Developing Effective TMDLs: An Evaluation of the TMDL Process

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ABSTRACT

As part of a larger suite of efforts underway to examine and strengthen the link between TMDLs and water quality restoration, EPA conducted an evaluation of non-point and stormwater source TMDLs. The Clean Water Act provides little regulatory authority over non-point sources of pollution, yet this type of pollution is ubiquitous and reductions in non-point source pollution are necessary for achieving water quality goals. This evaluation looked at whether various characteristics of data availability, funding resources, guidance materials, stakeholder involvement, scale of TMDLs, and implementation planning positively influence development of effective TMDLs. The methodology included a survey of TMDL program staff, a broader survey of staff from programs that implement TMDLs, and interviews with stakeholders in seven case study TMDLs. This expansive look at the TMDL development process yielded an array of recommendations including: improving data needed for setting specific non-point source allocations, brokering other federal funds, improving communications with stakeholders, developing watershed TMDLs, encouraging detailed TMDLs that can be used for implementation planning, and conducting outreach to agricultural and local government organizations. The conclusions from this evaluation can improve how EPA and states focus their resources to encourage implementation of non-point and stormwater source TMDLs.

KEYWORDS

Total Maximum Daily Load, TMDL, impaired waters, TMDL development, TMDL implementation, non-point source, storm water, stormwater, program evaluation

INTRODUCTION

Over 40% of the nation's assessed waters do not meet existing state, territory or tribal water quality standards. Section 303(d) of the Clean Water Act (CWA) requires that these impaired waters be placed on the 303(d) list and that states develop Total Maximum Daily Loads (TMDLs). TMDLs are calculations that determine the maximum amount of pollutant that can be released into a water body and set allocations of this load among the point sources and non-point sources in the watershed. For point sources, once a TMDL is approved, EPA and delegated states

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must ensure the permits issued through the CWA's National Pollutant Discharge Elimination System (NPDES) program are consistent with the wasteload allocation set in the TMDL. Usually this means pollutant concentration and loading limits placed on effluent. However, municipal stormwater permits are treated differently and are written with best management practices to reduce stormwater pollution instead of specific effluent limits. For non-point sources, states rely on a combination of state and local rules and voluntary actions to implement the load allocation in the TMDL.

In recent years the TMDL program has enjoyed great success in developing TMDLs at a high pace. More than 24,000 TMDLs exist, the majority of which were completed in the last three years (EPA 2007a). The program is now putting a greater focus on TMDL implementation and achieving environmental restoration. However, this will be challenging in light of how many waterbodies will need reductions in non-point source loadings to achieve water quality standards. Almost all TMDLs have a non-point source component; 47% of recent TMDLs (those approved since 2002) are a mix of point and non-point sources and 48% of recent TMDLs are non-point source only (EPA 2007b). Therefore the success of TMDL implementation depends on the success of non-point source implementation, which usually requires the coordination of a suite of voluntary activities.

EPA's Watershed Branch has an ongoing multi-year environmental results analysis effort underway to evaluate the success of the TMDL program and identify possible improvements. Due to the complexity of achieving water quality standards on impaired waters with non-point and stormwater sources and the prevalence of this type of TMDL, an evaluation of the development and implementation process for these TMDLs was conducted as a subset of the broader effort. This paper discusses the results of that evaluation. The analysis examined whether data availability, funding resources, guidance materials, stakeholder involvement, scale of scope of TMDLs, and implementation plans positively influence water quality decision makers to achieve water quality standards. EPA contracted Industrial Economics, Inc. (IEc) to conduct the evaluation and ensure the anonymity of survey respondents and case study interviewees.

METHODOLOGY

This evaluation included two surveys of EPA program staff and a review of seven case study TMDLs. The first survey targeted TMDL program staff in the ten EPA regions. Most of these staff review TMDLs for approval, but in regions under tight consent decree deadlines staff develop TMDLs for EPA establishment. The second survey targeted EPA staff working in programs engaged in activities related to TMDL implementation. This included the non-point source, national estuary, superfund, air quality, groundwater and drinking water, stormwater, smart growth and state revolving fund programs. The surveys were designed to elicit insights into the nature and quality of stakeholder participation and implementation plans during the development of TMDLs. To supplement the surveys, seven case study TMDLs were selected. Interviews with stakeholders involved in the development and implementation of these TMDLs were conducted to further explore how stakeholder involvement and implementation planning impact stakeholder knowledge of and approaches to watershed protection.

The two surveys garnered high response rates and hundreds of qualitative responses. Eight-four percent of the TMDL staff contacted in the first survey completed it (67 respondents out of 80 requested). The EPA program staff that received the second survey responded at a rate of 46 % (105 respondents out of 228 requested). The case studies also gathered information from a broader audience than the surveys. The 36 interviewees associated with the seven case studies spanned state, local, other federal, non-governmental, tribal, watershed, consultant and agricultural organizations.

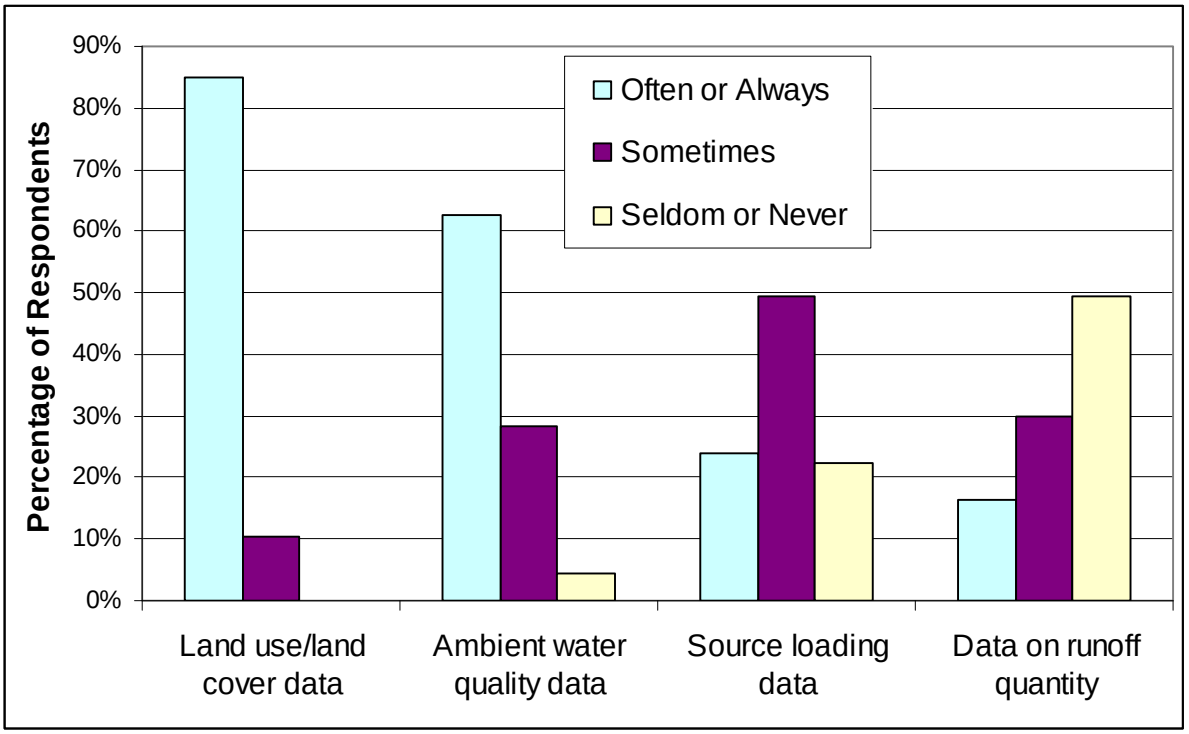
RESULTS

A complete report on the findings of this evaluation can be found at the following website http://www.epa.gov/evaluate/tmdlfinal.pdf. The following results represent the key findings of the evaluation organized by topic.

Data Availability

The first survey and case study interviewees confirmed that the availability of water quality data is a key factor needed for successful TMDL development and implementation planning. However, many types of data to support TMDL development are often unavailable. Most notably 49% of respondents indicated data on runoff quality is seldom or never available (Figure 1). This type of data is useful in estimating total loading rates as well as comparing loadings between sources. In a follow-up question TMDL staff indicated that data are least often available for allocating loads among sources and developing a detailed implementation plan.

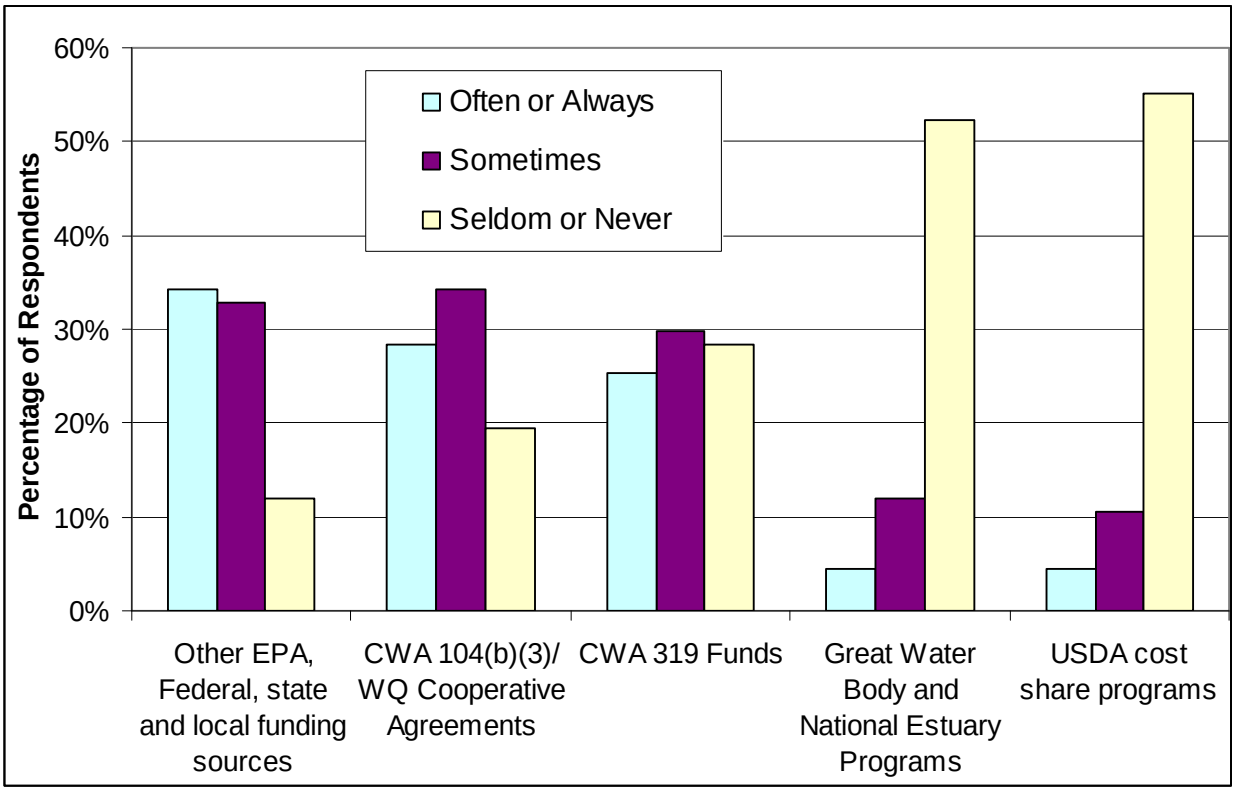
Figure 1. Availability of types of data to support TMDL development



Funding Resources

Survey and case study respondents indicated a need for greater and sustained funding to support data collection and TMDL implementation activities. The funding sources identified as most often supporting TMDL development included: Clean Water Act (CWA) 319 funds to states for implementing non-point source programs; CWA 104(b)(3) water quality cooperative agreements; and other EPA, federal, state and local sources (Figure 2). By contrast, 52% and 55% of respondents report that United States Department of Agriculture (USDA) or "Farm Bill" funding and Great Water Body funding, respectively, is seldom or never available for non-point source TMDLs.

Figure 2. Funding sources used to support TMDLs



The need for sustained funding of TMDLs and implementation has been echoed in other evaluations of the TMDL program including a review of success stories conducted by Virginia Tech University researchers (Benham et al 2006). They identified uninterrupted funding as a key element to successful TMDL implementation.

Guidance Materials

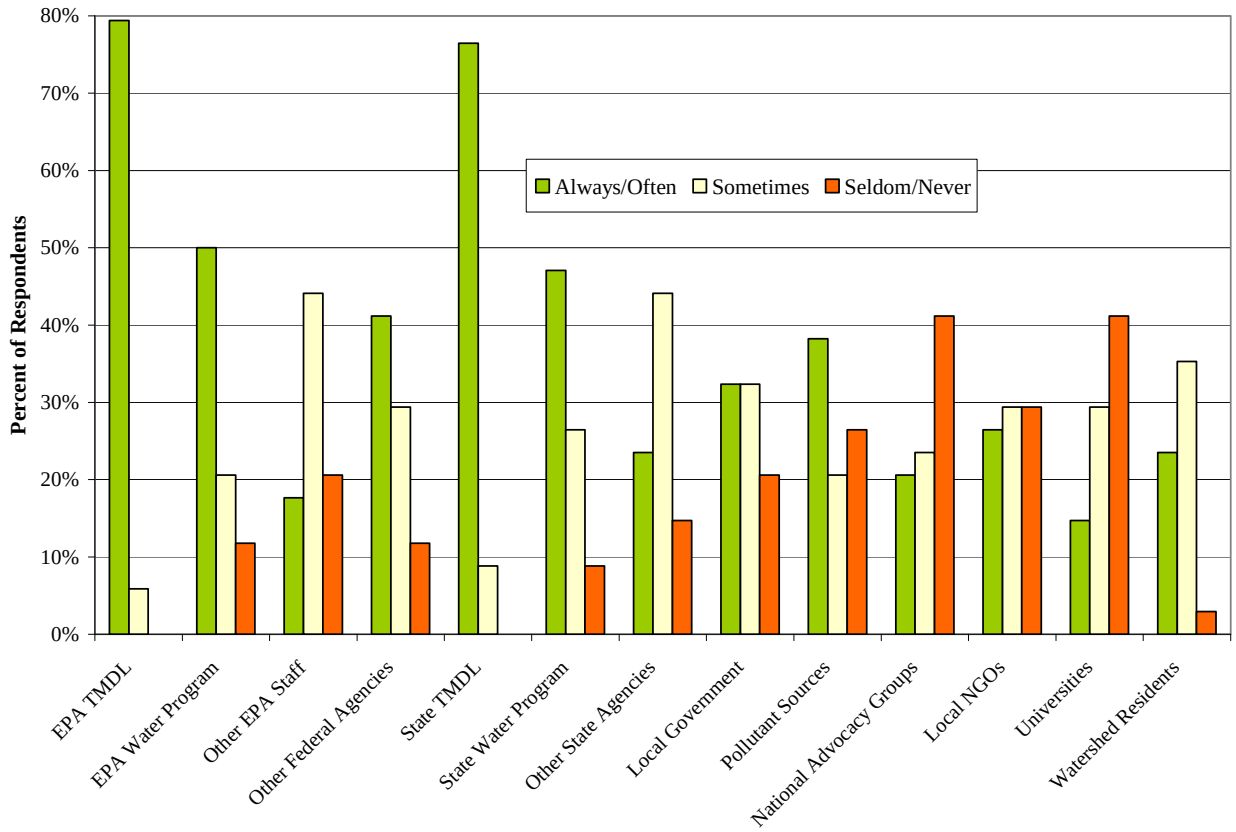
Respondents indicate that certain types of guidance materials are more useful than others. Thirty-nine percent report that adequate guidance and information on TMDL development is often or always available and an additional 25% indicate such materials are sometimes available. When differentiating between different types of guidance 51% and 49% of TMDL staff found cases studies and regional guidance documents, methodologies, and analyses often or always

useful, respectively. Overall, Regional TMDL staff report the need for guidance to address TMDL development for narrative standards for nutrients, sediment, and temperature, as well as modeling runoff from specific land uses in different types of geologic sites.

Stakeholder Involvement

Much of the analysis in this evaluation centered around stakeholder involvement and how, when and to what degree stakeholders can positively influence TMDL developmet and implementation. Stakeholders were broadly defined in this evaluation to include EPA and State TMDL staff, other EPA program staff, other Federal agencies (e.g. Natural Resources Conservation Service (NRCS), United States Forest Service (USFS), and United States Fish and Wildlife Service (USFWS)), local government agencies, pollutant sources, national and regional environmental advocacy groups, local NGOs and watershed organizations, universities, and watershed residents. More than half of staff surveyed that develop TMDLs (rather than review TMDLs for approval) view stakeholder participation as often or always having a positive impact on the development of useful, high quality TMDLs (52% of respondents). Figure 3 below presents the results of rankings by these staff of various stakeholders' positive impact on the effectiveness of the TMDL.

Figure 3. TMDL developers rank positive influence of stakeholders in development process



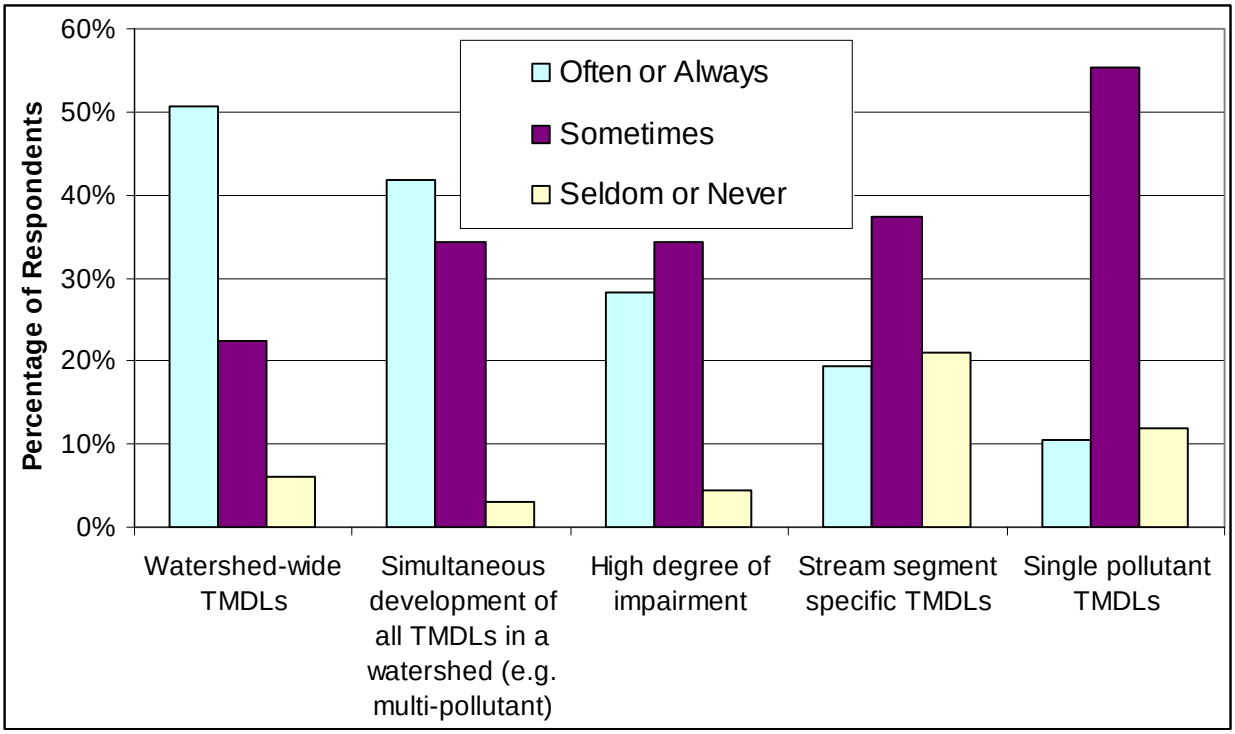
Case study interviewees indicated direct outreach to water quality decision makers at the state and local level is an important means of effecting behavioral changes and soliciting more investment in the implementation of water quality improvement projects. However, only about one-third of EPA TMDL staff report that water quality decision makers are committed to achieving water quality standards based on TMDLs or will take new actions to improve water quality. This difference in attitudes between external stakeholders to the TMDL process and internal TMDL program staff may be instructive to TMDL program staff in how they carry out TMDL development.

TMDL developers also view certain types of stakeholder involvement to be more useful than others. Survey respondents view stakeholders as often or always helpful with public outreach and implementation (66% of respondents) and in developing implementation plans (63% of respondents). However, the for more technical activities such as assembling data, monitoring, and analysis (48% of respondents), source assessments (37% of respondents), and assigning load allocations among sources (28% of respondents) stakeholder engagement is considered less useful. In contrast to EPA staff attitudes, case study interviewees indicated an interest in being involved earlier it the process, during data gathering, source assessment, and watershed characterization.

Scale and Scope of TMDLs

Certain types of TMDLs were found to be easier to engage stakeholders. Fifty-one percnt of respondents viewed watershed-wide TMDLs as often or always more likely to lead to meaningful stakeholder involvement. Surprisingly, this was a more important factor than even TMDLs involving a high degree of impairment. EPA encourages a watershed approach to water quality and developing watershed-wide TMDLs is also a much more efficient way to develop TMDLs and engage stakeholders than single stream segment TMDLs.

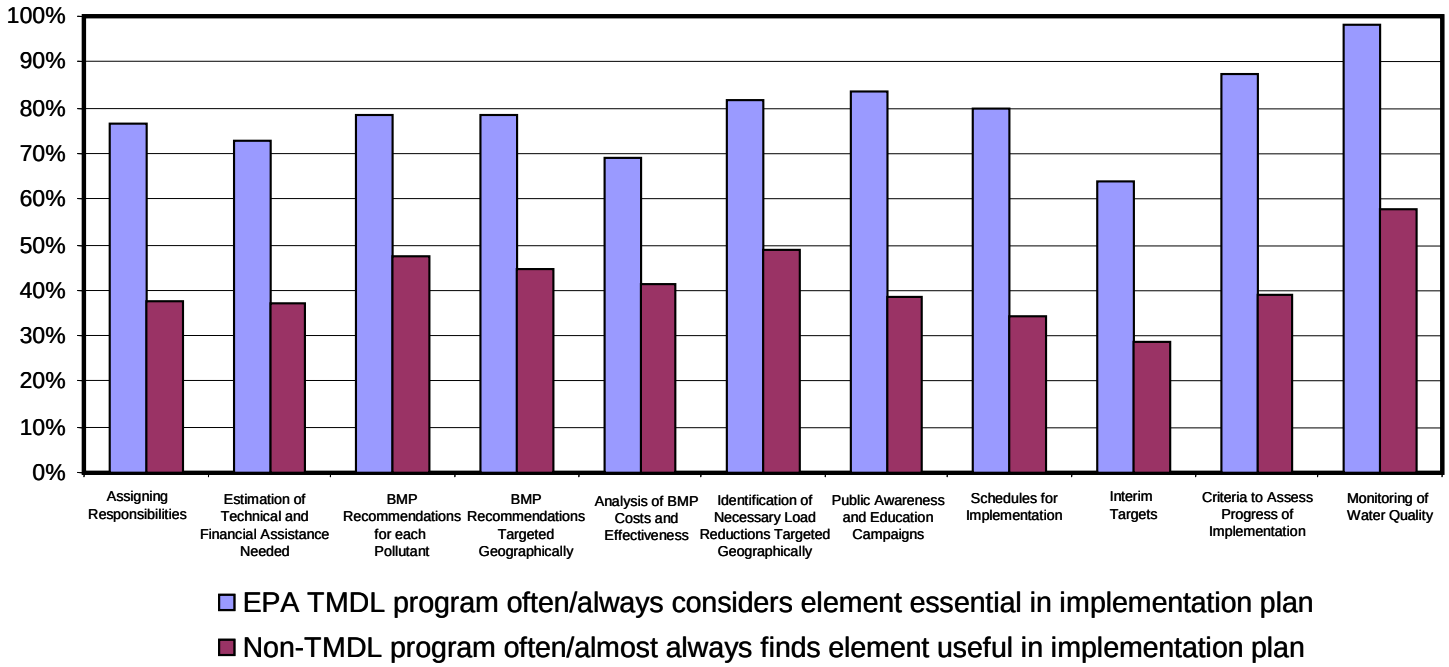
Figure 4. Extent to which different types of TMDLs lead to more meaningful stakeholder involvement



Implementation Planning

EPA lacks the legal authority to require implementation plans but does encourage there development as an effective means of achieving water quality goals. Only 37% of respondents report that TMDLs often or always have detailed implementation plans, and 46% of respondents indicate that TMDLs never or seldom have them. Implementation plans range from the very cursory or the very detailed. Both TMDL program staff and other EPA program staff were asked to rank the utility of various elements of a TMDL for effective implementation. The largest percentage of respondents from both groups considered the monitoring of water quality as often or always essential to effective TMDL implementation. The implementation plan elements ranked as 2nd, 3rd, and 4th by other program staff require adequate data to develop and speak to the need for adequate data in TMDL development. These implementation plan elements were the identification of necessary reductions targeted geographically, best management practice (BMP) recommendations by pollutant, and BMP recommendations targeted geographically, respectively. Additionally, information found in TMDLs on the compilation of source loads, pollutant reductions needed to meet water quality standards, and allocations to specific sources was found useful by staff in all of the other programs surveyed. The priorities of other EPA program staff differed from their TMDL program counterparts. However, other EPA programs are more closely tied to TMDL implementation and the target audience for TMDLs. TMDL developers should take note of their preferences.

Figure 5. TMDL implementation plan elements



Water Quality Decision Maker Understanding of TMDLs

TMDLs are implemented by many stakeholders. With the exception of the State Revolving Loan Fund (SRF) program, both EPA and state counterpart staff of each of the other programs surveyed had been involved to some degree in the development of a TMDL or TMDL implementation plan. This degree of involvement shows that communication amongst EPA programs has been adequate. However, communication to outside stakeholders may not be as effective.

Through the surveys and case studies, we hoped to identify the extent to which decision makers currently use TMDL information in their decision making and how that might be improved. Overall, less than 50% of EPA TMDL respondents reported that water quality decision makers often or always had knowledge of TMDLs, with the exception of state NPS programs that were viewed by 60% of the respondents *as often or always* understanding the TMDL program.

Some stakeholders were not viewed as active participants in the process. These include state and local planning agencies, state agricultural agencies, and USDA programs. These organizations are consistently ranked at the lower end of the scale for their knowledge of recommended activities to meet water quality standards and a demonstrated commitment to achieve water quality standards based on TMDLs (Table 1). Data from the case studies, however, underscore the importance of involving representatives from the agricultural community in the TMDL development and implementation planning process to obtain their buy-in and encourage their implementation of BMPs. In the Cottonwood Lake, Calleguas Creek, and

Middle Rio Grande TMDLs, the participation of the National Resource Conservation Service proved useful in establishing communication with agricultural producers. In the Nooksack River TMDL, the local chapter of the Washington State Dairy Federation served as a liaison with dairy farmers.

Table 1. Organizations that Often or Always Have Knowledge of Recommended Activities to Meet WQS and Those that Take New Actions to Improve WQ Based on TMDLs
Highlighting represents those organizations with the lowest rankings as identified by TMDL program staff.

Organizations that have knowledge of recommended activities to meet WQS	State Stormwater Programs 37% 1st	Permitted Stormwater Dischargers 36% 2nd	State NPS 31% 3rd	Watershed and NGOs 28% 4th	EPA Non-TMDL 25% 5th	USDA Programs 25% 5th	State/Local Planning 22% 6th	State Agriculture 19% 7th
Organizations that take new actions to improve WQ based on TMDLs	State NPS 36% 1st	State Stormwater 31% 2nd	Permitted Stormwater Discharges 26% 3rd	Watershed and NGOs 24% 4th	EPA Non-TMDL 24% 4th	State/Local Planning 14% 5th	USDA Programs 12% 6th	State Agriculture 8% 7th

CONCLUSIONS AND RECOMMENDATIONS

The TMDL program coordinates efforts across Federal, State, and local jurisdictions to achieve water quality standards in impaired water bodies. For TMDLs with significant non-point source contributions this can be very challenging because it involves working with a variety of partners at different levels of government and engaging non-point and stormwater-related sources to take voluntary action to improve water quality. This evaluation offered several recommendations to improve EPA's efforts to facilitate state development of effective TMDLs detailed below. The conclusions from this evaluation can improve how EPA and states focus their resources to encourage implementation of non-point and stormwater source TMDLs.

Data Availability

Both survey respondents and case study interviewees confirmed the need for available, quality data. To ensure that useful non-point and stormwater source TMDLs are developed and embraced by stakeholders, it is recommended that EPA and states develop strategies to increase the availability of data on runoff quality and non-point source loadings. This would likely require more comprehensive non-point source and stormwater monitoring activities by states. This improved data would facilitate the development of individual load allocations for specific non-point sources (instead of a lump allocation) and would provide an opportunity to influence the commitment and actions of such sources to improve water quality.

Funding Resources

The evaluation echoed a consistent sentiment from states that sufficient funding to develop and implement TMDLs does not exist. The evaluations recommended that EPA help broker other federal funds to support TMDL development and implementation as CWA Section 319 monies are limited. While EPA could encourage use of funds from National Estuary Program (NEP) and the great water body program for TMDL implementation, more significant resources reside with the USDA and Farm Bill agriculture money. In addition to attempting to broker other federal funds for TMDL development and implementation, the evaluation recommended that EPA Regional offices conduct an analysis of the degree to which other state and local funding sources are available to support TMDLs and broker these sources as well. EPA's recent efforts to encourage implementation of TMDL alternatives is one way of tapping into other federal agency resources for watershed restoration.

Guidance Materials

Development of these regional guidance materials and case study guidance materials is a recommendation of this evaluation. Several efforts are currently underway to develop guidance materials with case studies on subjects such as expressing TMDL endpoints as daily loads, addressing stormwater sources in TMDLs and developing watershed TMDLs.

Stakeholder Involvement

The evaluation recommends EPA develop a communications strategy for both internal and external stakeholders to facilitate TMDL development and specific implementation activities. Due to the degree of variation among TMDLs, this strategy would require targeted communication between EPA TMDL staff, other EPA program staff, their state counterparts, watershed groups and other stakeholders on a TMDL-specific basis. This approach would have the advantage of raising awareness of TMDLs among water quality decision makers as well as encouraging their direct involvement in activities being implemented to improve water quality.

Scale and Scope of TMDLs

Survey respondents' clear preference for watershed-wide TMDLs to encourage stakeholder involvement yielded a recommendation that EPA encourage development of TMDLs in this way. EPA encourages the watershed approach and is currently developing a watershed TMDL guidance document that addresses this recommendation. Watershed TMDLs are both an efficient way of developing TMDLs and a good way of engaging stakeholders since the project as a whole, and their involvement, will lead to a more meaningful and large scale result. Also, in larger scale TMDLs more resources are available for outreach.

Implementation Planning

To address the lack of EPA legal authority over the development of implementation plans, the evaluation recommends that EPA encourage development of detailed TMDLs which can be used for implementation planning. Both TMDL and other program staff stated the importance of detailed TMDLs; specifically identifying necessary reductions targeted geographically, and targeting BMP recommendations by pollutant and geographically. These detailed TMDLs can facilitate implementation when funds and a lead agency are available for

implementation. In addition, although EPA cannot mandate water quality monitoring by states, the evaluation recommends EPA encourage follow-up monitoring in implementation plans. Both implementation planning and follow-up monitoring are stressed in existing EPA guidance.

Water Quality Decision Maker Understanding of TMDLs

The evaluation recommended that EPA promote an understanding of TMDLs by water quality decision makers to engage them in implementation efforts. EPA is currently redesigning its website to make TMDL information easier to access. A greater focus on user-friendly TMDLs should make this information easy to understand by watershed groups, local government, affected home owners, and other interested parties Given the low level of confidence that agricultural and local planning organizations have knowledge of TMDLs the evaluation recommends that EPA target efforts to engage these groups. EPA is implementing this recommendation by conducting outreach to many entities including, the National Association of Counties and the National Corn Growers Association.

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