ISSUES RELATED TO THE SUCCESS OF THE TMDL PROGRAM

Bethany T. Neilson

David K. Stevens
Civil and Environmental Engineering Department
Utah State University

The Clean Water Act (CWA) of 1972 (United States Code, 2001) includes provisions for what is known as the Total Maximum Daily Load or TMDL program. This program has been forced into high priority for water quality management within the last decade because of litigation that mandates EPA to enforce TMDL requirements (Houck, 1997; USEPA, 1998a). The program requirements, described mainly in Section 303(d) of the CWA (United States Code, 2001), 40 CFR 130.2 and 130.7 (United States Code of Federal Regulations, 2001), and guidance from EPA headquarters and regions, dictate that for all impaired waters, a total load needs to be allocated to point and non-point sources so that instream water quality standards are met. Although this may seem like a reasonable requirement, states struggle to meet the provisions called for by the 29-year-old law due to the many unanswered questions about EPA's expectations and the overwhelming demands of the program (USEPA, 1998a). This paper attempts to capture EPA's perspective regarding the issues that affect the success of the TMDL program by: 1) clarifying EPA's expectations in particular areas of the program and 2) identifying inconsistencies and their sources in the program.

METHODOLOGY

The problem of assessing expectations among parties involved in the TMDL process and identifying inconsistencies in the program implementation was addressed by key informant interviews of personnel in the TMDL program within the EPA. Since communication is a two-way activity, it was important to approach these issues from two sides – that of EPA headquarters and that of the EPA regions. Communication between EPA and States in the TMDL program, even though equally as important, will not be addressed in this research.

At EPA headquarters, the Office of Wetlands, Oceans, and Watersheds (OWOW) is charged with implementation and enforcement of the TMDL program. The Watershed Branch chief, TMDL team leader, and TMDL program attorney were selected as the representative key informants for OWOW. At the EPA regional level, TMDL coordinators are charged with enforcing TMDL development and reviewing and approving representative TMDLs submitted to their region. They thus best understand how their region approaches the program, leading to their selection for interviews. One of the EPA regional coordinators did not respond to our requests for an interview, so an alternative expert key informant, the region's 303(d) list coordinator, was chosen.

Interview Approach

The interviews were designed to be open-ended discussions guided by a protocol of interview questions, which often resulted in candor and elaboration on sensitive topics. Although most of the questions were asked of both EPA headquarters and EPA regions, additional questions were tailored to each group due to their different roles in the TMDL program. Given the flexibility and variability of key informant interviews, it was known that not all questions would necessarily be asked of each person interviewed, that the order in which they would be asked would vary, and responses from interview questions would not be in a format that lends itself to quantitative or statistical analysis.

Each interviewee was contacted by telephone and an interview was scheduled from January to July 2001 at the expert key informant's office either at EPA headquarters in Washington, D.C. or at the regional EPA informant's office. During this preliminary contact, background information about the research was presented.

At the interview, a copy of the initiating letter was provided and each expert key informant was assured that the information provided would be cast in a constructive rather than confrontational light and that no results would be published or released without their consent. Each interview lasted about 90 minutes and, with a single exception, each was tape recorded so that the information would not be misrepresented. Transcripts of the tapes were reviewed in preparing this report.

DATA ANALYSIS

After reading the transcripts of the interviews and reviewing interview notes, data were analyzed by grouping answers to the interview questions by similarity of the responses. Care was taken to maintain objectivity in this process to reduce personal bias. This paper has not gone through the official peer review process within EPA and is therefore not representative of the opinion of EPA.

RESULTS AND DISCUSSION

Guidance from EPA

The purpose of the TMDL program is to help solve the nation's remaining water quality problems that other sections of the CWA have not addressed. However, according to the Federal Advisory Committee for the TMDL program (USEPA, 1998a) and both the administrative and regional respondents, the guidance in many portions of the TMDL process is insufficient for the purpose of successfully developing and supporting TMDLs and is frequently unclear about the EPA's expectations concerning the program.

Insufficient guidance from EPA has caused states and regions to demand more detailed direction in order to better meet the statutory and regulatory requirements while minimizing controversy and inconsistencies (USEPA, 1998a). Consistency in any program is fostered by the authoritative agency. In the case of the TMDL program, EPA is in charge of administering the program but this requires information and procedures that are consistent from the top. This may be an intuitive statement, but EPA headquarters' perspective on the issues in TMDL development is similar to that in other environmental legislation: with time, the program will evolve and the rough spots will be smoothed out. Houck (1998:10415) expressed this approach to environmental law best, stating, "Environmental law is a continuing experiment, and one ingredient of its success has been its tendency to throw several approaches at a problem and test their survival." Because of this approach, EPA's TMDL guidance contains many suggestions (or experiments) on how to handle issues not addressed directly in the regulations (e.g., stakeholder involvement and voluntary actions in addressing non-point source issues).

Regulations are needed in the TMDL program to promote consistent implementation of Clean Water Act requirements, leading to defensible TMDLs, while at the same time maintaining flexibility to address diverse issues within the program. Don Brady, the Watershed Branch chief, agreed that there was a need for better regulations and hence the new TMDL regulations were passed in July 2000 (Federal Register, 2000). These new regulations were intended to clarify requirements by generating a stronger administrative base to work from (D. Brady, personal communication, 2000). This new administrative base would theoretically minimize discrepancies within the program. Evaluation of these new regulations in addressing these concerns, however, has been delayed due to Congress suspending implementation of the program until further information is gathered on certain aspects of the TMDL program (e.g. National Research Council, 2001). The effects of information gathering efforts on the proposed rules are not yet known and therefore, the lack of uniformity in the current TMDL program needs addressing.

Differing Regional Expectations

As the TMDL program has grown since the mid-1990s, EPA regions and states have each developed local criteria and methods due to the lack of sufficient guidance from headquarters (e.g., Idaho Department of Environmental Quality 1999; USEPA 2000a, 2000b, 2000c). The TMDL program in some regions is still in its infancy while the program in other regions has made considerable progress over several years. Regional programs have developed independently from each other due to different driving factors such as litigation, resources, priorities, etc. This has resulted in regions with differing degrees and types of experience in the program and is one of many causes of differing regional expectations. Other major contributing factors to regional differences in the TMDL program are: 1) state programs that affect the consistency of the TMDL program; 2) regional and state resource availability; 3) available technical approaches given resource availability; and 4) amount of regional litigation.

Regional differences are in some respects necessary artifacts of the TMDL program. The broad spectrum of problems encountered and the wide variety of circumstances regulators face dictates deliberate flexibility and/or ambiguity in TMDL law and regulations. Although needed, this flexibility leads to the appearance of inconsistencies within the program. It is necessary to identify whether inconsistencies exist due to varying interpretations of the regulations or if they are differences due to geographical location and other external factors driving the program.

State Programs That Affect the TMDL Program

Water quality standards. Parallel but different state water quality-related programs cause and compound regional and national discrepancies in the TMDL program. For example, although EPA provides national

minimum water quality guidelines, water quality standards are established by each state independently. Additionally, many standards are narrative (e.g., sediment and nutrients, both of which have narrative standards in most states, are the number one and three listed parameters requiring TMDL development [USEPA, 2000d]) giving rise to varying interpretations of those standards in determining loadings. Three of nine regional TMDL coordinators described problems resulting from narrative standards within their regions.

Related to the standards problem is the regional interpretation of a water quality standard exceedance. One regional coordinator cited an example of the Commonwealth of Puerto Rico in which ammonia concentrations in streams exceed EPA guidelines by several orders of magnitude. However, aquatic species are thriving apparently by virtue of elevated ammonia tolerance, calling the relevance of those guidelines into question. Similar confusion exists when "natural" concentrations exceed standards.

303(d) listing process. The criteria for development of the 303(d) list have been debated heavily since environmental groups and point and non-point source interests challenged them. Two of nine regions, many environmental groups, and point and non-point source organizations have voiced concerns about the criteria for development of the 303(d) list and its impact on the TMDL program. Some waterbodies are listed because there are large amounts of data that demonstrate obvious water quality impairment. Some clearly impaired waterbodies are not listed due to the lack of data while others were listed by mere "drive-by" water quality assessments. The most likely reason for errors in development of the 303(d) list is that states' resources are limited and detailed assessments are costly.

Limited Resources and TMDLs

The issue of limited resources in the TMDL program is prevalent from EPA headquarters down to the state programs. The most pertinent resources include money, staff, and water quality modeling expertise. The availability of these resources predicts each region's and state's approach and abilities in the program. The most critical resource limitations of the TMDL program are financial. Without money, necessary personnel are not available and data cannot be collected. Without data, scientifically informed decisions cannot be made.

Currently, each region is given a specific dollar amount to distribute evenly among their respective states for the purpose of TMDL development. However, external factors can determine the available funds. For example, EPA regions in the Eastern U.S. (e.g., Regions 1-3) have considerably more funds for data collection and modeling efforts due to local revenue from large numbers of point source dischargers and other sources. Point source dischargers have a vested interest in the equitable determination of load allocations due to high treatment costs that may be imposed on them. In the East, there are also many more organizations whose primary focus is protecting the environment due to high population density and pollution problems that have existed for many years. These entities (e.g., environmental interest groups and watershed advisory groups) are often willing to support data collection and organizational efforts that states cannot afford. States themselves, however, can also be a source of variability in funding availability for TMDL development due to variation in the number of 303(d) listed segments, greater emphasis on environmental protection in certain areas, local political climates, etc.

Technical Constraints in TMDL Development

In considering the difficulties encountered in the TMDL program, it appears probable that environmental policy is ahead of science, and that is one reason why there is a lack of consistency in technical approaches and guidance. It is also possible that guidance is sparse because there is no consistent manner in which problem areas in TMDL development are solved (e.g., accurate non-point load estimation, load allocation in data poor areas, etc.). EPA regional TMDL coordinators' responses to these issues varied. Historically, in environmental management, policy has preceded science. As one expert key informant stated, EPA headquarters often has the philosophy that "if you build it (policy) they (scientists) will come." In the TMDL program, key informants at EPA headquarters and five of the nine regional expert key informants interviewed stated that TMDL policy is ahead of science and is, therefore, driving the science. This raises questions of how exactly to guide states and regions in the technical aspects of TMDL development. One regional expert key informant stated that the TMDL policy is driving the development of the necessary science but the process is not complete, while another stated that the theoretical science is available while the practical application of the science is not.

One regional coordinator expressed the opinion that science is ahead of the policy, arguing that data limits the application of science. The coordinator said that this opinion is supported by the fact that the CWA is still being interpreted, 30 years after it was written. Regardless of which argument is correct, the end result of confusion and inconsistency is the same. EPA has recognized the need for better policy that attempts to more fully address its expectations of the TMDL

program while considering the limitations of science, data, etc. in implementing the new regulations (Brady, personal communication 2000).

Water quality modeling is seen by many as a critical component of TMDL development (USEPA, 1997a, 1997b, 1998b). Often (when funds and expertise are available) modeling is used as a placeholder when data are scarce. Questions arise as to whether models are required and whether EPA expects mechanistic models to be applied in each TMDL situation. Without modeling, can regulators determine whether or not load reallocations are likely to meet instream standards? In interviewing expert key informants, it became apparent that the definition of modeling is extremely broad, ranging from "back of the envelope" mass balances to complex time-varying computer models. However, for the purposes of this research, a narrow definition of modeling, referring specifically to mechanistic models such as QUAL2E (Brown & Barnwell, 1987) and HSPF (Bicknell et al., 1993), part of EPA's BASINS (USEPA, 1998b) TMDL support software, was used.

Figure 1 shows interview results regarding the question of modeling requirements, broadly characterizing the type of technical approaches used in various regions. The four categories shown in the figure are: regions relying more on modeling approaches, regions relying on non-modeling or data-driven approaches, regions implementing both modeling and non-modeling approaches, and regions whose approaches are governed by litigation (i.e., consent decrees requiring large numbers of TMDLs in short time periods). EPA regions 2 and 3 are much more dependent on modeling approaches while regions 5, 7, 8, and 9 depend more on non-modeling or data driven approaches (e.g., empirical relationships, statistical approaches, biological assessments). Region 1 and 10 depend on both modeling and non-modeling. Once again, this variability is due partly to the availability of resources. However, other factors besides the financial and data issues discussed earlier influence technical approaches. Time constraints and the availability of proven scientific approaches are the primary reasons voiced for using nonmodeling approaches. Limited staff availability and modeling expertise, coupled with pressing deadlines, make developing and calibrating a model for each listed waterbody difficult for states. More time, increased in-house expertise, and additional resources to hire contractors would allow for more aggressive modeling approaches.

An additional factor that causes differences in technical approaches between the East and the West is the basis on which most water quality models are developed. Most water quality models have been developed based upon Midwestern and Eastern systems to address long-term historical water quality problems (e.g., HSPF Bicknell et al., 1993) and, according to one expert key informant, problems have arisen when these models have been applied to the drier, more "flashy," systems in the Rocky Mountains. Most successful validation has occurred on the eastern systems. Attempts at validation of some common models in the West have been unsuccessful. This has left many western regions hesitant in applying some classical water quality models.

The last reason for differences in modeling approaches deals with model capabilities. In many circumstances, no model applies to a specific situation. An example of this is a water quality limited stream segment impaired by sediment loading from streambank erosion. There are currently no models available that accurately represent this situation. Therefore, alternative, non-modeling approaches have been used.

Many regional expert key informants agreed that there are complex or high-stake situations that demand intensive modeling. However, there are also many simple situations with less at stake where simpler models (e.g., empirical) can be used. There is an understanding within the program that complex models do not necessarily mean better TMDLs. Modeling (especially for non-point sources) does not always decrease the amount of uncertainty one finds when a less rigorous approach is taken. The uncertainty may just be better defined.

Litigation and TMDL Development

Some expert key informants stated that litigation is an important factor driving the TMDL program. Six of the 10 regions are undergoing moderate amounts of litigation, which includes lawsuits filed to force TMDL development for specific watersheds. One region presently had no litigation at the time of the interview and three regions were dealing with statewide 303(d) litigation as a result of which entire 303(d) lists are being rewritten and the numbers of listed streams and TMDLs have increased substantially. Three out of the nine regional expert key informants interviewed stated that their efforts are benefiting from litigation because more money is being put into specific regional and state programs in order to avoid statewide litigation. However, Regions 4 and 6 are dealing with heavy litigation and have literally been drowning in the requirements of consent decrees. Because of these lawsuits, regions and the respective states feel that they have lost primacy in setting TMDLs. Court orders have made regions handle their approach to the TMDL program much differently than might have been

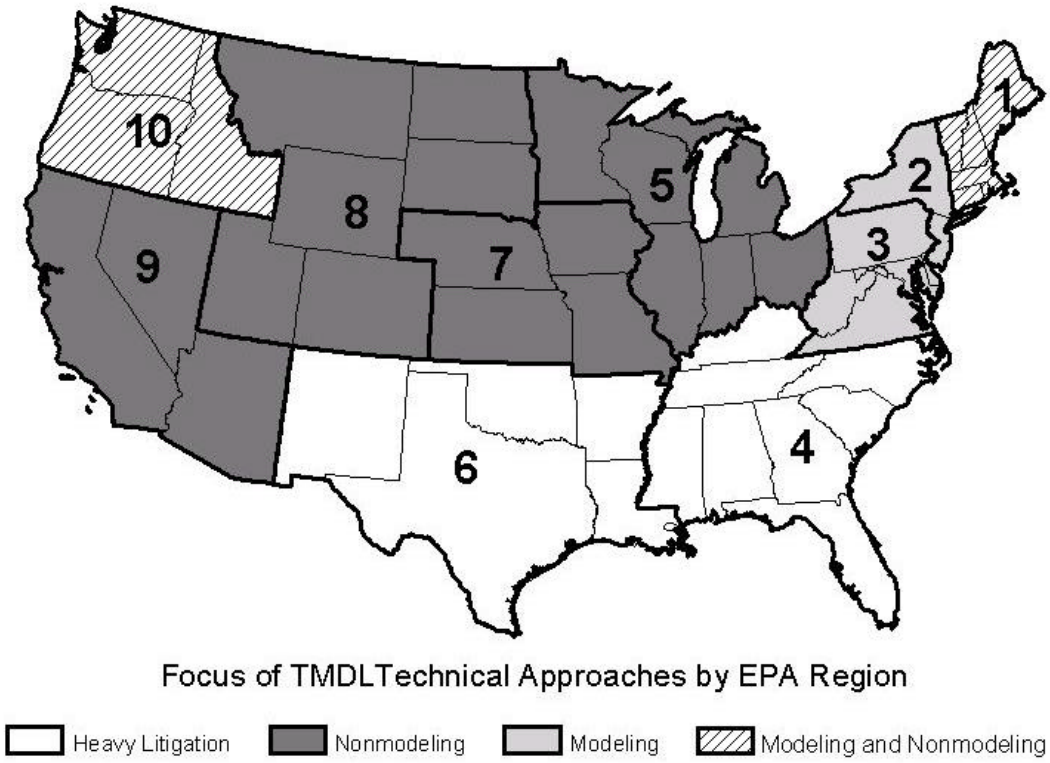

Figure 1. Map of USEPA regions categorized by the focus of technical approaches in TMDL development. The categories consist of regions that generally rely on modeling approaches, nonmodeling approaches, combination of modeling and nonmodeling approaches, and those regions where heavy litigation has significantly influenced technical approaches in TMDL development.

desirable, and simplistic, less rigorous approaches are often used due to time and money constraints.

Litigation is but another source of variation in the TMDL program. What may be acceptable in a region under heavy litigation may not be acceptable in a region without these pressures. According to several of the regional key informants, the requirements of court orders have forced some TMDLs to be developed without completing the desired scope of work, resulting in more phased TMDLs. It is not clear whether the litigation is beneficial or harmful to the program. In some ways the benefits are obvious: more TMDLs are developed. However, when TMDLs have to be developed in an extremely short time period, the possible hardship on stakeholders may be greater than the benefit because the desired analysis could not be undertaken in the time available.

CONCLUSIONS

The question of whether there are truly inconsistencies in the TMDL program design, or if there are regional differences that occur due to external factors affecting the TMDL program that appear as inconsistencies, still remains. Unclear expectations from EPA headquarters were determined to be the only area in which true interpretive inconsistencies in the program may exist. External factors such as state programs that influence TMDL development, resource availability, and varying degrees of litigation contribute to regional differences in the TMDL program. These external factors, however, cannot be controlled by the TMDL program and therefore cannot be pinpointed as a shortcoming of the program. State programs that drive the TMDL program will be a source of variation as long as individual states are in charge or are given a degree of latitude. Resource availability will also be a continuous source of variation. Increases in funding in the TMDL program at the federal and state level will help the program, but there will always be a need for more data, more modeling expertise, more data collection, etc. Litigation is an issue that will always be present in ambiguous environmental law. No matter how successful the TMDL program becomes, questions will remain concerning what is good enough and whether the CWA goals are actually being met.

Many expert key informants argued that the successes and failures of the TMDL program are due primarily to limited resource availability. Some experts stated that resources are being sucked dry fighting litigation rather than improving water quality, while others stated that a combination of litigation and rule making has been the focus while the technical side of the program has been neglected. Is it possible that national consistency in the TMDL program is not a CWA goal and that is why it affords great flexibility and why many issues have not been dealt with? Whether this is the case or not, environmental policy (such as the TMDL requirements) that considers the limitations of science but still pushes science to answer hard questions is necessary. If hard questions are not asked, research will not head in the direction of issues that need to be addressed in order to preserve our environment (D. Brady, personal communication, 2000).

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AUTHORS

Bethany Neilson received a B.S. and M.S. in Civil and Environmental Engineering from Utah State University. She is currently a research engineer as a Utah State University under Dr. David K. Stevens. Bethany Neilson has researched many facets of the TMDL program including available modeling approaches for TMDL development and the communication of technical information contained within TMDLs to non-technical stakeholders. The integration of policy and science in TMDL decision-making within watershed stakeholder groups has also been an emphasis.

David K. Stevens received a B.S. in Civil Engineering from Tufts University, a Ph.D. in Civil Engineering from University of Wisconsin- Madison, and was a post-doctoral researcher at the University of Cincinnati/EPA. He also spent two years in the Peace Corps as an Irrigation Engineer. He is currently a Professor at Utah State University in the Department of Civil and Environmental Engineering.

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