UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
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Philadelphia, Pennsylvania 19103-2029

Decision Rationale
Total Maximum Daily Loads
Stump Creek Watershed
For Metals, pH and Sediment
Jefferson and Clearfield Counties, Pennsylvania

Signed

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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 submitted the *Stump Creek Watershed TMDL, Jefferson and Clearfield Counties For Acid Mine Drainage Affected Segments* (TMDL Report), dated March 1, 2007, to the U.S. Environmental Protection Agency (EPA) for final Agency review and was received on March 8, 2007. This report includes the TMDLs for metals (*i.e*., iron, aluminum, and manganese), pH and sediment, 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 1996, 1998, 2002, and 2004 Section 303(d) listing information for the impaired segment first listed in 1996.[1]

TABLE 1. SECTION 303(D) LISTINGS FOR STUMP CREEK, PENNSYLVANIA

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[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.*

State Water Plan (SWP) subbasin: 17-D Stump Creek						
303(d) List	**Segment ID, Assessment ID**	**Stream Code**	**Stream Name**	**Source**	**Cause**	**Listing Date**
1996		47922	Stump Creek	RE	Metals, Other Inorganics, Suspended Solids	1996
1998	5291	47922	Stump Creek	AMD	Metals, Other Inorganics	1996
	5292	47922	Stump Creek	AMD	Metals	1996
	7215	47922	Stump Creek	AMD	Metals	1996
2002	5291	47922	Stump Creek	AMD	Metals, Other Inorganics	1996
	5292	47922	Stump Creek	AMD	Metals, Suspended Solids	1996
	7215	47922	Stump Creek	AMD	Metals	1996
	981013-1315-DSB	47952	Sugarcamp Run	AMD	Metals	2002
2004	5291	47922	Stump Creek	AMD	Metals, Other Inorganics, Suspended Solids	1996
	5292	47922	Stump Creek	AMD	Metals, Other Inorganics, Suspended Solids	1996
	7215	47922	Stump Creek	AMD	Metals, Other Inorganics, Suspended Solids	1996
	981013-1315-DSB	47952	Sugarcamp Run	AMD	Metals	2002

RE = Resource Extraction

See Attachment I 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.

Pennsylvania's 1996 Section 303(d) list also included "other inorganics" (i.e., sulfates) as a cause of impairment for this waterbody. However, PADEP has since requested the delisting of 1996 "other inorganics" impairment listings as part of Pennsylvania's 2006 Integrated Report submittal, since the original 1996 listings were based on a presumed sulfate impairment. The 2006 Section 303(d) list of impaired waters will be addressed in a separate document. As PADEP continues to reassess its waters and finds that an other inorganics/sulfates impairment does actually exist, these waters must return to the Section 303(d) list and would then require a TMDL.

The metals and pH 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 identifies the metals and pH TMDLs for the Stump Creek Watershed. PADEP treats each segment on the Section 303(d) list as a separate TMDL and expresses each metals and pH TMDL as a long-term average loading. The sediment TMDL was developed using a Reference Watershed Approach to meet Pennsylvania's narrative criteria at Pennsylvania Code Title 25, Chapter 93, Section 93.6a. Page 24 of the TMDL Report identifies the sediment TMDL for the Stump Creek Watershed. (See Attachments C and D of 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:

$$\text{TMDL} = \sum \text{WLAs} + \sum \text{LAs} + \text{MOS}$$

The TMDL is a written plan and analysis established to ensure that a waterbody will attain and maintain 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.

Stump Creek and Sugarcamp Run were identified on the 1996 Section 303(d) list of impaired waters and count 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 Stump Creek Watershed is 28.3 square miles in area and is located in Jefferson and Clearfield Counties, Pennsylvania. Stump Creek flows about 9 miles in a westerly direction from its headwaters to the town of Sykesville, where it then flows approximately 8 miles south until it converges with the East Branch Mahoning Creek. Major tributaries to Stump Creek include Limestone Run, Sugarcamp Run, and Poose Run. Land uses within the watershed include abandoned mine lands, forestlands, agricultural and some developed lands.

Stump Creek has been degraded by AMD originating from abandoned coal mines, as extensive coal mining began since the early 1800s and continued until the late 1900s. The TMDL Report provides detail on the various deep and surface mines that have operated within the watershed. Deep mine entries, refuse piles, subsidence and pooling areas, altered landscapes that were not reclaimed, and acid bearing overburden exposure to air and water have remained in the watershed as a result of past mining operations. PADEP notes that the suspended solids/siltation impairment in the Stump Creek Watershed is due to runoff from un-reclaimed abandoned mine lands, and large refuse piles from historic mining. The overwhelming majority of the sediment contribution comes from abandoned mine lands, croplands, and transitional lands. These sources have led to the pollution and degradation that the watershed currently experiences.

The TMDL Report also describes the various AMD abatement and inventory studies that have occurred in the area, and the several grants that have been awarded to the local conservation district and watershed association for AMD remediation efforts. These efforts include treatment alternatives for the Sugarcamp Run discharge and a feasibility study to investigate using the Sugarcamp Run deep mine discharge for a municipal water supply.

There is currently one active small noncoal (industrial minerals) surface mining permit issued in the Jefferson County portion of the Stump Creek Watershed and an active reclamation project in Clearfield County. There are also two active coal mining National Pollutant Discharge Elimination System (NPDES) permits within the watershed. The permitted discharges from these three NPDES-permitted operations are assigned WLAs, and all remaining discharges in the watershed result from abandoned mines and are treated as nonpoint sources.

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, protect public health and safety from the adverse effects of current surface coal mining operations, and promote the reclamation of mined areas left without adequate reclamation prior to August 3, 1977. SMCRA requires a surface mining 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.

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: (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 Stump Creek and Sugarcamp Run as Cold Water Fishery (CWF).

Metals and pH

To protect the designated use as well as the existing use, the water quality criteria shown in Table 2 apply to the waterbody for the metals and pH TMDL. The table includes the instream numeric criterion for the metals parameters 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
Manganese (Mn)	1.00	Maximum	Total Recoverable
pH	6.0 - 9.0	Inclusive	N/A

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 the metals and pH parameters 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.

The pH values shown in Table 2 were used as the 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, and these values can be 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 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 has been using an alternate 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 addressing 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 but not identical to 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 do not always include upstream waters not impacted by AMD. As PADEP does not list waters for inadequate alkalinity, TMDLs are not being developed for alkalinity.

Computational Procedure

The metals and pH 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[2], 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

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

sinks are located spatially in the watershed. A critical flow was not identified, and the reductions specified in the metals TMDLs apply at all flow conditions.

Sediments

Pennsylvania does not currently have specific numeric water quality criteria for sediments. Therefore, Pennsylvania utilized its narrative water quality criteria, which states that "water may not contain substances attributable to point or nonpoint source waste discharges in concentrations or amounts sufficient to be inimical or harmful to the water uses to be protected or to human, animal, plant, or aquatic life"[3], to establish endpoints for sediment such that the designated uses of the Stump Creek Watershed are attained and maintained.

In order to numerically express this endpoint consistent with the general water quality criteria, PADEP uses a Reference Watershed Approach in combination with the AVGWLF[4] watershed loading model. The reference watershed is representative of the conditions required for the impaired watershed to meet its designated uses. This representative condition is analyzed to determine an appropriate level of nutrient and sediment loading to the waterbody. The Reference Watershed Approach consists of comparing the biologically-impaired watershed with a reference watershed that is meeting its designated uses for aquatic life to determine an appropriate level of nutrient and sediment loading to the waterbody. This approach is based on comparing the impaired watershed to one with similar designated uses, geology, landuses, physiographic province, land area, soils, and meteorological patterns. The AVGWLF model provides a powerful and accurate means of estimating the dissolved and total nutrient loadings to a stream from the watershed with added GIS capabilities. The model provides monthly streamflow, soil erosion, and sediment yield values and includes both surface runoff and groundwater sources, as well as nutrient loads from point sources and onsite wastewater disposal (septic) systems[5]. Calibration of this model is not required; however, it has been applied and validated to an 85,000-hectare watershed in upstate New York. The rationale of this method is that achieving sediment loadings in the impaired sub-watershed similar to those loadings of the reference watershed will ensure that the impaired watershed will attain and maintain its designated uses and general water quality criteria.

Beaverdam Run was used as the reference watershed for comparison with the impaired Stump Creek to develop the sediment TMDL. The Beaverdam Run Watershed is located in northeastern Jefferson County and does not currently have a sediment problem.

Using the continuous simulation AVGWLF model, PADEP modeled the sediment load

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[3] Pennsylvania Code, Title 25, Environmental Protection, Chapter 93. Water Quality Standards, Section 93.6(a).

[4] Arcview Generalized Watershed Loading Function model, the Environmental Resources Research Institute of Pennsylvania State University's Arcview based version of the GWLF model developed by Cornell.

[5] Haith, D.A., R. Mandel and R.S. Wu, Generalized Watershed Loading Functions, Version 2.0, Cornell University, Dec. 15, 1992

originating from the reference watershed. As previously mentioned, AVGWLF has the ability to estimate dissolved and total monthly nutrient loads to streams from watersheds including surface runoff, groundwater sources, point sources, septic systems, monthly streamflow, soil erosion, and sediment yield values. In order to make these estimates, AVGWLF requires daily precipitation and temperature data, runoff sources and transport and chemical parameters. The AVGWLF model is a combined distributed/lumped parameter watershed model. In terms of surface loading, this means that the model allows the user to distribute multiple landuse/cover scenarios in the watershed. However, the loads originating from the watershed are lumped, and spatial routing of nutrient and sediment loads is not available. In terms of subsurface loading, the load contributions from subsurface areas are not distinct and are considered lumped using a water balance approach. The AVGWLF model relies on the Soil Conservation Service Curve Number (SCS-CN) to estimate surface runoff and the Universal Soil Loss Equation (USLE) to estimate erosion and sediment yield. Monthly estimates of nutrient and sediment loadings, applicable to each watershed, are generated by using watershed-specific local daily weather inputs and USLE factors[6]. The following average existing load values for sediment, identified in Table 3, were determined for the reference watershed and the Stump Creek Watershed using watershed-specific data.

TABLE 3. EXISTING SEDIMENT LOADING VALUES FOR THE IMPAIRED AND REFERENCE WATERSHEDS

Watershed	Area (Acres)	Mean Annual Sediment Load (lbs/yr)	Unit Area Sediment Loading Rate (lbs/acre/yr)
Stump Creek	17,715	23,463,338	1,324
Beaverdam Run	17,404	10,922,944	628

The final step in the process is to determine the appropriate pollutant loading for the watershed. For the Stump Creek Watershed, the values generated for sediment loadings were based on those found in the reference Beaverdam Run Watershed. In the process of determining the sediment loadings in the reference watersheds, a unit area-loading coefficient for the parameter of concern was calculated. That area-loading coefficient was then applied to the impaired watershed to determine the allowable (TMDL) sediment loadings. EPA finds this application reasonable to implement the applicable water quality standards.

Table 4 below illustrates the sediment TMDL calculations. The target TMDL values are determined by multiplying the unit area loading value of the reference watershed by the total area in acreage of the impaired watershed.

[6] Local daily weather inputs include temperature and precipitation. The USLE factors are KLSCP; K=changes in soil loss erosion, LS=length slope factor, C=vegetation cover factor, P=conservation practices factor.

TABLE 4. SEDIMENT TMDL CALCULATIONS FOR STUMP CREEK

Parameter	Unit area loading rate in Reference Watershed (lbs/acre/yr)	Total area of impaired watershed (acres)	TMDL Value (lbs/yr)
Sediment	628	17,715	11,118,323

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.

For purposes of these TMDLs only, point sources are identified as permitted discharge points or discharges having responsible parties, and nonpoint sources are identified as any pollution sources that are not point sources. Abandoned mine lands were treated in the allocations as nonpoint sources. As such, the discharges associated with these land uses were assigned LAs (as opposed to WLAs). The decision to assign LAs to abandoned mine lands does not reflect any determination by EPA as to whether there are unpermitted point source discharges within these land uses. 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.

To determine the WLAs for the NPDES permitted pit water treatment ponds, PADEP first calculated a total average flow for the water draining to the pit using average annual precipitation, the area of the pit, and a runoff factor. The WLAs were then calculated using this value and the BAT treatment pond effluent limits and were included in the mass balance along with the LAs.

Metals and pH

Once PADEP determined the allowable concentration and load for each metal pollutant and pH, 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 5 presents a summary of the allowable loads, LAs, and WLAs for metals and pH for the Stump Creek Watershed.

TABLE 5. METALS TMDL COMPONENT SUMMARY FOR THE STUMP CREEK 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* (%)
SC03 – Stump Creek headwaters						
Aluminum	ND	NA	0	NA	NA	NA
Iron	ND	NA	0	NA	NA	NA
Manganese	ND	NA	0	NA	NA	NA
Acidity	ND	NA	0	NA	NA	NA
SC04 – Unnamed Tributary 47973 of Stump Creek						
Aluminum	ND	NA	0	NA	NA	NA
Iron	ND	NA	0	NA	NA	NA
Manganese	ND	NA	0	NA	NA	NA
Acidity	4.02	4.02	0	NA	NA	NA
SC05 – Unnamed Tributary 47972 of Stump Creek						
Aluminum	ND	NA	0	NA	NA	NA
Iron	ND	NA	0	NA	NA	NA
Manganese	0.42	0.42	0	NA	NA	NA
Acidity	ND	NA	0	NA	NA	NA
SC02 – Unnamed Tributary 47971 of Stump Creek						
Aluminum	ND	NA	0	NA	NA	NA
Iron	ND	NA	0	NA	NA	NA
Manganese	1.44	1.44	0	NA	NA	NA
Acidity	82.07	54.04	0	54.04	28.03	34%
Stump Creek near Helvetia						
Aluminum	ND	NA	1.4	NA	NA	NA
Iron	14.04	14.04	2.2	NA	NA	NA
Manganese	16.59	15.84	1.4	14.44	0.75	5%
Acidity	353.39	276.60	0	276.60	48.76	15%
Stump Creek above confluence with Sugarcamp Run						
Aluminum	ND	NA	0	NA	NA	NA
Iron	104.68	103.05	0	103.05	1.63	2%
Manganese	28.16	28.16	0	NA	NA	NA
Acidity	ND	NA	0	NA	NA	NA
SR1 – Mouth of Sugarcamp Run						
Aluminum	44.96	9.84	0	9.84	35.12	78%
Iron	478.17	18.99	0	18.99	459.18	96%
Manganese	17.13	13.02	0	13.02	4.11	24%
Acidity	861.50	744.86	0	744.86	116.64	14%
SC11 – Stump Creek above S Park Street Bridge						
Aluminum	137.90	59.66	0	59.66	43.12	42%
Iron	1,389.92	125.36	0	125.36	700.70	85%
Manganese	67.65	67.65	0	NA	NA	NA
Acidity	1,544.05	1,308.36	0	1,308.36	119.05	8%

Parameter (lbs/day)	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	Load Reduction (lbs/day)	Percent Identified* (%)
BRD2 – Mine discharge into Buck Run under foundation						
Aluminum	ND	NA	0	NA	NA	NA
Iron	35.63	4.74	0	4.74	30.89	87%
Manganese	1.77	1.77	0	NA	NA	NA
Acidity	ND	NA	0	NA	NA	NA
BRD1 – Mine discharge into Buck Run						
Aluminum	ND	NA	0	NA	NA	NA
Iron	20.31	3.61	0	3.61	16.70	82%
Manganese	1.03	1.03	0	NA	NA	NA
Acidity	ND	NA	0	NA	NA	NA
BR1 – Buck Run at Mouth						
Aluminum	ND	NA	0	NA	NA	NA
Iron	12.43	12.43	0	NA	NA	NA
Manganese	1.19	1.19	0	NA	NA	NA
Acidity	ND	NA	0	NA	NA	NA
PRD1 – Mine Discharge to Poose Run						
Aluminum	9.03	2.04	0	2.04	6.99	77%
Iron	63.38	6.99	0	6.99	56.39	89%
Manganese	7.27	7.27	0	NA	NA	NA
Acidity	ND	NA	0	NA	NA	NA
PR1 – Poose Run below discharge						
Aluminum	10.80	3.88	0	3.88	0	0%*
Iron	77.69	16.13	0	16.13	5.17	24%
Manganese	8.68	8.68	0	NA	NA	NA
Acidity	98.91	98.91	0	NA	NA	NA
SC08 – Stump Creek upstream of Tributary 47940						
Aluminum	ND	NA	0	NA	NA	NA
Iron	963.22	211.82	0	211.82	0	0%*
Manganese	94.68	94.68	0	NA	NA	NA
Acidity	ND	NA	0	NA	NA	NA
SC07 – Stump Creek below SR 2008 Bridge						
Aluminum	71.58	34.07	0	34.07	37.51	52%
Iron	852.64	177.79	0	177.79	9.71	5%
Manganese	90.95	90.95	0	NA	NA	NA
Acidity	2,905.35	1704.73	0	1,704.73	1,200.62	41%
UNT11 – Unnamed Tributary 47939 to Stump Creek						
Aluminum	ND	NA	0	NA	NA	NA
Iron	1.28	0.96	0	0.96	0.32	25%
Manganese	0.97	0.97	0	NA	NA	NA
Acidity	ND	NA	0	NA	NA	NA
UNT12 – Unnamed Tributary 47938 to Stump Creek						
Aluminum	ND	NA	0	NA	NA	NA
Iron	ND	NA	0	NA	NA	NA
Manganese	ND	NA	0	NA	NA	NA
Acidity	ND	NA	0	NA	NA	NA
UNT9 – Unnamed Tributary 47936 to Stump Creek						

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	ND	NA	0	NA	NA	NA
Iron	14.58	5.61	0	5.61	8.97	62%
Manganese	4.99	2.87	0	2.87	2.12	42%
Acidity	ND	NA	0	NA	NA	NA
SC01 – Mouth of Stump Creek						
Aluminum	ND	NA	0	NA	NA	NA
Iron	425.21	176.57	0.29	176.28	0	0%*
Manganese	95.25	95.25	0	NA	NA	NA
Acidity	ND	NA	0	NA	NA	NA

ND = not detected
NA = not applicable, meets water quality standards, no TMDL necessary
* Percent reduction after upstream reductions are made

Sediment

Table 6 summarizes the elements of the TMDL for sediment as determined by PADEP using the Reference Watershed Approach and the AVGWLF model.

TABLE 6. SEDIMENT TMDL COMPONENT SUMMARY FOR THE STUMP CREEK WATERSHED

Mean Annual Existing Load (lbs/yr)	WLA (lbs/yr)	LA (lbs/yr)	MOS (lbs/yr)	TMDL (lbs/yr)	TMDL (lbs/day)
23,463,338	920	10,005,571	1,111,832	11,118,323	30,461

A. Wasteload Allocations (WLAs)

Pennsylvania indicates that there are three NPDES point sources within the watershed, two coal mining operations and one non-coal operation. Allegheny Enterprises, Inc., Helvetia #2 Operations (PA0256374) and Bloom Operation (PA0256471) are currently permitted mining operations in the Stump Creek Watershed. These operations have iron, manganese, and aluminum parameters included in their permits. Dominion Transmission, Inc. (PA0101656) discharges treated wastewater into the watershed and is assigned WLAs for iron and total suspended solids. There is also one active reclamation project within the watershed, although there is no NPDES permit for this site. This project, Rob Holland Enterprises' Helvetian #1 Operation (GFCC 17-04-09), is located at an old coal tipple near Helvetia. The reclamation of this site will help to reduce sediment entering Stump Creek and eliminate the ponding of water on the coal refuse.

It is appropriate to note that WLAs for the two mining operations mentioned above were calculated using flows calculated using PADEP's method to quantify treatment pond pollutant loads multiplied by the permitted BAT limits, as described in the TMDL Report. Typically, surface mining operations include an open pit where overburden material has been removed to access the underlying coal, and this pit can accumulate water primarily through direct precipitation and surface runoff. The pit water is pumped to a nearby treatment pond where it is treated to the level necessary to meet effluent limitations. However, precipitation events allow intermittent discharges from the treatment pond. If accurate flow data are available for a treatment pond, they can be used to quantify the WLA by multiplying the flow by the best available technology (BAT) effluent limitations for treatment ponds. However, these flow data are typically not available. Alternatively, PADEP calculated a total average flow for the water draining to the pit using average annual precipitation, the area of the pit, and a runoff factor. Utilizing this value and BAT treatment pond effluent limits, the WLAs were determined.

Where there are active operations, Federal regulations require that point source permitted effluent limitations be water quality-based subsequent to TMDL development and approval.[7] In addition, PA Title 25, Chapter 96, Section 96.4d requires that WLAs serve as the basis for determination of permit limits for point source discharges regulated under Chapter 92 (relating to NPDES permitting, monitoring, and compliance). EPA interprets the absence of an individual WLA to mean zero discharge. Therefore, no new mining discharge may be permitted within the watershed without reallocation of the TMDL. No required reductions of permit limits are necessary at this time, as all necessary reductions have been assigned to nonpoint sources. See Table 7 for permittees and applicable WLAs.

TABLE 7: WASTELOAD ALLOCATIONS OF PERMITTED DISCHARGES

Permittee	Parameter	Allowable Average Monthly Concentration (mg/L)	Average Flow (MGD)	WLA (lbs/day)
Allegheny Enterprises, Inc., Helvetia #2 Operations NPDES PA0256374	Al	2	0.0445	0.743
	Fe	3	0.0445	1.114
	Mn	2	0.0445	0.743
Bloom Operation NPDES PA0256471	Al	2	0.0445	0.743
	Fe	3	0.0445	1.114
	Mn	2	0.0445	0.743
Dominion Transmission, Inc. NPDES PA0101656	TSS	30	0.01008	2.52 or 920 lbs/yr
	Fe	3.5	0.01008	0.29

[7]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.

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. The AVGWLF process enables the total sediment LA to be distributed to sources based on landuse type.

As discussed earlier, LAs for sediment were determined by multiplying the unit area-loading rate of the reference watershed by the total area of interest in Stump Creek Watershed. The determination of how LAs are distributed is at the discretion of PADEP. To determine the distribution of the sediment LAs between contributing land based sources, PADEP uses a method called the Equal Marginal Percent Reduction (EMPR)[8]. This method equitably assigns the greater reduction requirements to the largest contributing source. The EMPR method assigns equal percent reductions to all baseline loads after adjusting any landuse loads that individually exceed the total load allocation. This process is established on a site-specific basis and considers several factors regarding ability to affect the pollutant loading processes. Table 8 shows the load allocations of sediment for Stump Creek. Existing sediment loads to this watershed were determined by PADEP utilizing a simple landuse area/loading coefficient methods where the loadings were computed based on landuse type and watershed loading values taken from the AVGWLF model. See Attachment G of the TMDL Report regarding the EMPR and calculations.

TABLE 8. SEDIMENT LAS FOR THE STUMP CREEK WATERSHED

Landuse	Existing Load (lbs/yr)	Allocated Load (LA) (lbs/yr)	Percent Reduction
Coal Mine	8,800	4,370	50
Cropland	12,751,000	2,781,910	78
Transitional	6,230,600	2,781,910	55
Quarry	68,800	34,163	50
Hay/Pasture	553,800	553,800	0
Forest	94,600	94,600	0
Unpaved Roads	129,600	129,600	0
Low Intensity Development	110,400	110,400	0
High Intensity Development	200	200	0

[8] Pennsylvania Department of Environmental Protection. June 1986. Implementation Guidance for the Water Quality Analysis Model 6.3. Document 391-2000-007.

Landuse	Existing Load (lbs/yr)	Allocated Load (LA) (lbs/yr)	Percent Reduction
Streambank	3,515,538	3,515,538	0

EPA finds that PADEP appropriately applied the EMPR method for sediment in the Stump Creek TMDL. While it is not necessary to specifically approve an allocation method, EPA believes that the EMPR method used by PADEP is acceptable because it supports three main objectives: (1) to assure compliance with the applicable water quality standard; (2) to minimize the overall cost of compliance, and; (3) to provide maximum equity among competing sources.

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

The metals and pH TMDLs were developed using instream data, which account for existing background conditions, and there are two separate considerations of background pollutants within the context of the sediment TMDL. First, there is the inherent assumption of the Reference Watershed Approach that, because of the similarities between the reference and impaired watersheds, the background pollutant contributions will be similar. Therefore, the background pollutant contributions will be considered when determining the loads for the impaired watershed, which are consistent with the loads from the reference watershed. Secondly, the AVGWLF model implicitly considers background pollutant contributions through the soil and groundwater component of the model process.

4. The TMDLs consider critical environmental conditions.

The reductions specified in the metals and pH TMDLs apply at all flow conditions. A critical flow condition for the metals impairment was not identified from the available data. Within the context of the Reference Watershed Approach used to develop the sediment TMDL, the assumption is that the reference watershed is achieving its designated use even during critical environmental conditions. Thus, achieving sediment loadings in the impaired watershed consistent with that of the reference watershed will effectively consider critical conditions. To account for different flow conditions, the AVGWLF model uses daily average temperature, daily time step and total precipitation values for each year simulated. PADEP modeled each watershed for a period of 23 years to develop the existing loading values for each watershed. The length of the model time period will also effectively consider critical environmental conditions. EPA finds that Pennsylvania adequately considered critical conditions in the TMDL analysis of Stump Creek.

5. The TMDLs consider seasonal environmental variations.

The metals and pH data set included data points from all seasons, thereby accounting for seasonal variation implicitly. For the sediment TMDL, the AVGWLF watershed modeling analysis was run over a 23-year period and appropriately considers seasonal environmental variations. As discussed in Section 4 above, the 23-year simulation period of the model appropriately considers seasonal variations in precipitation and temperature conditions. The model considers seasonal changes requiring specifications of the growing season, hours of daylight for each month, the months in which manure is applied to the land and by using daily time steps for weather data and water balance calculations. EPA finds that both the AVGWLF model and the assumptions of the Reference Watershed Approach effectively consider seasonal environmental variations.

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. EPA finds both the implicit MOS for metals and explicit MOS for sediment acceptable.

For the metals and pH TMDLs, 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.

For the sediment TMDL, PADEP reserved 10% of the TMDL value as the MOS to account for uncertainty in the data and computational methodology used in the analysis. Table 6 above indicates the actual value of the 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 Stump Creek Watershed to eliminate or treat pollutant sources. 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 Stump Creek TMDL identifies the necessary overall load reductions and distributes those reduction goals to the appropriate sources.

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. Aside from PADEP's primary efforts to improve water quality in the Stump Creek Watershed through reclamation of abandoned mine lands and through the NPDES permit program, additional opportunities for reasonable assurance exist. PADEP expects that activities such as research conducted by its Bureau of Abandoned Mine

Reclamation, funding from EPA's § 319 grant program, and Pennsylvania's Growing Greener program will 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.

The active reclamation project within the watershed, the Rob Holland Enterprises', Helvetian #1 Operation, will remove 42,300 tons of coal refuse and will reclaim 3.5 acres of abandoned mine land near the headwaters of Stump Creek. Reclamation of this site began in August 2006 and is to be completed by 2009. The reclamation of this site will help to reduce sediment entering Stump Creek and eliminate the ponding of water on the coal refuse.

To date, the Jefferson County Conservation District and the Upper Mahoning Creek Watershed Association have received Growing Greener grants for various projects within the watershed. These include the development of priorities for AMD remediation projects, and a feasibility study to investigate using the Sugarcamp Run deep mine discharge for a municipal water supply for the Sykesville Borough. The Jefferson County Conservation District and the Upper Mahoning Creek Watershed Association will continue to pursue AMD reclamation and remediation projects in the Stump Creek Watershed.

8. The TMDLs have been subject to public participation.

Public notice of the draft TMDL was published in the *Pennsylvania Bulletin* and *The Progress* on January 24 and 31, 2007, to foster public comment on the calculated allowable loads. A public comment period was provided to the public, and a public meeting was held on February 7, 2007, at the Moshannon District Mining Office, Pennsylvania, to discuss the proposed TMDL.

Comments were received from Dominion Transmission, Inc. These comments were incorporated into the final TMDL Report as appropriate, and PADEP's responses are included as Attachment K 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/.