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

Signed

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Water Protection Division

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I. Introduction

The Clean Water Act (CWA) requires that a Total Maximum Daily Load (TMDL) be developed for those waterbodies identified as impaired by the state where technology-based and other controls will not provide for attainment of water quality standards. A TMDL is a determination of the amount of a pollutant from point, nonpoint, and natural background sources, including a margin of safety (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 *Blue Run Watershed TMDL* (TMDL Report) dated November 17, 2005 to the U. S. Environmental Protection Agency (EPA) for final Agency review on April 24, 2006. This report includes the TMDL for metals (iron, manganese, and aluminum) and pH and addresses one segment on Pennsylvania's 1998 Section 303(d) list of impaired waters: Blue Run.

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 1998, 2002, and 2004 Section 303(d) listing information for the water quality limited segments first listed in 1998.[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 Group of Pennsylvania v. EPA.*

Table 1. 303(d) Sublist for Blue Run Watershed, Clearfield County, Pennsylvania

In 1997, PADEP began utilizing the Statewide Surface Waters Assessment Protocol to

Table 1. 303(d) Sub-List								
State Water Plan (SWP) Subbasin: 08-C Blue Run								
Year	Miles	Segment ID Assessment ID	DEP Stream Code	Stream Name	Designated Use	Data Source	Source	EPA 305(b) Cause Code
1998	1.35	7177	26293	Blue Run	CWF	SWMP	AMD	Metals
2002	0.4	20000809-0800-JSE		Blue Run	CWF	SWMP	AMD	Metals
2002	0.9	20000809-0801-JSE		Blue Run	CWF	SWMP	AMD	Metals
2002	0.3	7177		Blue Run	CWF	SWMP	AMD	Metals
2004	0.3	7177	26293	Blue Run	Aquatic Life		AMD	Metals
2004	0.4	20000809-0800-JSE	26293	Blue Run	Aquatic Life		AMD	Metals
2004	0.6	20000809-0801-JSE	26293	Blue Run	Aquatic Life		AMD	Metals
2004	0.8	20030929-1721-JCO	26294	UNT Blue Run	Aquatic Life		AMD	Metals
2004	0.8	20000809-0801-JSE	26295	UNT Blue Run	Aquatic Life		AMD	Metals

Cold Water Fishery= CWF
Surface Water Monitoring Program = SWMP
Abandoned Mine Drainage = AMD
See Attachment D, *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

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 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 at Pennsylvania Code Title 25, Chapter 96.3(c). Table 3 of the TMDL Report lists the TMDLs for the Blue Run Watershed, addressing metals and pH in the stream segments listed as PADEP stream codes 26293, 26294, and 26295.

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.

III. Background

The Blue Run Watershed is 1.04 square miles in area and is located in Central Pennsylvania, occupying a southeastern portion of Clearfield County within Beccaria Township and Glen Hope Borough. Blue Run flows through the borough of Glen Hope and passes under State Route 53 to the east of the intersection of State Routes 729 and 53. Blue Run consists of a main stem and two unnamed tributaries, one entering the headwaters from the northwest and the other entering the mid-section from the northeast.

Land uses within the watershed include abandoned mine lands in the headwaters, forest lands in the mid-section, and the village of Glen Hope at the confluence of Blue Run and Clearfield Creek. The village of Glen Hope consists of 50-75 permanent residences scattered within the village boundaries. Glen Hope's water supply is located in the headwaters of the watershed on the unnamed tributary that flows along State Route 729.

Blue Run is affected by pollution from abandoned mine drainage (AMD), causing high levels of metals in the watershed. However, there currently are no active mining operations in the watershed. Each segment on the Section 303(d) list will be addressed as a separate TMDLs and expressed as long-term average loadings. Due to the nature and complexity of mining effects on the watershed, expressing the TMDL as a long-term average gives a better representation of the data used for the calculations.

Early mining in the watershed included small underground "punch" mines on the Upper and Lower Freeport seams. Most of these underground workings were later daylighted and removed with the recent strip-mining in the watershed. Past strip-mining operations on the Upper Freeport, Lower Freeport, and in some places on the Middle Kittanning seams were left abandoned and unreclaimed throughout the watershed. Recent strip-mining projects by the Benjamin Coal Company, the Glendale Contracting Company, and the Northern Counties Coal Company have reclaimed many of these abandoned areas.

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[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 times 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: 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.

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. Blue Run has been designated by Pennsylvania as a cold water

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

fishery with criteria to protect the aquatic life use, and the designation can be found at Pennsylvania Title 25 § 93.9(l). To protect the designated use as well as the existing use, the water quality criteria shown in Table 2 apply to all evaluated segments. The table includes the instream numeric criterion for each parameter and any associated specifications.

Table 2. Applicable Water Quality Criteria

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

Pennsylvania Title 25 § 96.3(c) requires that water quality criteria be achieved at least 99% of the time, and TMDLs expressed as long-term average concentrations are expected to meet these requirements. That is, the statistical Monte Carlo simulation used to develop TMDLs and LAs for each parameter 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.

EPA finds that these TMDLs will attain and maintain the applicable narrative and numerical water quality standards. For iron, the TMDL endpoint was expressed as total recoverable iron because all monitoring data was expressed as total recoverable iron.

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 *Blue Run Watershed TMDL* Report, Attachment B). A summary of the methodology is presented as follows.

The parameter of pH, a measurement of hydrogen ion acidity presented as a negative logarithm of effective hydrogen ion concentration, is not conducive to standard statistics. Additionally, pH does not measure latent acidity that can be produced from the hydrolysis of metals. PADEP 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 acid mine drainage (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 ($\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 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.

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

All allocations are assigned to nonpoint sources, and the absence of a WLA for the mining operations is interpreted as a zero allocation. For purposes of these TMDLs only, point sources are identified as permitted discharge points, and nonpoint sources are identified as other discharges from abandoned mine lands which can include, but are not limited to, tunnel discharges, seeps, and surface runoff. Since there are currently no active permitted mining operations in the watershed, abandoned and reclaimed 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 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 LAs, EPA is not determining that these discharges are exempt from National Pollution Discharge Elimination System (NPDES) permitting requirements.

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, is indicative that there is a loss of instream load between

the points, and the ratio of the decrease shall be applied to the allowable load being tracked from the upstream point.

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

Table 3 presents a summary of the allowable loads for the Blue Run Watershed.

Table 3. Summary Table for Blue Run Watershed

Station	Parameter (lbs/day)	Existing Load (lbs/day)	TMDL Allowable Load (lbs/day)	WLA (lbs/day)	LA (lbs/day)	Load Reduction (lbs/day)	Reduction Identified %
BR07 - Headwaters of Blue Run where it surfaces	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
BR05 - Blue Run before confluence with unnamed tributary	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
BR06 - Headwaters of unnamed tributary	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
BR04 - Unnamed tributary to Blue Run from Glen Hope water supply	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
BR03 - Blue Run behind contracting company	Aluminum	ND	NA	0	NA	NA	NA
	Iron	ND	NA	0	NA	NA	NA
	Manganese	8.31	1.34	0	1.34	6.97	84%
	Acidity	ND	NA	0	NA	NA	NA
BR08 - At gated road over tributary to Blue Run	Aluminum	ND	NA	0	NA	NA	NA
	Iron	0.10	0.07	0	0.07	0.03	30%
	Manganese	ND	NA	0	NA	NA	NA
	Acidity	2.96	0.54	0	0.54	2.42	82%
BR02 - Unnamed tributary to Blue Run behind	Aluminum	ND	NA	0	NA	NA	NA
	Iron	ND	NA	0	NA	NA	NA

contracting business	Manganese	0.91	0.40	0	0.40	0.51	56%
	Acidity	ND	NA	0	NA	NA	NA
BR01 - Mouth segment of Blue Run close to confluence with Clearfield Creek	Aluminum	ND	NA	0	NA	NA	NA
	Iron	ND	NA	0	NA	NA	NA
	Manganese	3.90	1.25	0	1.25	0	0%
	Acidity	ND	NA	0	NA	NA	NA

* Total of loads affecting this segment is less than the allowable load calculated at this point; therefore, no reduction is necessary.

WLA = point source loads
LA = total nonpoint loads entering segment, including any upstream loads
ND = non detectable
NA = not applicable, meets water quality standards, no TMDL necessary

PADEP allocated only to nonpoint sources, as there are no current mining operations with permitted discharges within the watershed. Where there are active mining operations or post-mining discharge treatments in the watershed, federal regulations require that point sources permitted effluent limitations be water quality-based subsequent to TMDL development and approval.[3] In addition, PA Title 25, Chapter 96, Section 96.4(d) 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). Therefore, no new mining may be permitted within the watershed without reallocation of the TMDL.

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

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 available data, so the average flow for the 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, indicating that PADEP considered seasonal variations to the extent that data was available.

[3]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.

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 based on conservative assumptions in the Monte Carlo statistical analysis. Pennsylvania Title 25 § 96.3(c) requires that water quality criteria be achieved at least 99% of the time. All of the @Risk analysis results surpass the minimum 99% level of protection. Another margin of safety used for this TMDL analysis results from effluent variability. Effluent variability plays a major role in determining the average value that will meet water quality criteria over the long-term. The value that provides this variability in the analysis is the standard deviation of the dataset. The simulation results are based on this variability and the existing stream conditions (an uncontrolled system). The general assumption can be made that a controlled system (one that is controlling and stabilizing the pollution load) would be less variable than an uncontrolled system. This implicitly builds in a margin of safety.

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

The *Recommendations* section of the TMDL Report highlights what can be done in the Blue Run Watershed to eliminate or treat pollutant sources. Aside from PADEP's primary efforts to improve water quality in the Blue Run 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 Clearfield Creek Watershed Association is currently not focused on the Blue Run Watershed area. This watershed organization has focused its efforts in other areas of the Clearfield Creek watershed. Blue Run may become the focal point of the watershed group in the future. Hence, future projects in the Blue Run Watershed may be initiated to achieve the reductions recommended in this TMDL document.

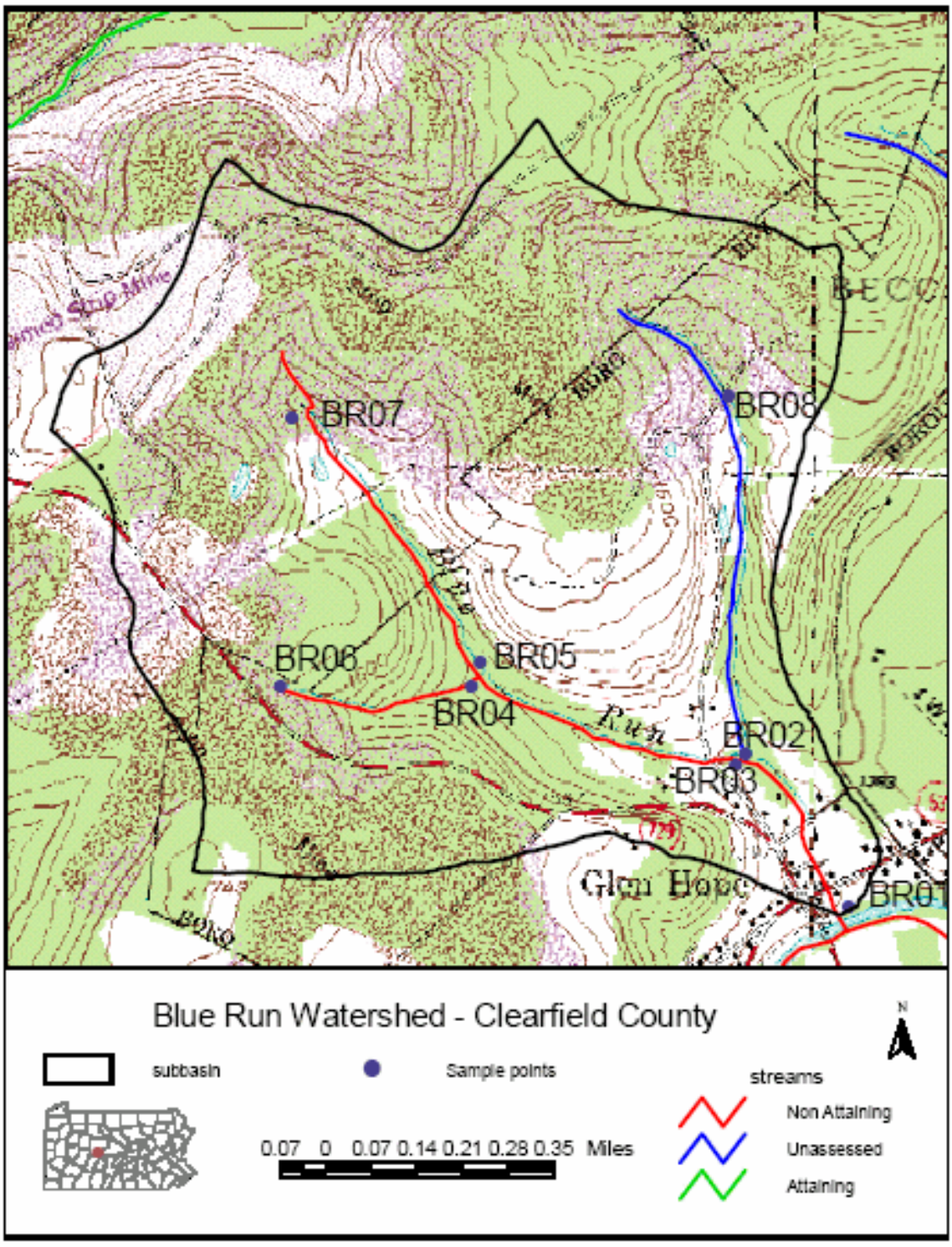
8. The TMDLs have been subject to public participation.

Public notice of the draft TMDL was published in the *Pennsylvania Bulletin* and The Progress to foster public comment on the calculated allowable loads. A public meeting was held on January 25, 2006 at the Clearfield County Multi Service Center in Clearfield, PA to discuss the proposed TMDL.

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/.

Attachment A

Blue Run Watershed Map


BR07
BR08
BR06
BR05
BR04
BR02
BR03
BR01
Run
Glen Hope
Blue Run Watershed - Clearfield County
subbasin
Sample points
streams
Non Attaining
Unassessed
Attaining
0.07 0 0.07 0.14 0.21 0.28 0.35 Miles
N