

# Metals and pH Total Maximum Daily Loads (TMDLs) for the Tug River Watershed, West Virginia

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Region III  
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Signed  
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Date

**Decision Rationale**  
**Total Maximum Daily Loads**  
**Tug Fork River Watershed**  
**For Acid Mine Drainage Affected Segments**

**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 did 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 water quality-limited water body.

This document sets forth the U. S. Environmental Protection Agency's (EPA's) rationale for establishing the TMDLs for metals and pH in the Tug Fork River watershed. These TMDLs were established to address impairment of water quality, caused by mine drainage and other sources, as identified in West Virginia's 1996 and 1998 Section 303(d) list of impaired waters.

The following regulatory requirements were considered in establishing the Tug Fork River TMDLs:

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.

From this point forward, all references in this approval rationale are found in the TMDL Report, *Metals and pH TMDLs for the Tug Fork River Watershed, West Virginia*.

**II. Summary**

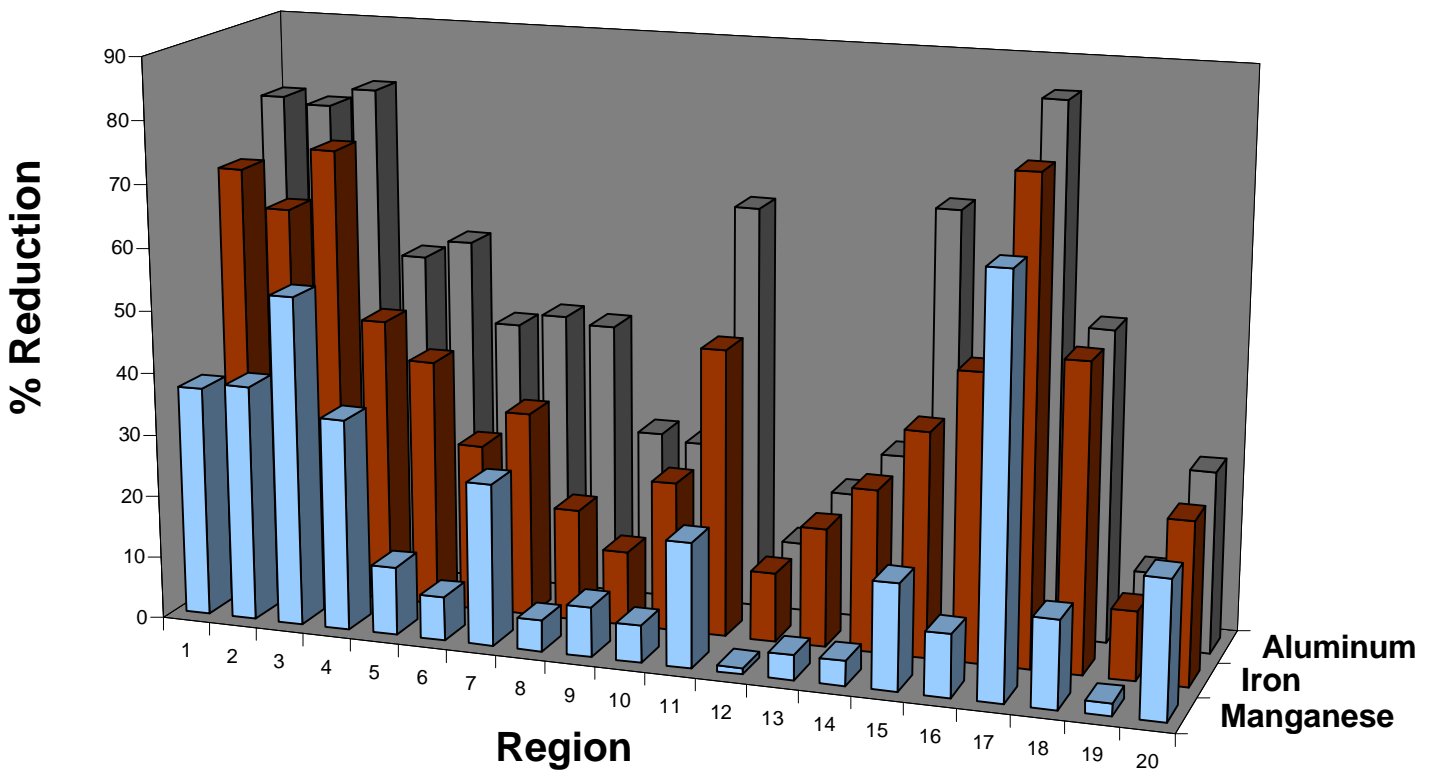
The Tug Fork watershed lies within the borders of West Virginia, Kentucky, and Virginia. Table 1-4 presents the West Virginia 1996 and 1998 Section 303(d) listing information for pollutants exceeding the existing water quality standards in the Tug Fork River and 63 tributaries. Of the water quality limited segments shown, all were first identified on the 1996 Section 303(d) list, all are listed for some combination of pH and metals, which include total iron, aluminum, manganese, and zinc and have been attributed to acid mine drainage. In addition, Table 1-5 presents the 1996 and 1998 Section 303(d) listing information for Kentucky and Virginia listed waterbodies in the Tug Fork Basin. These TMDLs represent the sixty-four West Virginia listed segments in the Tug Fork River watershed. This TMDL provides gross

allowable loads for the Kentucky and Virginia impaired water bodies providing the necessary framework for future TMDLs.

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

To develop the TMDL the watershed was divided into 20 hydrological regions. Figure 1-3 shows a map of the regions. Figure 1 below shows the percent reduction summary by pollutant for allocated load reductions for each of 20 segments.

**Figure 1. Percent Reduction by Region**



### III. Background

The Tug Fork watershed is located in the Big Sandy River basin along the borders of West Virginia, Kentucky, and Virginia. The heavily forested area drained by the Tug Fork River is approximately 1,500 square miles and lies within portions of the following counties: McDowell, Mingo and Wayne in West Virginia; Lawrence, Martin and Pike in Kentucky; Buchanan and Tazewell in Virginia. A large portion of the Tug Fork basin lies in the southern coalfields of West Virginia, where extensive coal deposits are the most economically valuable mineral resource in the area. Forestry is another major industry in the Tug Fork watershed. Currently, the quality of the Tug River and its tributaries are being negatively impacted by acidic drainage from abandoned mines, harvested forest, oil and gas operations and roads.

The 20 regions were divided into subwatersheds for modeling purposes (455 total for the entire watershed). The 20 regions and their respective subwatersheds provided a basis for georeferencing pertinent source information and monitoring data, and for presenting TMDLs. The Mining Data Analysis System (MDAS) was used to represent the source-response linkage in the Tug Fork watershed for aluminum, manganese, and iron. The MDAS is a comprehensive data management and modeling system that is capable of representing loads from nonpoint and point sources found in the watershed and simulating in-stream processes. The MINTEQ modeling system was used to represent the source-response linkage in the Tug Fork watershed for pH.

These TMDLs were established by EPA to fulfill requirements of the 1997 TMDL lawsuit settlement agreement. The 1997 consent decree requires that West Virginia, or the USEPA if West Virginia fails to, develop TMDLs for 44 priority waters included on West Virginia's 1996 Section 303(d) list by September 30, 2002. The Tug Fork River main stem is a priority water quality limited segment. In addition, the consent decree required a total of 350 waters impacted by mine drainage to have TMDLs completed by March 31, 2006.

#### Computational Procedure

Section 3.0 of the TMDL Report discusses the formation of acid mine drainage and discusses point sources and nonpoint sources of acid mine drainage. Generally, point sources are permitted mining operations and nonpoint sources are pre-Surface Mining Control and Reclamation Act (SMCRA) sources such as abandoned mine lands and discharges from abandoned deep mines. Section 3.5.2 identifies the link between metals and sediment in the Tug River mainstem. Reduction of metals to the mainstem will require a reduction in the sediment load. Table 4a, 4b, and 4c Appendix A-2 presents the allocation information for permitted mines point sources in the West Virginia portion of the watershed. Tables 5a through 5c, Appendix A-2, divides the LAs according to land use.

Section 4.0 discusses the technical approach, data sources, and application of the MDAS model. The parameter, pH, cannot be modeled as readily as can the metals. It is assumed that implementation of TMDLs in the Tug River watershed for metals will result in stream metals concentrations meeting water quality standards. Compliance with the pH water quality standards is demonstrated by the use of MINTEQA2 model. MINTEQA2 is a geochemical equilibrium

speciation model. By inputting into the MINTEQA2 model, the dissolved concentrations of metals, a pH value can be predicted.

#### **IV. Discussions of Regulatory Requirements**

EPA has determined that these TMDLs are consistent with statutory and regulatory requirements and EPA's policy and guidance. EPA's rationale for establishing these TMDLs is set forth according to the regulatory requirements listed below.

1. *The TMDLs are designed to implement the applicable water quality standards.*

Since the Tug River and its tributaries, for which this TMDL is being established, forms the boundary between the Kentucky, Virginia and West Virginia, all these states water quality standard must be considered in the development of the TMDL. The applicable water quality criteria are shown in Table 2-1 for West Virginia, Table 2-2 for Kentucky and Table 2-3 for Virginia.

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

A TMDL is the total amount of a pollutant that can be assimilated by the receiving water while still achieving water quality standards. TMDLs can be expressed in terms of mass per time or by other appropriate measures. TMDLs are comprised of the sum of individual wasteload allocations (WLAs) for point sources, LAs for nonpoint sources, and natural background levels. In addition, the TMDL must include a MOS, either implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving stream. Conceptually, this definition is denoted by the following equation.

$$\text{TMDL} = \text{Sum of WLAs} + \text{Sum of LAs} + \text{MOS}$$

For purposes of these TMDLs only, point sources are identified as permitted discharge points from active mining sites and nonpoint sources are discharges from abandoned and reclaimed mine lands which includes such things as tunnel discharges, seeps, and surface runoff. With one exception, the non-mining permits are not expected to be significant sources of contaminants and were not considered for in the modeling effort. Abandoned and reclaimed mine lands were treated in the allocations as nonpoint sources because there are no National Pollutant Discharge Elimination System (NPDES) permits associated with these areas. As such, the discharges associated with these land uses were assigned LAs (as opposed to wasteload allocations). 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 load allocations, EPA is not determining that these discharges are exempt from NPDES permitting requirements.

Tables 5-2 through 5-5 present, for each water West Virginia quality limited segment, the WLA and LA. Tables 4a through 4c in Appendix A present each permittees's WLAs. Table 5a through 5c in Appendix A present LAs information by region. Loading from Kentucky and

Virginia were in the baseline calculation and given allocations to meet in-stream water quality standards at the mouth of the Tug Fork main stem. As Kentucky and Virginia develop LAs for their individual watersheds these TMDLs will be required to meet water quality standard at all locations throughout the Tug Fork main stem. Table 5-6 presents the allocated loads to the Kentucky and Virginia areas of the watershed.

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

MDAS considers background pollutant contributions in that all land uses are modeled. Table 4-2 identified the land uses considered and Tables 4-4a and 4-4b present land uses by subwatersheds. The loading from the one minor discharger (Mingo County PSD, WV0115444) was included in the background conditions during the water quality calibration, baseline and allocation calculations. The WLA assigned to this facility was calculated based on the average flow and the maximum allowable metal concentration.

4. *The TMDLs consider critical environmental conditions.*

Allocations were made to provide consistency with the technical and regulatory requirements of 40 CFR Section 130. For instance, following the data analysis and model calibration, it was determined that violations of applicable water quality criteria occur at both low-flow and high-flow conditions, indicating no critical flow condition. Accordingly, the TMDL, model calibration, and allocation process were designed to consider both low-flow and high-flow conditions.

5. *The TMDLs consider seasonal environmental variations.*

Seasonal variation was considered by modeling over a period of several years, seasonal hydrologic and critical conditions were inherently considered. The metals concentrations simulated on a daily time step by the model were compared to TMDL endpoints. An allocation which meets these endpoints throughout the year was developed.

6. *The TMDLs include a margin of safety.*

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 suggest 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.

An implicit MOS was included by setting the modeling end points to 95 percent of the water quality standards, Section 5.1.3..

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

Section 6.0 addresses reasonable assurance. There are two primary programs in effect which provide reasonable assurance that the TMDLs will be implemented. Section 6.2.1 discusses the duties of the Office of Abandoned Mine Lands and Reclamation and Section 6.2.2

discusses the duties of the Special Reclamation Group. Adequate funding for reclaiming abandoned mine lands is an issue to be addressed.

In addition, the next round of NPDES permitting will require that effluent limitations reflect the individual WLAs. The WLAs will be converted to effluent limitations using the procedures of EPA's *Technical Support Document for Water Quality-based Toxics Control* (EPA, 1991).

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

Section 8.0 describes the public participation which included an informational meeting, a 35-day public comment period, and a public informational meeting. A responsiveness summary is included as part of this TMDL.