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

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Water Protection Division

Date: _____

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I. Introduction

The Clean Water Act (CWA) requires a Total Maximum Daily Load (TMDL) be developed for those water bodies 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 water body without violating water quality standards..

The Pennsylvania Department of the Environmental Protection (PADEP), Bureau of Watershed Conservation, submitted the *Laurel Run Watershed Total TMDL*, dated December 10, 2002 (TMDL Report), to EPA for final Agency review on March 10, 2003. This report included Total Maximum Daily Loads (TMDLs) for three metals, aluminum, iron, and manganese and addresses one segment on Pennsylvania's 1996 Section 303(d) list of impaired waters, Laurel Run.

EPA's rationale is based on the TMDL Report and information contained in the Appendices 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 waste load allocations and load allocations.
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.
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 and 1998 Section 303(d) listing information for the one water quality limited segment.

Table 1. 303(d) Sub-List

State Water Plan (SWP) Subbasin: 17-E Crooked Creek

Year	Miles	Segment ID	DEP Stream Code	Stream Name	Designated Use	Data Source	Source	EPA 305(b) Cause Code
1996	2.7	4787	38491	LaurelRun	CWF	305(b) Report	RE	Metals & Other Inorganics
1998	2.59	4787	38491	LaurelRun	CWF	SWMP	AMD	Metals & Other Inorganics
2000	1.41	980714-0850-ATP	38491	LaurelRun	CWF	SWMP	AMD	Metals & suspended solids
2002	No additional assessment							

Resource Extraction=RE
Warm Water Fishes=WWF
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 Title 25 Chapter 93.

The TMDLs were developed using a statistical procedure to ensure that water quality standards are met 99 percent of the time as required by Pennsylvania's water quality standards Pennsylvania Title 25, Chapter 93.5(b). Table 2 summarizes the TMDLs for Laurel Run as determined by PADEP.

Table 2 - TMDL Summary

Segment	Parameter	TMDL (lbs/day)	WLA[1] (lbs/day)	LA[2] (lbs/day)	MOS[3] (lbs/day)
134	Al	0.6	0	0.6	implicit
	Fe	1.4	0	1.4	implicit
	Mn	0.3	0	0.3	implicit
	Acidity	61.9	0	61.9	implicit
133	Al	0.6	0	0.6	implicit
	Fe	1.0	0	1.0	implicit
	Mn	0.2	0	0.2	implicit
	Acidity	1.2	0	1.2	implicit
132	Al	6.8	0	6.8	implicit
	Fe	10.4	0	10.4	implicit
	Mn	5.6	0	5.6	implicit
	Acidity	186.3	0	186.3	implicit
131	Al	6.4	0	6.4	implicit
	Fe	11.9	0	11.9	implicit
	Mn	10.9	0	10.9	implicit
	Acidity	136.6	0	136.6	implicit

[1] WLA = Waste Load Allocation, [2] LA = Load Allocation
[3] MOS = Margin of Safety

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 "margin of safety" 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 re-submittal to EPA for approval. The unassessed waters protocol, a method of conducting biological assessments of Pennsylvania's waters, was developed in 1996 and began implementation 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 re-assess 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

Laurel Run is a relatively small watershed, totaling approximately 5.2 miles of stream in the Youghiogheny River watershed. The Laurel Run watershed lies on the eastern flank of Laurel Ridge, which rises to more than 2850 feet, immediately south of headwaters of the stream. The Laurel Run watershed is primarily wooded with moderate to steep slopes and is sparsely populated. The upper two-thirds of the stream trends east-southeast to west north-west where it then turns abruptly due north for the remainder of its flow path. Laurel Run then becomes a tributary to Meadow Run, to the Youghiogheny River.

Mining activities have been confined to the lower third of the watershed, on the eastern side of the stream. Surface mining occurred primarily on the Lower Kittanning underclay, and Lower Kittanning Coal on two sites; Harbison-Walker Refractories, MDP 2969BSM24A, Smith Mine (120+ acres) to the north and Kaiser Aluminum, MDP 2966BMS50, Potato Ridge Site (143 + acres) to the south (located on map in attachment A). Active mineral removal on both sites was completed over several decades ago; both sites have been regarded and revegetated with grasses, legumes, and/or evergreens, although the Harbison-Walker site contains several steep unvegetated outslopes. Chemically, the spoil material at both sites is predominately acidic; the bedrock in unmined areas of the watershed is primarily neutral to acidic.

There are no active mining operations in the watershed. Discharges in the watershed from abandoned mines will be treated as non-point sources. There are also two permitted discharges for iron and manganese. The distinction between non-point and point sources in this case is determined on the basis of whether or not there is a responsible party subject to a National Discharge Pollutant Elimination System (NPDES) permit for the discharge. Where there is no responsible party the discharge is considered to be a non-point source. Each segment on the Section 303(d) list will be addressed as a separate TMDL. The TMDL are expressed as long-term averages. See 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 pubic 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.

PADEP promotes re-mining as method of reclaiming abandoned mine lands and limit liability for pre-existing discharges. The portion of Pennsylvania’s mining regulations regarding pre-existing discharges were not promulgated pursuant to the Clean Water Act and may be included in the load allocation. Should re-mining operations increase pollutant concentrations in a pre-existing discharge, the operator is responsible for the increased pollution only.

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 standards are met 99 percent of the time as required by Pennsylvania’s water quality standards.

Within the Morris Run watershed, data sets ranged from a low of nine data points to a high of 29 for Morris Run south of East Mine Discharge to its mouth. Between June 2000 and March 2001 four data points were obtained in Huskins Run Watershed for each sampling point.

Evaluation of the Morris Run south of East Mine Discharge data set disclosed no correlation between concentrations and flow. Analyses of the data could not determine a critical flow. PADEP felt that the available data for the streams in this watershed did not have enough paired flow/parameter data to calculate correlations. Although no analysis for correlations between flow and concentration was performed, such an analysis almost always produces little or no correlation and discloses no critical condition.

TMDLs for each parameter were determined using a Monte Carlo simulation, @RISK[1]. For each source and pollutant, it was assumed that the observed data are log-normally 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.

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

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 water body. 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. All of the stream segments evaluated in the Laurel Run Watershed have been designated by Pennsylvania as protecting the aquatic life uses. The designations for these stream segments can be found at Pennsylvania Title 25 § 93.9letter. 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
Sulfate (SO_4)	**250***	**Maximum**	**N/A**

***Applicable at potable water supply**

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 load allocations 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 log-normally 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 because on all monitoring data expressed as total recoverable.

The pH values shown in Table 3 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 ***Laurel Run*** *Watershed TMDL* report, Attachment **B**. A summary of the methodology is presented by 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 standards statistics. Additionally, pH does not measure latent acidity that can be produced from hydrolysis of metals. For these reasons, PADEP is using the following approach to address the stream impairments noted on the Section 303(d) list due to pH. The concentration of acidity in a stream is partially dependent upon metals. For this reason, it is extremely difficult to predict the exact pH values which would result from treatment of acid mine drainage. Therefore, net alkalinity will be used to evaluate pH in these TMDL calculations. This methodology assures that the standard for pH will be met because net alkalinity is able to measure the reduction of acidity. When acidity in a stream is neutralized or is restored to natural levels, pH will be acceptable ($\geq$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 is related to but not identical to pH, of minimum 20 mg/l calcium carbonate except were natural conditions are less. Alkalinity is a measure of the buffering capacity of the water. Adequate buffering prevents large swings in pH with additions of small amount of acid. Although many of the AMD-impacted streams are naturally low in alkalinity, available monitoring data does not always include upstream waters un-impacted by AMD. PADEP's pH calculations are modified to use net alkalinity instead of total alkalinity. 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 20mg/l or natural conditions, PADEP should list the waters for alkalinity and develop TMDLs.

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. Routine monitoring for AMD-impacted waters includes sulfates. Where sulfate concentrations exceed 250 mg/l, this TMDL makes the demonstration that no potable water supply withdrawal points are affected.

2. *The TMDLs include a total allowable load as well as individual waste load allocations and load allocations.*

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 tunnel discharges, seeps (although none were specifically identified), and surface runoff. Abandoned and reclaimed mine lands and bond forfeiture mines 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 land uses were assigned load allocations (as opposed to wasteload allocations). The decision to assign load allocations to abandoned and reclaimed 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 load allocations, EPA is not determining that these discharges are exempt from NPDES permitting requirements. Waste load allocations were assigned to the two permitted discharges of iron and manganese in the watershed. Aluminum and acidity are not included in the permit so no waste load allocation is assigned for these parameters. The waste load allocations are based on measured flow data and the permit limits, which are Best Available Technology (BAT) limits. No required reduction of these permits is necessary at this time because there are non-point contributions upstream of Sample Point 132 and downstream of Sampling Points 133 and 134 that when reduced will satisfy the TMDL. All necessary reductions are assigned to the nonpoint sources. Table 4 contains the waste load allocations for the two permitted discharges, 11 and 2M. Flow data for these discharges is located in Appendix F.

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 Laurel Run itself will achieve water quality standards. PADEP performed a Monte Carlo simulation on Laurel Run to determine the allowable load for each parameter that would meet water quality standards 99 percent of the time. Then, the allowable loads for Laurel Run and its unnamed tributary were summed. This load was compared to the calculated allowable load for Laurel Run. If this load was less than the calculated load for Laurel Run, a reduction was identified for Laurel Run, in addition to the reductions necessary in the unnamed tributary. Table 3 presents a summary of the allowable loads for the Morris Run watershed. Note the reduction identified for Laurel Run is the reduction necessary after upstream reductions have been made.

Table 3 - Summary Table for Laurel Run Watershed

Station	Parameter	Measured Sample Data		Allowable		Reduction Identified %
		Conc (mg/L)	load (lbs/day)	LTA Conc (mg/L)	load (lbs/day)	
134						
	Al	0.04	0.6	0.04	0.6	0
	Fe	0.10	1.4	0.10	1.4	0
	Mn	0.02	0.3	0.02	0.3	0
	Acidity	4.50	61.9	4.50	61.9	0
	Alkalinity	33.37	459.2			
133						
	Al	0.44	1.3	0.20	0.6	53
	Fe	0.40	1.2	0.32	1.0	20
	Mn	0.08	0.2	0.08	0.2	0
	Acidity	4.44	13.3	0.40	1.2	91
	Alkalinity	1.30	3.9			
132						
	Al	0.34	6.8	0.34	6.8	0

Station	Parameter	Measured Sample Data		Allowable		Reduction Identified %
		Conc (mg/L)	load (lbs/day)	LTA Conc (mg/L)	load (lbs/day)	
	Fe	0.82	16.5	0.64	10.4	21
	Mn	2.23	44.8	0.36	5.6	84
	Acidity	9.25	186.3	9.22	186.3	0
	Alkalinity	24.72	497.9			
131						
	Al	0.57	12.6	0.29	6.4	46
	Fe	1.18	26.0	0.54	11.9	47
	Mn	2.90	63.9	0.49	10.9	59
	Acidity	10.50	231.5	6.20	136.6	0
	Alkalinity	21.58	475.7			

LTA = Long Term average

Table 4. Waste Load Allocation of Permitted Discharges

Parameter	Allowable Average Monthly Conc. (Mg/L)	Average Flow (MGD)	Allowable Load (lbs/day)
Discharge 11			
Fe	3.0	0.045	1.1
Mn	2.0	0.045	0.7
Discharge 2M			
Fe	3.0	0.055	1.4
Mn	2.0	0.055	0.9

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 50th percentile flow. Assuming the sample set is log normally distributed, the long-term average is related to the load allocation (or waste load allocation) 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[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 National Pollutant

[2]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.

Discharge Elimination System permitting, monitoring and compliance). Therefore, no new mining may be permitted within the watershed without re-allocation of the TMDL.

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

Laurel Run and its unnamed tributary are located in an area that was extensively mined. Laurel Run and its unnamed tributary are poorly buffered, as is the case here, such that the natural pH is below the minimum standard of 6.0. 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.

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 margin of safety.

The Clean Water Act and federal regulations require TMDLs to include a margin of safety (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 assumptions 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 standards 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.

With respect to pH, State water quality standards state that if the naturally occurring pH values are outside the water quality range, the naturally occurring pH becomes the standard for the waterbody. PADEP, however, based the required net alkalinity value using the water quality standard in lieu of the background value, which also provides an implicit MOS.

Contrary to the TMDL report's statement, running the @RISK for 5000 iterations does not increase the MOS, as the mean and standard deviation of the population is determined by a small sample set.

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

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

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

Passive treatment is the construction of wetlands and other treatment facilities that do not require intensive maintenance. They add alkalinity to water and/or remove metals. These types of systems can be installed if space requirements are available. They do not provide dramatic increases in water quality, but are relatively inexpensive to build and maintain.

Chemical treatment is the addition of neutralizing agents to the acid mine drainage which increases the alkalinity in the water and the pH and it also precipitates significant amount of the metals dissolved in mine drainage. This type of treatment can be very effective but it can be expensive and the treatment facilities need regular maintenance.

The PA DCNR is actively treating the discharges from Harbison-Walker site through the use of flushing ponds. These ponds mainly treat for aluminum. Kaiser Aluminumis currently treating discharges from its site utilizing both passive and chemical treatment.

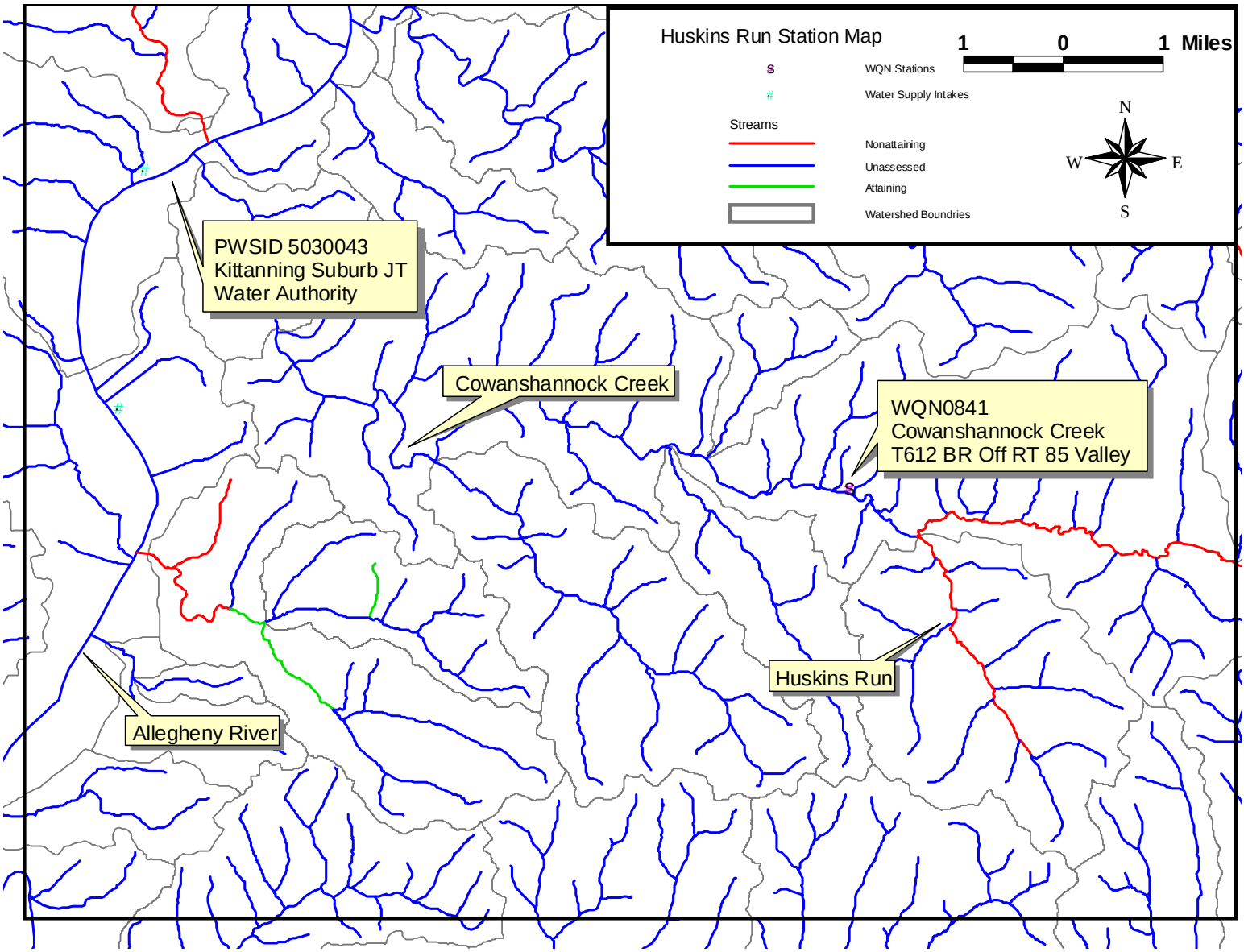
8. The TMDLs have been subject to public participation.

Public notice of the draft TMDL was published in the Pennsylvania Bulletin on December 21, 2002 and The Herald Standard on January 10, 2003 to foster public comment on the allowable loads calculated. A public meeting was held on January 15, 2003 at the Stwart Townsip Community Building in Ohiopyle at 7:00 pm to discuss the proposed TMDL

Although not specifically stated in the TMDL Report, PADEP routinely posts the approved TMDL report on their web site.

Attachment A

Huskins Run Watershed Map


Huskins Run Station Map
1 0 1 Miles
WQN Stations
Water Supply Intakes
Streams
Nonattaining
Unassessed
Attaining
Watershed Boundries
N
W
E
S
PWSID 5030043
Kittanning Suburb JT
Water Authority
Cowanshannock Creek
WQN0841
Cowanshannock Creek
T612 BR Off RT 85 Valley
Huskins Run
Allegheny River