UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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Decision Rationale
Total Maximum Daily Loads
Beaverdam Branch
For Iron and Aluminum
Blair and Cambria Counties, Pennsylvania

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I. Introduction

The Clean Water Act (CWA) requires that Total Maximum Daily Loads (TMDLs) 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 (MOS) that may be discharged to a waterbody without exceeding water quality standards.

The Pennsylvania Department of Environmental Protection (PADEP) Bureau of Watershed Management electronically submitted the *Beaverdam Branch Watershed TMDL* (TMDL Report) dated March 8, 2007, to the U.S. Environmental Protection Agency (EPA) for final Agency review on March 8, 2007. This report includes the TMDLs for two metals, iron and aluminum, and addresses one segment on Pennsylvania's 1996 Section 303(d) list 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 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 Section 303(d) listing information for the impaired segment first listed in 1996.[1]

[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 Research Group of Pennsylvania v. EPA.*

TABLE 1. SECTION 303(D) LISTINGS FOR BEAVERDAM BRANCH, PENNSYLVANIA

State Water Plan (SWP) Subbasin 11-A Little Juniata River and Frankstown Branch				
Year	**Segment ID**	**Stream Code**	**Stream Name**	**Source/Cause**
1996	6561	16317	Beaverdam Branch	CSO/Organic Enrichment/DO, Urban Runoff/Storm Sewer/Other, AMD/Metals

See Attachment A of the TMDL Report, *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.

In 1997, PADEP began utilizing an earlier version of the current Statewide Surface Waters Assessment Protocol to assess Pennsylvania's waters. This protocol is a modification of EPA's 1989 Rapid Bioassessment Protocol II and provides for a more consistent approach to conducting biological assessments than previously used methods. The biological assessments are used to determine which waters are impaired and should be included on the State's Section 303(d) list.

While the 1996 Section 303(d) listing identified Beaverdam Branch as being impaired due to organic enrichment and dissolved oxygen (DO) from combined sewer overflows (CSOs), PADEP has since determined that CSOs are not contributing to the stream impairment. As part of the TMDL analysis, the Susquehanna River Basin Commission (SRBC) collected various grab samples during storm events to establish CSO and urban runoff/storm sewer contributions, as well as samples during baseflow and medium flow conditions. Based on the water quality results from the storm events compared to baseline results, it was found that BOD and DO from CSOs were not contributing to water quality impairments (Results in Attachment D of the TMDL Report). However, SRBC did find that urban runoff/storm sewer sources contribute high levels of iron and aluminum during storm events, providing clarification to the original 1996 "other" impairment cause. As such, PADEP developed TMDLs for iron and aluminum to address the 1996 "other" impairment. Note that a separate TMDL was developed by PADEP to address the metals from abandoned mine drainage impairment listing.

The TMDLs in this report were developed using a statistical procedure to ensure that water quality criteria are met 99% of the time as required by Pennsylvania's water quality standards at Pennsylvania Code Title 25, Chapter 96.3c. Table 3 of the TMDL Report lists the TMDLs for the Beaverdam Branch Watershed, addressing two metals in the stream segments listed as PADEP stream code 16317. PADEP expresses each TMDL as a long-term average loading. (See Attachment B of the TMDL Report for the TMDL calculations.)

TMDLs are defined as the summation of the point source WLAs, plus the summation of the nonpoint source LAs, plus a MOS and are often shown as follows:

$$TMDL = \sum WLAs + \sum LAs + MOS$$

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

Beaverdam Branch was identified on the 1996 Section 303(d) list of impaired waters and counts toward the tenth year (2007) TMDL milestone commitment under the requirements of the 1997 TMDL lawsuit settlement agreement. Tenth year milestones include the development of TMDLs for 20% of the waters listed on Pennsylvania's 1996 Section 303(d) list of impaired waters by the effects of AMD (80 waters since 2005) and the remaining waters listed as impaired by non-AMD impacts. Delisted waters may count for 20% of the requirement.

III. Background

The Beaverdam Branch Watershed is located predominantly in Blair County with a very small portion in Cambria County, draining approximately 87 square miles. Beaverdam Branch flows about six miles from its headwaters to its confluence with the Frankstown Branch Juniata River. The entire length of Beaverdam Branch is listed as impaired, as well as three of its tributaries, including Mill Run, Sugar Run, and Burgoon Run. These three tributaries all flow into Beaverdam Branch in its headwaters. The aquatic life use for the mainstem of Beaverdam Branch is warm water fishes (WWF). The TMDL Report gives detail on the topography and geology of the watershed.

Based on GIS datasets created in 2001, land use values calculated for the Beaverdam Branch Watershed show that forested land is the dominant land use (61% of the watershed). Developed land comprises over 19% of the watershed and is concentrated around the mainstem of Mill Run and Beaverdam Branch. Beaverdam Branch and its major tributaries flow through low intensity and high intensity commercial areas. The stream channel is ditched and bordered directly by pavement in some portions of the watershed, as shown in Figure 2 of the TMDL Report. Storm sewers from these developed areas flow into the stream channel resulting in excess pollutants and sediment. The remaining land uses include agriculture (14%), disturbed (4%), and water (0.5).

Beaverdam Branch originates in Altoona and flows through Hollidaysburg before it enters the Frankstown Branch Juniata River. As it flows through these population centers, numerous storm pipes empty into the channel, along with four combined sewer overflow (CSO) points. Two of the CSOs are on the mainstem of Beaverdam Branch in Hollidaysburg, and two are on tributaries, Mill Run and Brush Run. Based on water quality samples collected during median and storm event flows, urban runoff/storm sewers contribute the metals to the stream causing the impairment. In addition, there are two National Pollutant Discharge Elimination System (NPDES) facilities and one designated Municipal Separate Storm Sewer (MS4) within the Beaverdam Branch Watershed.

Computational Procedure

The TMDLs were developed using a statistical procedure to ensure that water quality criteria are met 99% of the time as required by Pennsylvania's water quality standards. A two-step approach was used for the TMDL analysis of impaired stream segments.

The first step used a statistical method for determining the allowable instream concentration at the point of interest necessary to meet water quality standards. An allowable long-term average instream concentration was determined at each sample point for metals and acidity. The 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, and the simulation was run assuming the data set was log normally distributed. Using @Risk[3], each pollutant source was evaluated separately by performing 5000 iterations of the model where each iteration was independent of all other iterations. This procedure was used to determine the required percent reduction that would allow the water quality criteria to be met instream at least 99% of the time. A second simulation that multiplied the percent reduction by the sampled value was run to ensure 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.

The second step was a mass balance of the loads as they passed through the watershed. Loads at these points were computed based on average annual flow. Once the allowable concentration and load for each pollutant was determined, mass-balance accounting was performed starting at the top of the watershed and working downstream in sequence. This mass balance or load tracking through the watershed utilized the change in measured loads from sample location to sample location as a guide for expected changes in the allowable loads.

The existing and allowable long-term average loads were computed using the mean concentration from @RISK multiplied by the average flow. The loads were computed based on average annual flow and should not be taken out of the context for which they are intended. They are intended to depict how the pollutants affect the watershed and where the sources and sinks are located spatially in the watershed. A critical flow was not identified, and the reductions specified in this TMDL apply at all flow conditions.

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.

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

Water quality standards are state regulations that define the water quality goals of a waterbody. Standards are comprised of three components: (1) designated uses; (2) criteria necessary to protect those uses; and (3) antidegradation provisions that prevent the degradation of water quality. PA Code, Title 25 Chapter 93 Water Quality Standards designates Beaverdam Branch as WWF. To protect the designated use as well as the existing use, the water quality criteria shown in Table 2 apply to the waterbody. 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)	1.50 0.30	30-day Average Maximum	Total Recoverable Dissolved

Pennsylvania Title 25 §96.3c requires that water quality criteria be achieved at least 99% 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 TMDL WLAs and LAs for each parameter resulted in a determination that any required percent pollutant reduction would assure that the water quality criteria would be met instream at least 99% of the time. The Monte Carlo analysis performed 5,000 iterations of the model where each iteration was independent of all other iterations and the data set was assumed to be log normally distributed.

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

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

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 downstream in sequence. 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, it 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 performed to ensure

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, LAs, and WLAs for the Beaverdam Branch Watershed. Note that the TMDL accounts for reductions assigned in PADEP's Beaverdam Branch AMD and Mill Run metals TMDLs.

TABLE 3. TMDL COMPONENT SUMMARY FOR THE BEAVERDAM BRANCH WATERSHED

Parameter (lbs/day)	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	Load Reduction (lbs/day)	Percent Identified‡ (%)
BVDM8.0 - Mouth of Mill Run**						
Iron	1,020.9	60.4	37.0	23.4	557.3	90
Aluminum	4,42.2	35.1	25.4	9.7	207.8	86
Point 36* - Mouth of Burgoon Run						
Iron	4,10.3	78.0	-	-	0	0
Aluminum	4,90.3	24.5	-	-	0	0
Point 34* - Mouth of Sugar Run						
Iron	20.5	12.3	-	-	0	0
Aluminum	22.8	6.4	-	-	0	0
Point 33* - Beaverdam Branch below the confluences of Mill, Sugar and Burgoon Runs						
Iron	544.9	234.3	-	-	0.0	0
Aluminum	620.9	62.1	-	-	76.6	55
BVDM9.0 - Beaverdam Branch above Hollidaysburg						
Iron	5,936.1	294.7	60.4	234.3	4,487.6	94
Aluminum	4,641.6	136.8	74.7	62.1	3,582.9	97
BVDM10.0 - Beaverdam Branch above Old Plant CSO						
Iron	4,270.1	384.3	150.0	234.3	0	0
Aluminum	2,487.3	202.8	140.7	62.1	0	0
BVDM11.0 - Beaverdam Branch below Old Plant CSO and above River Road CSO						
Iron	4,159.7	417.1	182.8	234.3	0	0
Aluminum	2,228.0	197.6	135.5	62.1	0	0
BVDM12.0 - Beaverdam Branch below River Road CSO						
Iron	3,213.3	541.1	306.8	234.3	0	0
Aluminum	2,407.2	187.7	125.6	62.1	189.1	50
BRHR1.0 - Brush Run above Jones Road CSO						
Iron	303.4	112.0	91.5	20.5	191.4	63
Aluminum	243.9	56.7	48.5	8.2	187.2	77
BRHR2.0 - Brush Run below Jones Road CSO						
Iron	355.5	145.1	123.7	21.4	19.0	12
Parameter (lbs/day)	**Existing Load (lbs/day)**	**TMDL Allowable Load (lbs/day)**	**WLA (lbs/day)**	**LA (lbs/day)**	**Load Reduction (lbs/day)**	**Percent Identified‡ (%)**
Aluminum	271.4	72.6	64.0	8.6	11.6	14

BVDM4.0 - Mouth of Beaverdam Branch						
Iron	5,675.1	682.0	447.7	234.3	2,110.5	76
Aluminum	2,895.4	308.8	246.7	62.1	385.7	56

ND = not detected
NA = not applicable, meets water quality standards, no TMDL necessary
‡ Percent reduction after upstream reductions are made
* Allocations from Beaverdam Branch AMD TMDL
** Allocations from Mill Run TMDL

A. Wasteload Allocations (WLAs)

The TMDL includes WLAs for two NPDES permittees, Altoona Water Treatment Plant and Altoona City Authority, as well as those portions of the Beaverdam Branch Watershed that are contained within a designated MS4 area. Small MS4s are now considered point sources under EPA's Phase II NPDES Stormwater Regulations and therefore are addressed by the WLA portion of the TMDL. A portion of the watershed falls within the City of Altoona MS4 area and receives runoff from stormwater pipes and overland flow. The metals WLAs assigned to these permittees are listed in Table 7 below.

Should the two facilities choose to expand their discharge, or should another facility apply for NPDES coverage within the watershed, the TMDL and allocations should be revisited prior to permit issuance. Federal regulations at 40 CFR 122.44(d)(1)(vii)(B) require that NPDES permit effluent limits to be consistent with the assumptions and requirements of the approved WLA. EPA interprets the absence of an individual WLA to mean zero discharge.

TABLE 7: WASTELOAD ALLOCATIONS OF PERMITTED DISCHARGES

Permittee	Station	Parameter	Allowable Average Monthly Concentration (mg/L)	Average Flow (MGD)	WLA (lbs/day)
Altoona Water Treatment Plant NPDES PA0082538	-	Fe	2.0	0.19	3.2
		Al	4.0	0.19	6.3
Altoona City Authority NPDES PA0085120	-	Fe	2.0	0.058	1.0
		Al	1.2	0.058	0.6
City of Altoona MS4	BVDM9.0	Fe	-	-	56.2
		Al	-	-	67.8
	BVDM10.0	Fe	-	-	150.0
		Al	-	-	140.7
City of Altoona MS4 – con't.	BVDM11.0	Fe	-	-	182.8
		Al	-	-	135.5
	BVDM12.0	Fe	-	-	306.8
		Al	-	-	125.6

Permittee	Station	Parameter	Allowable Average Monthly Concentration (mg/L)	Average Flow (MGD)	WLA (lbs/day)
	BRHR1.0	Fe	-	-	91.5
		Al	-	-	48.5
	BRHR2.0	Fe	-	-	123.7
		Al	-	-	64.0
	BVDM4.0	Fe	-	-	447.7
		Al	-	-	246.7

B. Load Allocations (LAs)

The TMDLs include LAs for nonpoint sources. According to Federal regulations, 40 CFR §130.2(g), LAs are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading.

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

The TMDLs were developed using instream data, which account for existing background conditions.

4. The TMDLs consider critical environmental conditions.

The reductions specified in these TMDLs apply at all flow conditions. A critical flow condition was not identified from the available data.

5. The TMDLs consider seasonal environmental variations.

The data set included data points from all seasons, thereby accounting for seasonal variation implicitly.

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 that the treated instream concentration variability was 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% of the time than if the variability of the treated discharge is reduced.

Additionally, calculations were performed using a daily average for iron rather than the 30-day average, thereby, incorporating a MOS.

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

EPA requires that there is reasonable assurance that TMDLs can be implemented. The *Recommendations* section of the TMDL Report highlights what can be done in the Beaverdam Branch Watershed to address metals impairments. As TMDLs represent an attempt to quantify the pollutant load that may be present in a waterbody and still ensure attainment and maintenance of water quality standards, the Beaverdam Branch Watershed TMDL identifies the necessary overall load reductions currently causing use impairments and distributes those reduction goals to the appropriate sources. There exist several programs that can be utilized to help implement the TMDLs.

For point sources, Federal regulations require effluent limitations for an NPDES permit to be consistent with the assumptions and requirements of any available WLA for the discharge prepared by the state and approved by EPA. Additionally, the MS4 within the Beaverdam Branch Watershed will be responsible for evaluating which portions of the total area are contributing to the storm sewers and which are actually nonpoint sources. In September 2002, Pennsylvania adopted a Comprehensive Stormwater Management Policy. Pennsylvania's program is constructed to integrate state requirements under Act 167 for stormwater management planning, Federal NPDES program, and voluntary financial incentives provided to communities and project sponsors.

With regard to load allocations for nonpoint sources, numerous state programs, such as CWA Section 319 and Pennsylvania's Growing Greener programs, are available. Reaching the reduction goals established by the TMDLs for nonpoint sources will mainly occur through best management practices (BMPs). BMPs that would be effective in lowering the amount of metals that flow into Beaverdam Branch include: riparian buffer strips, proper lawn care, bioretention areas, wetland complexes, and heavy use area protection, among many other urban BMPs. The TMDL Report also cites the Natural Resource Conservation Service's National Handbook of Conservation Practices, which provides information on a variety of BMPs. Determining the most appropriate BMPs, where they should be installed, and implementing them will require the development and implementation of a comprehensive watershed restoration plan. EPA agrees with PADEP that the reduction goals specified in this TMDL help to set the stage for local

citizens to design and implement watershed restoration plans to correct current use impairments.

The City of Altoona and surrounding townships have already been active in the watershed in securing Growing Greener Grants and other funding sources. This funding has been used to convert property to open space for increased filtration and has improved the stormwater runoff controls.

8. The TMDLs have been subject to public participation.

In the beginning stages of the Beaverdam Branch watershed TMDL, an early notification letter was sent to inform stakeholders and interested parties that a TMDL would be completed in their watershed and to offer them the opportunity to submit information for the TMDL development. PADEP considered all information submitted and all pertinent information was included in the final report.

Public notice of the draft TMDL was published in the *Pennsylvania Bulletin* on January 13, 2007, and *The Mirror* in February 2007, to foster public comment on the calculated allowable loads. A 45-day public comment period was provided to the public, and a public meeting was held during the evening of February 6, 2007, at the Holiday Inn Express in Altoona, Pennsylvania, to discuss the proposed TMDL.

Comments were received from the Altoona City Authority and City of Altoona, Department of Public Works. These comments were incorporated into the final TMDL Report as appropriate, and PADEP's responses are included as Attachment F of the TMDL Report.

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