, to discuss the TMDLs. Only EPA commented on the draft TMDL Report during the public comment period.

Although not specifically stated in the TMDL Report, PADEP routinely posts the approved TMDL report their web site:  
[http://www.dep.state.pa.us/watermanagement\\_apps/tmdl/default.asp](http://www.dep.state.pa.us/watermanagement_apps/tmdl/default.asp)

# **Attachment A**

Beaver Run Watershed Map

