

# DEFINING A PROCESS FOR ESTABLISHING SCIENCE-BASED SEDIMENT TMDLS IN GEORGIA AND THE SOUTHEAST

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**Abstract.** In May 2000, The University of Georgia's Institute of Ecology (IOE) and The Georgia Conservancy (TGC) co-sponsored a forum to bring together scientists to discuss the process by which total maximum daily loads (TMDLs) for sediment are established. The forum resulted in the creation of a TMDL technical advisory group (TAG). This TAG is composed of individuals from universities, federal, state, and local agencies and non-profit organizations and represents diverse interest groups concerned with sediment-related water quality problems in Georgia and the Southeast. This paper provides the history and the goals of the TMDL TAG, describes the consensus building process, and reports preliminary consensus items and common areas of scientific concern.

## INTRODUCTION

### Definition

Section 303(d) of the 1972 Clean Water Act requires that each state identify waterbodies that are unlikely to meet the identified ambient water quality standards even after point source pollution has been regulated (Schoenbaum and Rosenberg 1991). For each listed waterbody, the state must prepare a total maximum daily load (TMDL). According to the Act, a TMDL is the sum of constituents from natural and anthropogenic point and nonpoint sources and is to be set at "a level necessary to implement the applicable water quality standards with seasonal variations and a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality" (33U.S.C Section 1313).

### Challenges

Federal requirements for TMDLs have presented many challenges. Over the past thirty years regulators have focused primarily on technological improvements to help reduce point sources of water pollution. Because limiting point sources led to significant reductions in overall pollution levels, and the

identification and limitation of nonpoint sources is difficult, the state's legal obligation to look at all contributing sources has been deficient. As water quality in Georgia continued to degrade several non-governmental organizations (NGOs) filed suit against the US Environmental Protection Agency (EPA), Region IV, for not forcing the state to carry out provisions of the Clean Water Act, namely establishing TMDLs.

The lawsuits have succeeded in requiring EPA, and subsequently the Georgia Environmental Protection Division (EPD), to establish TMDLs. However, the complex nature of and widespread problems associated with nonpoint source pollution and the governments agencies' limited resources have led to less than satisfactory TMDLs and, therefore, scientific concern.

## BACKGROUND OF TMDL FORUM AND TAG

After reviewing proposed TMDLs for sediment in the Chattooga River Basin in Northeast Georgia, staff at TGC and researchers at the IOE recognized that the legal and technical challenges associated with TMDL development were preventing good science from guiding their establishment. As a result, TGC and IOE sponsored a forum in Athens to discuss the best way to establish TMDLs for sediment. Fifty people from various agencies, universities and non-profit organizations attended the forum and recommended the formation of a TMDL technical advisory group (TAG). This TAG is composed of scientists from universities, federal, state, and local agencies and NGOs and represents regionally diverse interests and concerns with sediment-related water quality problems. The goals of the TAG are: (1) identify general characteristics of scientifically-based sediment TMDLs, and (2) recommend a protocol for establishing sediment TMDLs in Georgia.

Currently, the TAG is only addressing establishment of sediment-related TMDLs; however, many members are interested broadening the TAG's area of focus.

Members have expressed concern with and interest in the scientific processes used to list impaired streams, effectively implement TMDLs, and address other types of TMDLs, such as dissolved oxygen and fecal coliform.

## PROCESS

The TAG began meeting in August 2000. At that time the group decided to meet monthly for an undetermined period of time. Meetings, usually held in Athens on the University of Georgia campus, are arranged to be both listening sessions and open discussions. Every meeting is facilitated and begins with a recap of the previous meeting and a discussion of possible consensus items. Presentations are then given by individuals who volunteer their time and resources to report on a particular subject of interest, such as current research, the TMDL process in other states, and tools to aid establishment. Discussion is held throughout the presentations and recorded. The meetings end with identification of action items to occur before the next month's meeting and the setting of future agenda items.

## PRELIMINARY RECOMMENDATIONS AND ISSUES OF CONCERN

The TAG's overall goal is to help produce an ideal TMDL that will serve to improve the status of the region's impaired streams. In light of this, the TAG believes an effective TMDL should paint an accurate picture of the existing stream and watershed conditions; identify sources of excess sediment and how much each is contributing; establish short- and long-term monitoring plans; and develop an implementation plan that provides individuals and local decision makers with the tools necessary to improve water quality conditions.

EPA's *Protocol for Developing Sediment TMDLs* published in 1999 provides a general framework by which the TAG will offer recommendations on the best way to establish sediment TMDLs in Georgia and the Southeast. The TAG's final recommendations will be offered for public discussion at a TMDL forum similar to the forum held in May 2000. In this publication, the TAG reports the following preliminary recommendations and issues of common concern that require further research and discussion. (The EPA framework items are *italicized* and the TAG recommendations and/or issues of concern are underlined.)

### *Identify Problem*

Properly identify the problem causing the stream segment to not meet standards. To date, the primary state-initiated resource evaluation that leads to listing a stream as impaired due to sediment is fish community assessments. It is difficult to determine if the sediment is from an active source, a historic source, channel alteration, or a combination of all the above. Further, it is difficult to segregate the biological impacts resulting from physical effects, or from the chemical constituents, associated with sediment. Regardless, correcting the problem will require solutions that result in improved fish community integrity.

### *Develop numeric targets*

Members of the TAG recognize that it is difficult to develop numeric targets for streams impaired by excessive sediment levels. The TAG is discussing the challenges related to setting numeric targets. Specifically, difficulty lies in differentiating between historic, recent, or on-going sediment loads. For a stream with a history of excess sediment, is it necessary to define a numeric "total maximum daily load" if these earlier loads caused the impairment? Some members of the TAG believe that TMDLs should be set as near zero as practical, and focus should be placed on implementing a plan to eradicate most of the potential sediment sources in the watershed. Also, in light of the dynamic nature of a stream system, there is difficulty in predicting how each impaired stream will respond to its changing environs. Setting numeric targets to define a dynamic system poses many challenges that the TAG continues to examine.

Determine appropriate timing of loads (annual vs. daily). The TAG is addressing the issue of temporal resolution for TMDLs. Although the term TMDL implies daily loads will be established, existing TMDLs establish loads on an annual basis. Some TAG members are concerned that while there is value in addressing sediment loading on an annual basis from a general land management perspective, this does not adequately address short-term impacts.

Sediment TMDLs must be related to in-stream processes. In instances where a numeric TMDL can be established, the TAG has indicated a preference for a flow-weighted measure of sediment, as opposed to, for example, a calculated land-surface yield. That is, the maximum allowable sediment concentration (mg/L) can be expressed as a function of stream discharge, because typically, there is a strong positive correlation

between water discharge and suspended sediment concentration (Meade et al., 1990, Holmbeck-Pelham and Rassmussen, 1997). As such, it has been suggested that statistical models be developed (perhaps for different physiographic regions) that use discharge as the predictor and sediment concentration (mg/L) as the response variable. In these models concentrations that exceed the regulatory standard would be identified as values above some reference line, such as the two standard deviation line. In addition, there has been some discussion about formulating more complex multivariate models, with discharge as well as additional predictors, because some studies have shown that predictions of sediment concentration are better when additional variables (i.e., season, topography, and antecedent moisture) are included (Lemke, 1990).

#### *Source Assessment*

Differentiate between historic levels of sediment and recent or active sediment “dumps.” As discussed above, differentiating between historic sediment (material already in the stream) and sediment that is actively being delivered to the stream is a difficult task that the TAG is addressing. The TAG has reached consensus on the fact that for an effective TMDL report, historic contributions must be identified and differentiated from loads actively entering the stream system or which have recently been delivered to the stream.

Perform a watershed assessment. Land use activities within the watershed of an impaired stream segment can further degrade or possibly improve local water quality. Watershed assessments should be conducted to identify sources of current sediment inputs and characterize sediment inventories within the riverine system. Watershed assessments also can confirm the accuracy of currently available data and identify as yet unaccounted sources. Some members suggest conducting geomorphic surveys and the development of sediment budgets to better understand the stream's assimilative capacity, as well as its ability to recover over time.

Nonpoint source sediment modeling is an important tool in establishing TMDLs. Traditionally, the Universal Soil Loss Equation (USLE), that predicts the amount of sediment lost from particular land uses, has been used for establishing TMDLs. However, most TAG members agree that these modeling techniques are not advanced enough to provide a linkage among potential upland erosion, in-stream turbidity and

sediment transport, and fish assemblage structure. Because many TAG members are actively researching such advanced modeling techniques, many of the discussions are centered around the possible ways to improve the existing technology.

#### *Develop monitoring and review plan/schedule*

As with most scientifically-based projects, an ideal TMDL would be established from data spanning years. However, in many cases sediment TMDLs in Georgia are developed with insufficient data. As such, the monitoring program associated with each TMDL takes on added significance because it may represent the only means of generating sufficient data to ultimately establish a pragmatically effective TMDL. As a minimum, the monitoring program will have to address the issues of: (1) discharge (water volume/time); (2) concentration limits (mg of sediment/L of water); and (3) most importantly, temporal resolution (daily, weekly, monthly, seasonally, yearly). The monitoring plan should incorporate the use of accurate sampling and analytical procedures because suspended sediment displays marked short- and long-term spatial and temporal variability. Monitoring requirements should be based on the individual TMDL, with the understanding that it must be more frequent than the temporal resolution of the standard (in other words, a daily resolution may require hourly sampling, a weekly resolution may require daily sampling, etc.).

Develop a realistic implementation plan. Although the TAG currently is focusing attention on developing a scientific way to establish sediment TMDLs, many of the group discussions are centered around TMDL implementation. The TAG has reached consensus that realistic and achievable implementation is vital to see the TMDL to fruition. As previously mentioned many members are interested in expanding the TAG goals to discuss and recommend what a good implementation plan should contain.

## CONCLUSION

The preliminary recommendations and issues of concern identified above are very general. The TAG recognizes that many challenges face the federal and state agencies charged with establishing TMDLs and that many factors prevent regulators from producing successful TMDLs (i.e., incomplete data, limited resources.) However, sediment in Southeastern streams and associated problems calls for thoughtful

and scientifically-based solutions. The TAG will produce a detailed "white paper" that outlines the most effective science-based process to establish sediment-related TMDLs.

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