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U.S. Environmental Protection Agency

Total Maximum Daily Loads

Guidance for Water Quality-Based Decisions: The TMDL Process

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Introductory Statement

Foreword

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Chapter 1 - Introduction And Executive Summary

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The TMDL Process

Purpose and Summary

The purpose of this guidance document is to explain the programmatic elements and requirements of the TMDL process as established by section 303(d) of the Clean Water Act and by EPA's Water Quality Planning and Management Regulations (40 CFR Part 130). A TMDL, or ***total maximum daily load***, is a tool for implementing State water quality standards and is based on the relationship between pollution sources and in-stream water quality conditions. The TMDL establishes the allowable loadings or other quantifiable parameters for a waterbody and thereby provides the basis for States to establish water quality-based controls. These controls should provide the pollution reduction necessary for a waterbody to meet water quality standards.

Section 303(d) of the Act establishes the TMDL process to provide for more stringent water quality-based controls when technology-based controls are inadequate to achieve State water quality standards. When implemented according to this guidance, the TMDL process can broaden the opportunity for public participation, expedite water quality-based National Pollutant Discharge Elimination System (NPDES) permitting, and lead to technically sound and legally defensible decisions for attaining and maintaining water quality standards. In addition, the TMDL process provides a mechanism for integrating the management of both the point and nonpoint pollution sources that together may contribute to a waterbody's impairment.

Chapter Two of this guidance document provides a description of the TMDL process in the context of the water quality-based approach to pollution reductions. This approach includes the identification and priority ranking of water quality-limited waters, the targeting and scheduling of high priority waters, the development of TMDLs, and the implementation of control actions that should result in the attainment of water quality standards. Assessment for water quality standards attainment provides the information needed to identify water quality-limited waters and for the evaluation of the TMDL and control actions.

The development and implementation of the TMDL establishes the link between water quality standards assessment and water quality-based control actions. The third chapter of this document describes how a State should proceed with developing TMDLs once waters are targeted for action and then how to implement them. Special consideration is given to such issues as adequacy of data and information, how to consider nonpoint source contributions, and when to use a modified approach, called the phased approach, that results in a TMDL with special requirements. Implementation of the TMDL is discussed in terms of the mechanisms that are available to reduce both point and nonpoint loads.

The final chapter of this guidance describes the specific roles and responsibilities that the States and EPA have in implementing CWA section 303(d). EPA review and approval of lists of waters submitted by the States, the priority rankings of these waters, and the TMDLs are set forth in the Water Quality Planning and Management Regulation. This guidance presents a detailed discussion of the submission of lists and TMDLs, and the review and approval processes. The States' responsibility to involve the public in the TMDL process is also highlighted in this chapter. The value and importance of public participation is also emphasized throughout the document.

This guidance focuses on the programmatic aspects rather than the technical issues of the TMDL process. Numerous technical guidance manuals have been developed by EPA to assist States in calculating wasteload allocations (WLA). A list of these manuals can be found in Appendix A along with a description of other relevant guidance documents. A brief description of selected technical considerations can be found in Appendix D and information about EPA supported models can be found in Appendix E. The other appendices provide the reader with useful and relevant information such as descriptions of related water quality programs (Appendix B) and a general outline of an EPA/State agreement for TMDL development (Appendix F).

Policies and Principals

To achieve the water quality goals of the Clean Water Act, EPA's first objective is to ensure that technology-based controls on point sources are established and maintained. Where such controls are insufficient to attain and maintain water quality standards, water quality-based controls are required. Under the authority of section 303(d) of the Clean Water Act, EPA expects States to develop TMDLs for their water quality-limited waters where technology-based effluent limitations or other legally required pollution control mechanisms are not sufficient or stringent enough to implement the water quality standards applicable to such waters.

More intensive assessments of water quality and an evaluation of pollution sources should be conducted where water quality standard violations occur or where indications of declining water quality or habitat loss are observed. A TMDL should be developed and appropriate control actions taken on all pollution sources and follow-up monitoring should be conducted to assure that water quality standards are met. If follow-up monitoring indicates that water quality standards are not or will not be met, a revised TMDL is required.

Lack of information about certain types of pollution problems (for example, those associated with nonpoint sources or with certain toxic pollutants) should not be used as a reason to delay implementation of water quality-based controls. When developed according to a phased approach, the TMDL can be used to establish load reductions where there is impairment due to nonpoint sources or where there is a lack of data or adequate modeling. EPA regulations provide that load allocations for nonpoint sources may be based on "gross allotments" (40 CFR 130.2(g)) depending on the availability of data and appropriate techniques for predicting loads. In addition, before approving a TMDL in which some of the load reductions are allocated to nonpoint sources in lieu of additional load reductions allocated to point sources, there must be specific assurances that the nonpoint source reductions will in fact occur. Therefore, this guidance provides that in specific situations, the TMDL must include a schedule for the implementation of control mechanisms, monitoring, and assessment of standards attainment. If standards are not attained, a TMDL revision is required. Data collected through monitoring would then be useful in revising the TMDL. While this phased approach requires additional monitoring of waterbody to evaluate the effectiveness of nonpoint source management measures or more stringent effluent limitations, it does not delay the establishment of such control mechanisms where there is a lack of information.

PRINCIPLES
Biennial Submission of Lists. Every two years, States will submit their required 303(d) identification of water quality-limited waters still needing TMDLs including a priority ranking of waterbodies to EPA. These lists may be included with a State's biennial 305(b) report or as a separate report submitted at the same time as the 305(b) report.
Priority TMDLs. Along with the biennial submission of 303(d) lists, States will identify high priority waters targeted for TMDL development over the next two years.
Approach for TMDL Development. When specific criteria are met, a TMDL with additional specifications for monitoring and implementation under the phased approach should be developed to provide for immediate pollution reduction and for collection of additional information.
Implementation of Controls Based on TMDLs. States will continue to improve and maintain

point source controls through WLAs and NPDES permits while implementing and maintaining nonpoint source controls through LAs and State or local requirements.

Nonpoint Source Controls. LAs for nonpoint sources will be accompanied by a description of nonpoint source load reduction goals and the procedure for reviewing and revising nonpoint source controls. Such descriptions will be referenced in reviewing TMDLs for approval.

Time Schedule. TMDLs will be developed on a schedule negotiated with EPA Regional offices. Time schedules for the review of TMDLs will also be negotiated with EPA Regional offices, but will occur within the statutory requirement of 30 days.

Geographic Targeting. States should develop TMDLs that account for both point and nonpoint sources on a geographically targeted waterbody basis. Geographically targeted waterbodies could include segments, basins, and watersheds as defined by the States.

Threatened Good Quality Waters. States are expected to include threatened good quality waters in their identification and prioritization of waters still needing TMDLs.

Public Participation. States are expected to ensure appropriate public participation in the TMDL development and implementation process.

Environmental Indicators. States should measure the effectiveness of control actions by monitoring changes in ambient water quality or biological conditions. Measuring environmental progress or showing environmental results is a critical need and has become a key element in EPA's strategic planning process.

As required by the Clean Water Act, States are to identify and report to EPA their water quality-limited waters. These waters are to be identified according to the provisions established in EPA's Water Quality Management and Planning Regulation at 40 CFR 130.7(b). The identified waters should include those impaired due to point and nonpoint sources and may include threatened good quality waters. EPA is establishing with this guidance that States should submit to EPA, in conjunction with the 305(b) water quality assessment reports, in April of 1992, the list of water quality-limited waters that still require TMDLs. Every two years thereafter, a State should update its list of 303(d) waters and submit it with the 305(b) report. This guidance describes in detail the identification process and the specific information that should be submitted to EPA.

As required by the Clean Water Act, States are to rank by priority all waters needing TMDLs. Since each State has a unique organizational arrangement for the protection of water quality, this guidance does not prescribe how a State should set its priorities. However, priority ranking should result in the identification of targeted waterbodies for which immediate TMDL development should be undertaken. In the biennial submission of their updated list of 303(d) waters, EPA expects States to identify the waters targeted for TMDL development in the forthcoming two years.

Historically, the water quality-based pollution control program has focused on reducing the load of chemical contaminants (e.g. nutrients, biochemical oxygen demand, metals) to waterbodies. EPA has defined the terms load, loading capacity, and load allocation in regulations and technical guidance documents so that wasteload allocations can be calculated. Chemical contaminant problems will continue to constitute a major portion of pollution control efforts and the terms "load" and "load reduction" are used throughout this document. However, it is becoming increasingly apparent that in some situations water quality standards -- particularly designated uses and biocriteria -- can only be attained if non-chemical factors such as hydrology, channel morphology, and habitat are also addressed. EPA recognizes that it is appropriate to use the TMDL process to establish control measures for quantifiable non-chemical parameters that are preventing the attainment of water quality standards. Control measures, in this case, would be developed and implemented to meet a TMDL that addresses these parameters in a manner similar to chemical loads. As methods are developed to address these problems, EPA and the States will incorporate them into the TMDL process.

The principles established by EPA in this guidance reflect these policies and reaffirm the existing regulatory requirements. They are intended to help States manage their surface water quality programs in a manner consistent with the intent and requirements of section 303(d) of the CWA and the Water Quality Planning and Management Regulations in 40 CFR 130. These principles are discussed throughout this guidance.

Clean Water Act Section 303(d)

Section 303(d) of the Act (see next page) requires States to identify waters that do not or are not expected to meet applicable water quality standards with technology-based controls alone. Waters impacted by thermal discharges are also to be identified. States are required to establish a priority ranking for these waters, taking into account the pollution severity and designated uses of the waters.

Once the identification and priority ranking of water quality-limited waters are completed, States are to develop TMDLs at a level necessary to achieve the applicable State water quality standards. Completed TMDLs must allow for seasonal variations and a margin of safety that accounts for any lack of knowledge concerning the relationship between effluent limitations and water quality.

States are required to submit to EPA the "waters identified and loads established" for review and approval by EPA. If disapproved, EPA will establish the TMDLs at levels necessary to implement the applicable water quality standards. For waters that are not identified under sections 303(d)(1)(A) and (1)(B) as being water quality-limited, States are to estimate TMDLs for information purposes.

Subsections 4(A) and (B) were added to CWA section 303(d) with the 1987 amendments in order to ensure consistency with the water quality standards process for use classification and with the NPDES antibacksliding requirements.

FEDERAL WATER POLLUTION CONTROL ACT
Section 303(d)

(1)(A) Each State shall identify those waters within its boundaries for which the effluent limitations required by section 301(b)(1)(A) and section 301(b)(1)(B) are not stringent enough to implement any water quality standard applicable to such waters. The State shall establish a priority ranking for such waters, taking into account the severity of the pollution and the uses to be made of such waters.

(B) Each State shall identify those waters or parts thereof within its boundaries for which controls on thermal discharges under section 301 are not stringent enough to assure protection and propagation of a balanced indigenous population of shellfish, fish, and wildlife.

(C) Each State shall establish for the waters identified in paragraph (1)(A) of this subsection, and in accordance with the priority ranking, the total maximum daily load, for those pollutants which the Administrator identifies under section 304(a)(2) as suitable for such calculation. Such load shall be established 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.

(D) Each State shall estimate for the waters identified in paragraph (1)(B) of this subsection the total maximum daily thermal load required to assure protection and propagation of a balanced, indigenous population of shellfish, fish and wildlife. Such estimates shall take into account the normal water temperatures, flow rates, seasonal variations, existing sources of heat input, and the dissipative capacity of the identified waters or parts thereof. Such estimates shall include a calculation of the maximum heat input that can be made into each such part and shall include a margin of safety which takes into account any lack of knowledge concerning the development of thermal water

quality criteria for such protection and propagation in the identified waters or parts thereof.

(2) Each State shall submit to the Administrator from time to time, with the first such submission not later than one hundred and eighty days after the date of publication of the first identification of pollutants under section 304(a)(2)(D), for his approval the waters identified and the loads established under paragraphs (1)(A), (1)(B), (1)(C), and (1)(D) of this subsection. The Administrator shall either approve or disapprove such identification and load not later than thirty days after the date of submission. If the Administrator approves such identification and load, such State shall incorporate them into its current plan under subsection (e) of this section. If the Administrator disapproves such identification and load, he shall not later than thirty days after the date of such disapproval identify such waters in such State and establish such loads for such waters as he determines necessary to implement the water quality standards applicable to such waters and upon such identification and establishment the State shall incorporate them into its current plan under subsection (e) of this section.

(3) For the specific purpose of developing information, each State shall identify all waters within its boundaries which it has not identified under paragraph (1)(A) and (1)(B) of this subsection and estimate for such waters the total maximum daily load with seasonal variations and margins of safety, for those pollutants which the Administrator identifies under section 304(a)(2) as suitable for such calculation and for thermal discharges, at a level that would assure protection and propagation of a balanced indigenous population of fish, shellfish and wildlife.

(4) LIMITATIONS ON REVISION OF CERTAIN EFFLUENT LIMITATIONS.--

(A) STANDARD NOT ATTAINED.--For waters identified under paragraph (1)(A) where the applicable water quality standard has not yet been attained, any effluent limitation based on a total maximum daily load or other waste load allocation established under this section may be revised only if (i) the cumulative effect of all such revised effluent limitations based on such total maximum daily load or waste load allocation will assure the attainment of such water quality standard, or (ii) the designated use which is not being attained is removed in accordance with regulations established under this section.

(B) STANDARD ATTAINED.--For waters identified under paragraph (1)(A) where the quality of such waters equals or exceeds levels necessary to protect the designated use for such waters or otherwise required by applicable water quality standard, any effluent limitation based on a total maximum daily load or other waste load allocation established under this section, or any water quality standard established under this section, or any other permitting standard may be revised only if such revision is subject to and consistent with the antidegradation policy established under this section.

Water Quality Planning and Management Regulation

EPA's Water Quality Planning and Management Regulation at 40 CFR Part 130 establishes the program and policies that implement CWA section 303(d) requirements. Section 130.7 describes the TMDL process and the State's responsibility for identifying waters still requiring TMDLs, setting priorities and developing TMDLs, submitting the waters identified with priority rankings and the TMDLs to EPA for approval, and the incorporation of the TMDLs into the State's Water Quality Management Plan.

To implement the program, the regulation establishes the following definitions for loading capacity, load allocation, wasteload allocation, total maximum daily load, water quality-limited segments and water quality-limited segments still requiring TMDLs. A definition for margin of safety (MOS) is also provided.

Loading capacity (LC) -- The greatest amount of loading that a water can receive without violating water quality standards. (40 CFR 130.2(f))

Load allocation (LA) -- The portion of a receiving water's loading capacity that is attributed either to one of its existing or future nonpoint sources of pollution or to natural background sources. Load allocations are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading. Wherever possible, natural and nonpoint source loads should be distinguished. (40 CFR 130.2(g))

Wasteload allocation (WLA) -- The portion of a receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. WLAs constitute a type of water quality-based effluent limitation. (40 CFR 130.2(h))

Total maximum daily load (TMDL) -- The sum of the individual WLAs for point sources and LAs for nonpoint sources and natural background. If a receiving water has only one point source discharger, the TMDL is the sum of that point source WLA plus the LAs for any nonpoint sources of pollution and natural background sources, tributaries, or adjacent segments. TMDLs can be expressed in terms of either mass per time, toxicity, or other appropriate measure that relate to a State's water quality standard. If Best Management Practices (BMPs) or other nonpoint source pollution control actions make more stringent load allocations practicable, then WLAs can be made less stringent. Thus, the TMDL process provides for nonpoint source control tradeoffs. (40 CFR 130.2(i))

In practice, the terms TMDL and WLA have at times been incorrectly used interchangeably instead of considering both LA and WLA as components of a TMDL. A TMDL, as referenced in this guidance, includes both WLAs and LAs, established in accordance with EPA's regulations.

Water quality-limited segments -- Those water segments that do not or are not expected to meet applicable water quality standards even after the application of technology-based effluent limitations required by sections 301(b) and 306 of the Act. (40 CFR 130.2(j)) Technology-based controls include, but are not limited to, best practicable control technology currently available (BPT) and secondary treatment.

Water quality-limited segments still requiring TMDLs -- Segments identified through a process established by paragraph 130.7(b)(1) of EPA's Water Quality Planning and Management Regulation. Waters need TMDLs when certain specified pollution reduction requirements (identified in the regulation under subparagraphs (b)(1)(i), (ii), and (iii)) are not stringent enough to implement water quality standards for such waters. The specified pollution controls include technology-based effluent limitations required by sections 301(b) and 306 of the Clean Water Act and other appropriate requirements that can provide a more stringent level of treatment than federally-required technology-based effluent limitations. (40 CFR 130.7 (b)(1))

This document contains the terms 303(d) waters and 303(d) lists. These waters (and waters on the 303(d) lists) are those water quality-limited segments that still require TMDLs as defined by the regulation. Thus, a water segment that meets its water quality standards after the implementation of water quality-based control actions would retain its water quality-limited status but would no longer be on a State's 303(d) list of waters still requiring TMDLs.

Margin of Safety (MOS) -- A required component of the TMDL that accounts for the uncertainty about the relationship between the pollutant loads and the quality of the receiving waterbody. (CWA section 303(d)(1)(C)) The MOS is normally incorporated into the conservative assumptions used to develop TMDLs (generally within the calculations or models) and approved by EPA either individually or in State/EPA agreements. If the MOS needs to be larger than that which is allowed through the conservative assumptions, additional MOS can be added as a separate component of the TMDL (in this case, quantitatively, a TMDL = LC = WLA + LA + MOS).

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Chapter 2 - The Water Quality-Based Approach To Pollution Control

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Guidance for Water Quality-Based Decisions:
The TMDL Process

The Water Quality Planning and Management Regulation (40 CFR 130) links a number of Clean Water Act sections, including section 303(d), to form the water quality-based approach to protecting and cleaning up the nation's waters (diagrammed in Figure 1). This chapter describes the overall approach for the development of TMDLs and subsequent implementation of water quality-based point and nonpoint source pollution control measures based on water quality standards. Other related guidance on various aspects of the water quality-based approach are described in Appendix A.

The water quality-based approach emphasizes the overall quality of water within a waterbody and provides a mechanism through which the amount of pollution entering a waterbody is controlled based on the intrinsic conditions of that body of water and the standards set to protect it. This approach begins with the determination of waters not meeting (or not expected to meet) water quality standards after the implementation of technology-based controls (such as BPT and secondary treatment). Waters identified through this process are considered water quality-limited and must be prioritized. An overall plan to manage the excess pollutants in each waterbody can then be developed. The necessary limitations on the introduction of pollutants to the waterbody are identified through the development of a TMDL under section 303(d).

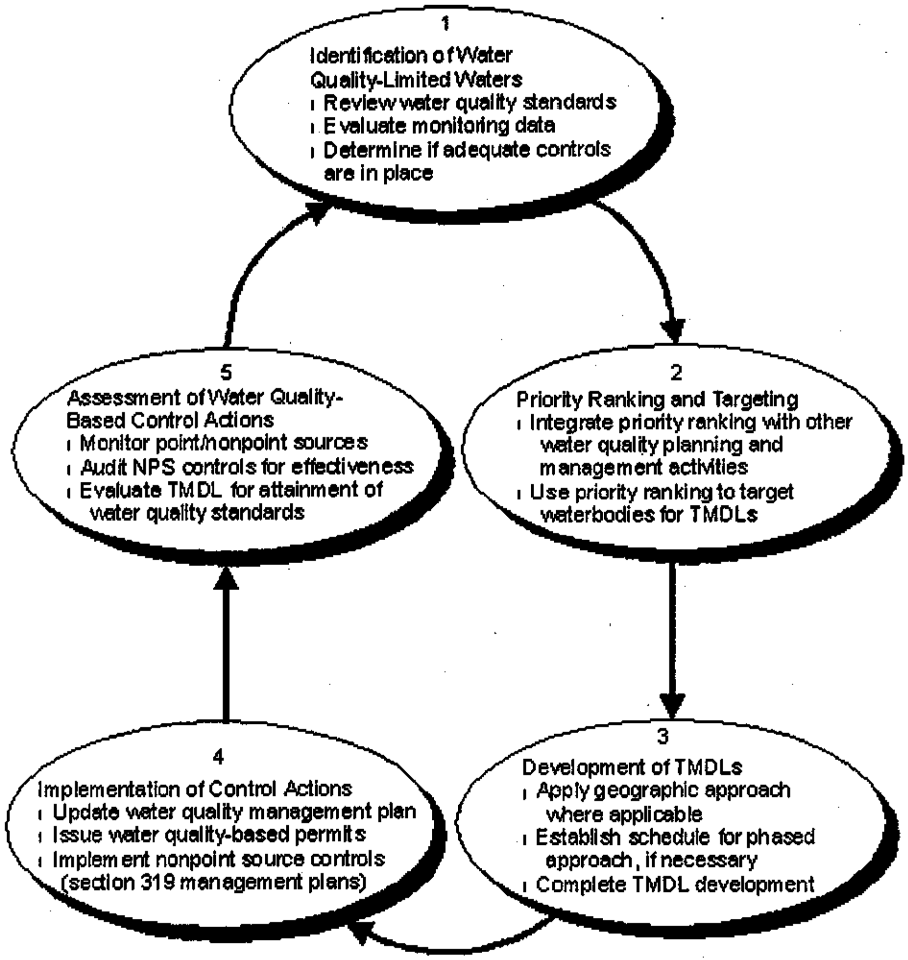
Previous practices for implementing 303(d) have focused primarily on point sources and wasteload allocations (WLA). All water quality-based permit limits are based on a WLA. The WLA is either reviewed individually by EPA or where there exists a State/EPA technical agreement, is developed consistent with that agreement.[1] In recent years nonpoint source contributions to water quality problems have become better understood and it is now clear that EPA and State implementation of 303(d) must encompass nonpoint source pollution problems and seek to address problems occurring over large geographic areas. As a consequence, this document describes a more rigorous process for implementing 303(d) and reinforces the need to develop TMDLs that include load allocations (LA) as well as wasteload allocations.

As shown in Figure 1, the water quality-based approach contains the following steps:

1. Identification of water quality-limited waters still requiring TMDLs.
2. Priority ranking and targeting.
3. TMDL development.
4. Implementation of control actions.
5. Assessment of water quality-based control actions

Steps 1, 2, and 3 are addressed by the CWA in section 303(d). Steps 4 and 5 are integral parts of the process and are briefly described in this document.

States are to review and revise water quality standards, as necessary, every three years and NPDES permits are to be re-evaluated and issued every five years. The water quality-based approach links these two processes and is, therefore, an ongoing process of evaluation and modification. In addition to standards and permits revisions, section 319(b) nonpoint source (NPS) management plans can and should be continually updated as well.



Step One: Identification of Water Quality-Limited Waters

The water quality-based approach to pollution control begins with the identification of problem waterbodies. State water quality standards form the basis and "yardstick" by which States can assess the waterbody status and implement needed pollution controls. State water quality standards include three elements: designated uses for the waterbody, criteria (physical, chemical, and biological) to protect the designated uses, and an antidegradation statement. States need to identify those waters not meeting any one of these components of water quality standards.

EPA's Water Quality Planning and Management Regulation establishes the process for identifying water quality-limited segments still requiring TMDLs. Waters require TMDLs when certain pollution control requirements (see box) are not stringent enough to implement water quality standards for such waters.

Identifying Waters Still Requiring TMDLs: 40 CFR 130.7(b)

(b)(1) Each State shall identify those water quality segments still requiring WLAs/LAs and TMDLs within its boundaries for which:

(i) Technology-based effluent limitations required by sections 301 (b), 306, 307, or other sections of the act;

(ii) More stringent effluent limitations (including prohibitions) required by either State or local authority preserved by section 510 of the Act, or Federal authority (e.g., law, regulation, or treaty); and

(iii) Other pollution control requirements (e.g., best management practices) required by local, State, or Federal authority

are not stringent enough to implement any water quality standard applicable to such waters.

The most widely applied water pollution controls are the technology-based effluent limitations required by section 301(b) and 306 of the Clean Water Act. In some cases, a State or local authority may establish enforceable requirements beyond technology-based controls. Examples of such requirements may be those that (1) provide more stringent NPDES permit limitations to protect a valuable water resource or (2) provide for the management of certain types of nonpoint source pollution.

To exempt a water quality-limited water from the TMDL process, the pollution control requirements cited in the regulation under 130.7(b)(i),(ii), and (iii) (see box) must be established and enforced by Federal, State, or local laws or regulations and be stringent enough that, when applied, the receiving waterbody will meet water quality standards. These requirements must also be specifically applicable to the particular water quality problem and, if not yet implemented, a schedule for the timely implementation of such requirements must be established. Chapter 4 contains more specific requirements pertaining to identification of water quality-limited waters still requiring TMDLs (see Chapter 4).

Identification of threatened good quality waters is an important part of this approach. Adequate control of new discharges from either point or nonpoint sources should be a high priority for States to maintain the existing use or uses of these waterbodies. In the identification of threatened waters it is important that the 303(d) process consider the water quality standards program to ensure that a State's antidegradation policies as established in State law are followed.

By identifying threatened good quality waters, States take a more proactive, "pollution prevention" approach to water quality management (see box).

Pollution Prevention Advantages

Consistent with 40 CFR 130.7 (c)(1)(ii) which requires that TMDLs be established for all pollutants that prevent or are expected to prevent water quality standards from being achieved.

Encourages States to maintain and protect existing water quality.

Easier and less costly in the long term to prevent impairments rather than retrofit controls to clean up pollution problems.

Meets EPA objectives to support the State's collection of data on impacted or threatened waters.

Each State may have different methods for identifying and compiling information on the status of its waterbodies depending on its specific programmatic or cross-programmatic needs and organizational arrangements. Typically, States utilize both existing information and new data collected from ongoing monitoring programs to assess whether water quality standards are being met, and to detect trends.

States assess their waters for a variety of purposes, including the targeting of cleanup activities, assessing the extent of contamination at potential Superfund sites, and for meeting federally mandated reporting requirements. While the identification of water quality-limited waters may appear to be a major task for the States, a significant amount of this work has already begun or has been completed under sections 305(b), 304(l), 314(a), and 319(a) of the Clean Water Act as amended in 1987. (Appendix B provides a summary of these supporting CWA programs.)

Section 305(b) requires States to prepare a water quality inventory every two years to document the status of waterbodies that have been assessed. Under section 304(l), States identified all surface waters adversely affected by toxic (65 classes of compounds), conventional (such as BOD, total suspended solids, fecal coliform, and oil and grease), and nonconventional (such as ammonia, chlorine, and iron) pollutants from both point and nonpoint sources. Under section 314(a), States identified a list of publicly owned lakes for which uses are known to be impaired by point and nonpoint sources. Section 319 State Assessment Reports identified waters adversely affected by nonpoint sources of pollution. Lists prepared to satisfy requirements under section 305(b), 304(l), 314(a) and 319 should be very useful in preparing 303(d) lists.

Other existing and readily available data and information sources should be utilized in preparing section 303 (d) lists. See, for example, Appendix C, which presents screening categories similar to those found in current regulations promulgating the 304(l) requirements.[2] Figure C-1 in the Appendix depicts a sample process for identifying 303(d) waters. Other data sources are listed as an appendix of the **Final Guidance for Implementation of Requirements Under Section 304(l) of the Clean Water Act as Amended**, March 1988. The Toxic Chemical Release Inventory (TRI) developed under Title III, Superfund and Reauthorization Act (SARA) is an important information source as well as any relevant State-run database.

Section 303(d) requires States to identify those water quality-limited waters needing TMDLs. States should regularly update their lists of waters (or the databases which store the information to produce the lists) as assessments are made and report these lists to EPA once every two years. States should include, in their biennial 303(d) lists, information on which waterbodies have been added or deleted from the list and which waterbodies were assessed since the last reporting period. (See Chapter 4 for further details on submission of lists to EPA.)

Step Two:Priority Ranking and Targeting

Once waters needing additional controls have been identified, a State prioritizes its list of waters using established ranking processes that should consider all water pollution control activities within the State. Priority ranking has traditionally been a process defined by the State and may vary in complexity and design. A priority ranking should enable the State to make efficient use of its available resources and meet the objectives of the Clean Water Act.

The Clean Water Act states that the priority ranking for such waters must take into account the severity of the pollution and the uses to be made of such waters. Several documents (see box) are available from EPA to assist States in priority setting.

Priority Setting Documents
Setting Priorities: The Key to Nonpoint Source Control (OWRS, July 1987).
Selecting Priority Nonpoint Source Projects: You Better Shop Around (OW and OPPE, August 1989, EPA 506/2-89/003).
The Lake and Resevoir Restoration and Guidance Manual, First Edition (OWRS, EPA 440/5-88-002).
The Lake and Reservoir Restoration and Guidance Manual, Second Edition (OWRS, EPA 440/4-90-006).
State clean Water Strategies: Meeting the Challenges for the Future (OW, December 1988).

According to EPA's State Clean Water Strategy document: "Where all water quality problems cannot be addressed immediately, EPA and the States will, using multi-year approaches, set priorities and direct efforts and resources to maximize environmental benefits by dealing with the most serious water quality problems and the most valuable and threatened resources first."

Targeting high priority waters for TMDL development should reflect an evaluation of the relative value and benefit of waterbodies within the State and take into consideration the following:

- Risk to human health and aquatic life.
- Degree of public interest and support.
- Recreational, economic, and aesthetic importance of a particular waterbody.
- Vulnerability or fragility of a particular waterbody as an aquatic habitat.
- Immediate programmatic needs such as wasteload allocations needed for permits that are coming up for revisions or for new or expanding discharges, or load allocations for needed BMPs.
- Waters and pollution problems identified during the development of the section 304(l) "long list."
- Court orders and decisions relating to water quality.
- National policies and priorities such as those identified in EPA's Annual Operating Guidance.

States are required to submit their priority rankings to EPA for review. EPA expects all waters needing TMDLs to be ranked, with "high" priority waters -- targeted for TMDL development within two years following the listing process -- identified. (See Chapter 4 for further details on submission of priorities to EPA.)

In order to effectively develop and implement TMDLs for all waters identified, States should establish multi-year schedules that take into consideration the immediate TMDL development for targeted waterbodies and the long-range planning for addressing all water quality-limited waters still requiring TMDLs. While it would be expected that these schedules would change when a State's priorities change in response to "hot spots" or critical situations at any given time, a long-range schedule provides several advantages to a State (see box).

Advantages to Long-range Schedules
• Encourages integration with the permitting cycle, the water quality standards revisions, and other required water quality management activities.
• Allows for long-term monitoring which may be needed to assess control action.
• Sets consistency in developing TMDLs.
• Establishes a basis for setting overall water quality management priorities.
• Supports a geopgraphic approach for TMDL development for targeted waterbodies.

Step Three: TMDL Development

For a water quality-limited water that still requires a TMDL, a State must establish a TMDL that quantifies pollutant sources and allocates allowable loads to the contributing point and nonpoint sources so that the water quality standards are attained for that waterbody. The development of TMDLs should be accomplished by setting priorities, considering the geographic area impacted by the pollution problem, and, in some cases, using a phased approach to establishing control measures based on the TMDL.

The TMDL is developed using one or a combination of three technical approaches to protect receiving water quality: the chemical specific approach, the whole effluent toxicity approach, and the biocriteria/bioassessment approach. The chemical specific approach is one where loadings are evaluated in terms of the impact on physical-chemical water quality conditions (e.g., dissolved oxygen or toxicant concentrations). While an integrated approach that considers all three techniques is preferred for the protection of aquatic life, the chemical specific approach is usually the one used to address loads that affect those water quality standards which protect human health.

Many water pollution concerns are area-wide phenomena that are caused by multiple dischargers, multiple pollutants (with potential synergistic and additive effects), or nonpoint sources. Atmospheric deposition and ground water discharge may also result in significant pollutant loadings to surface waters. As a result, EPA recommends that States develop TMDLs on a geographical basis (e.g., by watershed) in order to efficiently and effectively manage the quality of surface waters.

The TMDL process is a rational method for weighing the competing pollution concerns and developing an integrated pollution reduction strategy for point and nonpoint sources. The TMDL process allows States to take a holistic view of their water quality problems from the perspective of instream conditions. Although States may define a waterbody to correspond with their current programs, it is expected that States will consider the extent of pollution problems and sources when defining the geographic area for developing TMDLs. In general, the geographical approach for TMDL development supports sound environmental management and efficient use of limited water quality program resources. In cases where TMDLs are developed on watershed levels, States should consider modifying permitting cycles so that all permits in a given watershed expire at the same time.

For traditional water pollution problems, such as dissolved oxygen depletion and nutrient enrichment, there are well validated models that can predict effects with known levels of uncertainty. This is not true for such non-traditional pollution problems as urban stormwater runoff and pollutants that involve sediment and bioaccumulative pathways. Predictive modeling for these problems therefore uses conservative assumptions, but in many cases the degree of certainty cannot be well quantified until more data becomes available to develop sensitivity analyses and model comparisons. For TMDLs involving these non-traditional problems, the margins of safety should be increased and additional monitoring required to verify attainment of water quality standards and provide data needed to recalculate the TMDL, if necessary.

EPA regulations provide that load allocations for nonpoint sources and/or natural background "are best estimates of the loading which may range from reasonably accurate estimates to gross allotments...".[3] A phased approach to developing TMDLs may be appropriate where estimates are based on limited information. The phased approach is a TMDL that includes monitoring requirements and a schedule for re-assessing TMDL allocations to ensure attainment of water quality standards. Uncertainties that cannot be quantified may also exist for certain pollutants discharged primarily by point sources. In such situations a large margin of safety and follow-up monitoring is appropriate.

Where nonpoint source controls are involved, the phased approach is also necessary. Under the CWA, the only federally enforceable controls are those for point sources through the NPDES permitting process. In order to allocate loads among both nonpoint and point sources, there must be reasonable assurances that nonpoint source reduction will in fact be achieved. Where there are not reasonable assurances, under the CWA, the entire load reduction must be assigned to point sources. With the phased approach, the TMDL includes a description of the implementation mechanisms and the schedule for the implementation of nonpoint source control measures.

By pursuing the phased approach where applicable, a State can move forward to implement water quality-based control measures and adopt an explicit schedule for implementation and assessment. States can also use the phased approach to address a greater number of waterbodies including threatened waters or watersheds which would otherwise not be managed. Specific requirements relating to the phased approach are discussed in Chapter 3.

Step Four:Implementation of Control Actions

Once a TMDL or a phased TMDL has been established for a waterbody (or watershed) and the appropriate source loads developed, implementation of control actions should proceed. The State or EPA is responsible for implementation, the first step being to update the water quality management plan. Next, point and nonpoint source controls should be implemented to meet wasteload allocations and load allocations, respectively. Various pollution allocation schemes (i.e., determination of allowable pollution among different pollution sources in the same waterbody) can be employed by States to optimize alternative point and nonpoint source management strategies.

The NPDES permitting process is used to limit effluent from point sources. Chapter 3 provides a more complete description of the NPDES process and how it fits into the water quality-based approach to permitting. Construction decisions regarding publicly owned treatment works (POTWs) and advanced treatment facilities must also be based on the most stringent of technology-based or water quality-based limitations. These decisions should be coordinated so that the facility plan for the discharge is consistent with the limitations in the permit.

In the case of nonpoint sources, both State and local laws may authorize the implementation of nonpoint source controls such as the installation of Best Management Practices (BMPs). Section 319 State management programs can be a useful tool to implement nonpoint source control measures and ensure improved water quality. Many BMPs, however, may be implemented even where regulatory programs do not exist. In such cases, a State needs to document the coordination which may be necessary among State and local agencies, landowners, operators, and managers and then evaluate BMP implementation, maintenance, and overall effectiveness to ensure that load allocations are achieved. Chapter 3 discusses some of the technical issues associated with implementation of nonpoint source control measures.

Step Five:Assessment of Water Quality-Based Control Actions

Throughout the previous four steps, monitoring is a crucial element of water quality-based decision making. In this step, monitoring provides data for an independent evaluation of whether the TMDL and control actions that are based on the TMDL protect or improve the environment and are sufficient to meet changing waterbody protection requirements such as revised water quality standards or changing pollution sources (e.g., urbanization).

Monitoring programs often begin with baseline monitoring. Such monitoring should not be regarded as a prerequisite to implementing control measures for a waterbody. If monitoring has not yet begun, control measures and monitoring should be implemented simultaneously to assure that pollution abatement activities are not delayed.

In the case of point sources, assessments are facilitated in that dischargers are required to provide reports on compliance with NPDES permit limits. In some instances, dischargers may also be required in the permit to assess impact of their discharge on the receiving water. A monitoring requirement can be put into the permit as a special condition as long as the information is collected for purposes of writing a permit limit. States are also encouraged to use innovative monitoring programs (e.g., cooperative monitoring[4] and volunteer monitoring[5]) to provide for adequate point and nonpoint source monitoring coverage.

States should also ensure that effective monitoring programs are in place for evaluating nonpoint source control measures. EPA recognizes monitoring as a high priority activity in a State's nonpoint source management program. [6] To facilitate the implementation and evaluation of NPS controls States should consult current guidance. [7] [8]

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1 -- USEPA. 1985. Guidance for State Water Monitoring and Wasteload Allocation Program. OW/OWRS, EPA 440/4-85-031. Washington D.C. Back

2 -- 40 CFR 130.10 (d)(6) Back.

3 -- 40 CFR 130.2(g) Back

4 -- USEPA. 1984. Planning and Managing Cooperative Monitoring Projects. OW/OWRS. EPA 440/4-84-018. Washington D.C. Back

5 -- USEPA. 1990. Volunteer Water Monitoring: A Guide for State Managers. OW, EPA 440/4-90-010. Washington D.C. Back

6 -- 55 FR 3563, August 28, 1990 Back

7 -- USEPA. February, 1988. Draft Nonpoint Source Monitoring and Evaluation Guide. OW/NPS Branch. Washington D.C. Back

8 -- USEPA. September 19, 1989. Nonpoint Source Monitoring and Reporting Requirements for Watershed Implementation Grants. OW/NPS Branch. Washington D.C. Back

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Appendix A - Relationship To Other Guidance

Guidance for Water Quality-Based Decisions: The TMDL Process

Monitoring Guidance

The Clean Water Act specifies that States and Interstate Agencies, in cooperation with EPA, establish water quality monitoring systems necessary to review and revise water quality standards, calculate TMDLs, assess compliance with permits, and report on conditions and trends in ambient waters. EPA's current program guidance [21] discusses the programmatic relationships of monitoring as an information collection tool for many program needs. NPS pollution concerns are discussed in draft guidance along with some means to monitor and evaluate NPSs. [22] Revised Monitoring Program Guidance is planned for FY 1991.

Cooperative Monitoring/Citizen Volunteer Monitoring Guidance

Cooperative monitoring involves shared efforts by individuals or groups in assessing water quality conditions. Cooperative arrangements are encouraged by the Clean Water Act as referenced in section 104. Cooperative monitoring projects require careful planning and strong management controls. Current guidance [23] [24] describes the factors to be considered in designing and implementing cooperative and volunteer monitoring projects so that specific provisions are made for the collection and analysis of scientifically valid water quality data, and so that the State water pollution control agencies have the necessary information for final review and approval of all projects.

Cooperative monitoring projects can serve the same usefulness as other monitoring studies; however, they also provide a mechanism to maximize limited resources. In addition to "tapping" additional resources for monitoring, there are other incentives for States and the regulated community to cooperate, such as having more site-specific data from which to develop site-specific, scientifically-based water quality criteria.

Citizen volunteer monitoring involves identifying sources of pollution, tracking the progress of protection and restoration projects, and/or reporting special events such as fish kills and storm damage. For more information on citizen monitoring programs, contact the EPA Office of Water Regulations and Standards (OWRS), Monitoring Branch at 202/382-7056.

Wasteload Allocation Technical Guidance

Technical guidance manuals prepared by EPA explain how to prepare wasteload allocations (WLAs). These manuals are listed at the right. Those available can be obtained from the OWRS Monitoring Branch at 202/382-7056.

Technical Support Document for Water Quality-based Toxics Control

The Technical Support Document (TSD) for Water Quality-based Toxics Control [25] presents recommendations to regulatory authorities when they are faced with the task of controlling the discharge of toxic pollutants to the nation's waters. Included in this document are detailed discussions on EPA's recommended criteria for whole effluent toxicity, a screening analysis methodology for effluent characterization, human health risk assessment, the use of exposure assessments for wasteload allocations, and the development of permit requirements and compliance monitoring. The TSD provides guidance for assessing and regulating the discharge of toxic substances. It supports EPA's initiative to control toxic pollution by involving the application of biological and chemical assessment techniques and proposes solutions to complex and site-specific pollution problems. Information on this document can be obtained from EPA's Water Quality and Industrial Permits Branch at 202/475-9537.

Technical Guidance Manuals for Performing Wasteload Allocations	
Book Title	
I.General Guidance	
II.Streams and Rivers	• Biochemical Oxygen Demand/Dissolved Oxygen • Nutrient/Eutrophication • Toxic Substances • Simplified Analytical Method for Determining NPDES Effluent Limitations for POTWs Discharging into Low-Flow Streams
III.Estuaries	• Estuaries and Wasteload Allocation Models • Application of Estuarine Waste Load Allocation Models • Use of Mixing Zone Models in Estuarine Waste Load Allocations* • Critical Review of Estuarine Waste Load Allocation Modeling*
IV.Lakes and Impoundments	• Biochemical Oxygen Demand/Dissolved Oxygen • Nutrient/Eutrophication • Toxic Substances
V.Technical Support Document for Water Quality-Base Toxics Control	
VI.Design Conditions	• Design Flow • Design Temperature, pH, Hardness, and Alkalinity
VII.Permit Averaging	
VIII.Screening Manual	• Biochemical Oxygen Demand/Dissolved Oxygen • Toxic Organics • Toxic Metals • Nutrients/Eutrophication
IX.Innovative Wasteload Allocations*	

**** not yet available***

Permit Writers Guidance

The Permit Writer's Guide to Water Quality-based Permitting For Toxic Pollutants[26] provides State and Federal NPDES permit writers and water quality management staff with a reference on water quality-based permit issuance procedures. This guidance presents fundamental concepts and procedures in detail and refers to more advanced toxics control procedures, such as dynamic modeling of complex discharge situations, which may not yet be incorporated into many State programs. The guidance explains aspects of water quality-based toxics control in terms of what a permit writer currently needs to know to issue a water quality-based toxics control NPDES permit.

The NPDES permits program is now focused on control of toxic pollutants and the guidance document is directed at supporting these control efforts. Water quality problems related to conventional pollutants, such as those associated with point source contributions to oxygen depletion, are addressed in other guidance documents.

The Permit Writer's guide addresses three areas of toxic effects: aquatic life, human health, and the bioaccumulation of specific chemicals. Each effect must be dealt with on an individual basis using available data and tools. This guidance also catalogues the principal procedures and tools available.

The guidance supports an integrated toxics control strategy using both whole effluent toxicity-based assessment procedures and pollutant-specific assessment procedures. Both procedures are needed to enforce State water quality standards.

Nonpoint Source Guidance

Section 319 of the Clean Water Act establishes direction and financial assistance for the implementation of State NPS programs. NPS guidance [27] encourages States to develop State Clean Water Strategies for integrating and unifying the States' approach to water quality protection and clean-up. Three steps are identified for this process: comprehensive assessment of impaired or threatened waters, targeted protection of waters, and development of strategic management plans. States are to develop NPS programs which build upon related programs (e.g., Clean Lakes, National Estuaries, Stormwater Permits, Ground Water, Toxics Controls, State Revolving Funds, and Wetlands) and to coordinate their efforts with other federal agencies.

The 1987 amendments to the CWA include provisions to encourage States to accelerate efforts to control nonpoint source pollution. The amendments require States to prepare a Nonpoint Source Assessment Report and a 4-year Management Program. Funds are provided to assist the States in implementing these programs. Information on this guidance can be obtained from EPA's Nonpoint Source Control Branch at 202/260-7085.

21.USEPA. 1985. Guidance for State Water Monitoring and Wasteload Allocation Programs. OW/OWRS, EPA 440/4-85-031. Washington, D.C.Back.

22.USEPA. 1987. Draft Nonpoint Source Monitoring and Evaluation Guide. OW/OWRS, EPA. Washington, D.C. Back.

23.USEPA. 1984. Planning and Managing Cooperative Monitoring Projects. OW/OWRS, EPA 440/4-84-018. Washington, D.C. Back.

24.USEPA. 1990. Volunteer Water Monitoring: A Guide for State Managers. OW, EPA 440/4-90-010. Washington, D.C. Back.

25.USEPA. 1985. Technical Support Document for Water Quality-based Toxics Control. OW/OWRS and OWEP, EPA 440/4-85 Washington, D.C. A revised draft (April 23, 1990) is available and will replace the 1985 Guidance once it is finalized .Back.

26.USEPA. 1987. Permit Writer's Guide to Water Quality-based Permitting for Toxic Pollutants. OW/OWEP, EPA 440/4-87-005. Washington, D.C .Back.

27.FUSEPA. 1987. Nonpoint Source Guidance. OW/OWRS, EPA. Washington, D.C.Back.

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Chapter 3 - Development And Implementation Of The TMDL

Guidance for Water Quality-Based Decisions:
The TMDL Process

Development of the TMDL

The TMDL process is an important element of the water quality-based approach. It links the development and implementation of control actions to the attainment of water quality standards. This chapter expands the discussion introduced in Chapter 2 on how to develop TMDLs and implement controls for water quality-limited waters. Appendix D and E provide supporting information on some important technical considerations and EPA supported models for TMDL development.

The TMDL Objective

As stated in 40 CFR 131.2, "[water quality] standards serve the dual purposes of establishing the water quality goals for a specific waterbody and serve as the regulatory basis for the establishment of water-quality-based treatment controls and strategies beyond the technology-based levels of treatment required by section 301(b) and 306 of the Act." Standards also contain antidegradation provisions to prevent the degradation of existing water quality.

The objective of a TMDL is to allocate allowable loads among different pollutant sources so that the appropriate control actions can be taken and water quality standards achieved. The TMDL provides an estimate of pollutant loadings from all sources and predicts the resulting pollutant concentrations. The TMDL determines the allowable loads and provides the basis for establishing or modifying controls on pollutant sources.

The TMDL Process

The total pollutant load to a waterbody is derived from point, nonpoint, and background sources. Pollutant loads may be transported into waterbodies by direct discharge, overland flow, ground water, or atmospheric deposition. The TMDL concept has successfully been applied to develop wasteload allocations for point source discharges in low flow situations where nonpoint sources are not a concern. TMDLs can and should be used, however, to consider the effect of *all activities or processes that cause or contribute to the water* quality-limited conditions of a waterbody. Activities may relate to thermal changes, flow changes, sedimentation, and other impacts on the aquatic environment. Control measures to implement TMDLs, therefore, are not limited to NPDES authorities but should also be based on State and local authorities and actions to reduce nonpoint source pollution.

An example of how to apply such a TMDL might be in the control of excess sediment which causes loss of a beneficial use of a waterbody. If standards, established to protect against the loss of a beneficial use (e.g., fish spawning), are not met and, if the process causing the problem (i.e., excess sedimentation) can be *quantified, then it may be appropriate to use the TMDL process to assess the adverse impacts and* potentially set controls on the problem activity. In this example, the activity might be urban development for which effective controls can be implemented to reduce sediment loading to the impacted waterbody.

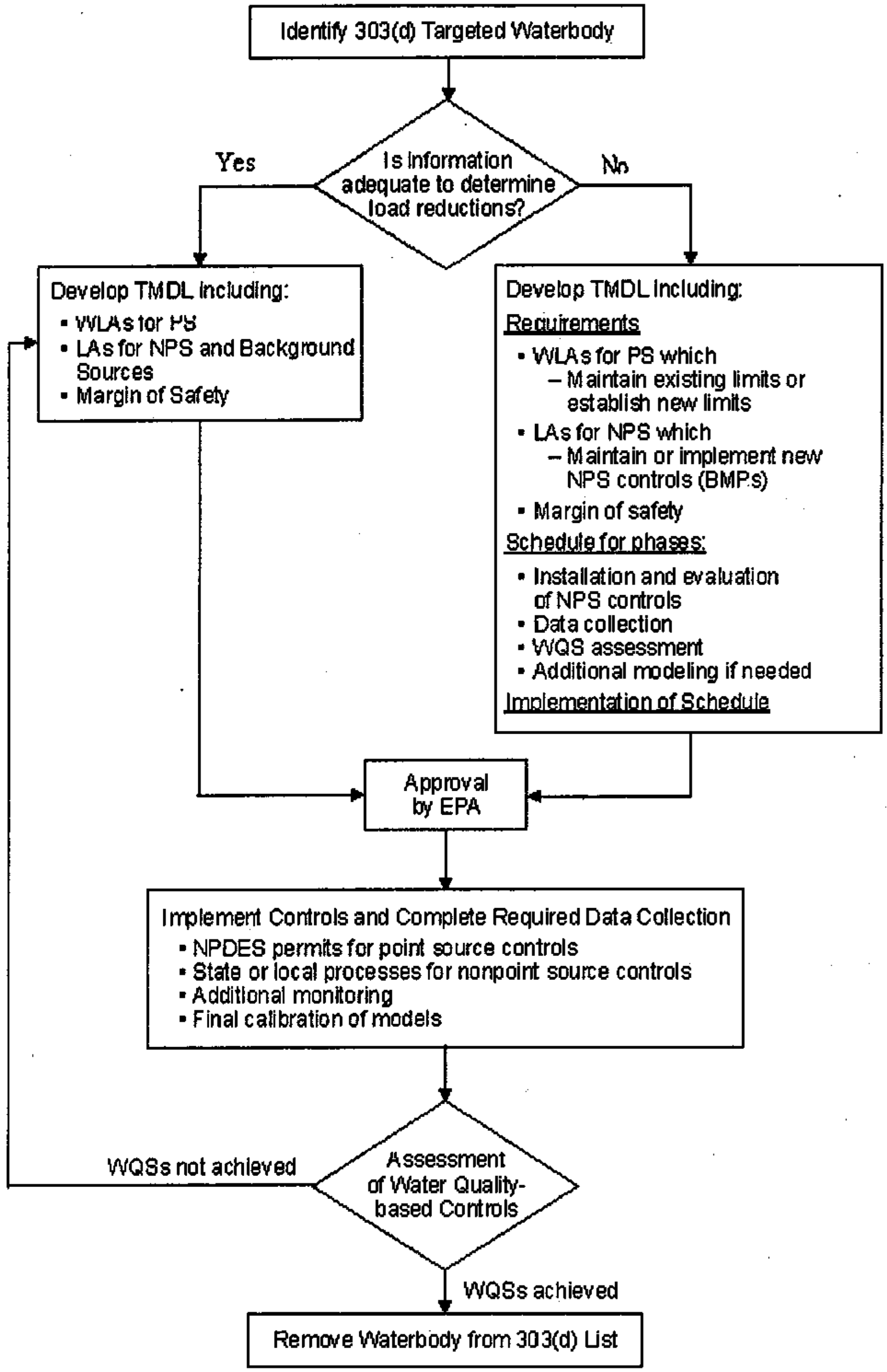
The TMDL process distributes portions of the waterbody's assimilative capacity to various pollution sources -- including natural background sources and a margin of safety -- so that the waterbody achieves its water quality standards. The analyst may use predictive modeling procedures to evaluate alternative pollution allocation schemes in the same waterbody. By optimizing alternative point and nonpoint source control strategies, the cost effectiveness and pollution reduction benefits of allocation tradeoffs may be evaluated (see Appendix D). The approach normally used to develop a TMDL for a particular waterbody or watershed consists of five activities (see box).

TMDL Development Activities
• Selection of the pollutant to consider. • Estimation of the waterbody assimilative capacity. • Estimation of the pollution from all sources to the waterbody. • Predictive analysis of pollution in the waterbody and determination of total allowable pollution load. • Allocation(with a margin of safety) of the allowable pollution among the different pollution sources in a manner that water quality standards are achieved.

In developing a TMDL it is important to keep in mind certain constraints on the WLA portion that are imposed by antibacksliding regulatory provisions. The WLA will normally result in new or more stringent water quality-based limits than those contained in a previously issued permit. In a limited number of cases, however, it is conceivable that less stringent water quality-based limits could result. In these cases, permit limits must conform to the antibacksliding provisions contained in section 402(o) of the CWA.

Selection of Approach

Figure 2 illustrates the critical decisions and the appropriate steps in the TMDL process for developing load allocations and implementing and evaluating control actions. In some cases, as illustrated by the left side of the diagram, TMDL development can be straight-forward and relatively simple. In other cases, as depicted by the right side of the diagram, a phased approach may be more appropriate. Regardless of which path is followed, the allocation of loads and establishment of control actions should ensure that all water quality-limited waters will meet their standards.



Once a waterbody is selected for action, an analyst must decide if the available data and information about the sources, fate, and transport of the pollutant to be controlled is adequate. The level of effort and scientific knowledge needed to acquire adequate data and perform meaningful predictive analyses is often a function of the pollutant source, pollutant characteristics, and the geographical scale of the pollution problem. As described in Chapter 2, modeling the fate and transport of conventional pollutants (e.g. biochemical oxygen demand) and point source contributions is better developed than modeling for non-traditional pollution problems. For certain non-traditional problems, if there are not adequate data and predictive tools to characterize and analyze the pollution problem with a known level of uncertainty, a phased approach may be necessary.

The phased approach is required when the TMDL involves both point and nonpoint sources and the point source WLA is based on a LA for which nonpoint source controls need to be implemented. There must be assurances that nonpoint source control measures will achieve expected load reductions in order to allocate a wasteload to a point source with a TMDL that also allocates expected nonpoint source load reductions. In this case, a phased approach is required because the TMDL that is developed has additional requirements that provide these assurances.

Despite the additional requirements of the phased approach, States may actually prefer it because the additional data collected can be used to verify expected load reductions, evaluate effectiveness of control measures, and ultimately determine whether a TMDL needs to be revised.

The Phased Approach

Under the phased approach, the TMDL has LAs and WLAs calculated with margins of safety to meet water quality standards. The allocations are based on estimates which use available data and information, but monitoring for collection of new data is required. The phased approach provides for further pollution reduction without waiting for new data collection and analysis. The margin of safety developed for the TMDL under the phased approach should reflect the adequacy of data and the degree of uncertainty about the relationship between load allocations and receiving water quality.

The TMDL, under the phased approach, includes (1) WLAs that confirm existing limits or would lead to new limits for point sources and (2) LAs that confirm existing controls or include implementing new controls for nonpoint sources. This TMDL requires additional data to be collected to determine if the load reductions required by the TMDL lead to attainment of water quality standards. Data collection may also be required to more accurately determine assimilative capacities and pollution allocations.

In addition to the allocations for point and nonpoint sources, a TMDL under the phased approach will establish the schedule or timetable for the installation and evaluation of point and nonpoint source control measures, data collection, the assessment for water quality standards attainment, and, if needed, additional predictive modeling. The scheduling with this approach should be developed to coordinate all the various activities (permitting, monitoring, modeling, etc.) and involve all appropriate local authorities and State and Federal agencies. The schedule for the installation and implementation of control measures and their subsequent evaluations will include descriptions of the types of controls, the expected pollutant reductions, and the time frame within which water quality standards will be met and controls re-evaluated.

Where no monitoring program exists, or where additional assessments are needed, it is necessary for States to design and implement a monitoring plan. The objectives of the monitoring program should include assessment of water quality standards attainment, verification of pollution source allocations, calibration or modification of selected models, calculation of dilutions and pollutant mass balances, and evaluation of point and nonpoint source control effectiveness. In their monitoring programs, States should include a description of data collection methodologies and quality assurance/quality control procedures, a review of current discharger monitoring reports, and be integrated with volunteer and cooperative monitoring programs where possible. If properly designed and implemented, the monitoring program will result in a sufficient data base for assessment of water quality standard attainment and additional predictive modeling if necessary.

Approval of TMDLs by EPA

TMDLs developed for all water quality-limited waters are submitted to EPA for review and approval. States are encouraged to coordinate with EPA prior to formal submission of their TMDLs. Chapter 4 explains EPA and State responsibilities for the review and approval process.

Implementation of the TMDL

After identifying the necessary pollutant load reductions through the development of TMDLs and after approval by EPA, State water quality management plans should be updated and control measures implemented. This section provides a brief review of point and nonpoint source control implementation. Additional guidance is available and is referenced throughout the remainder of this chapter.

NPDES Process for Point Sources

Both technology-based and water quality-based controls are implemented through the National Pollutant Discharge Elimination System (NPDES) permitting process. Permit limits based on TMDLs are called water quality-based limits.

Wasteload allocations establish the level of effluent quality necessary to protect water quality in the receiving water and ensure attainment of water quality standards. Once allowable loadings have been developed through WLAs for specific pollution sources, limits are incorporated into NPDES permits. It is important to consider how the WLA addresses variability in effluent quality. On the one hand, allocations for nutrients or bioaccumulative pollutants could be expressed as the required average effluent quality because the total loading of these pollutants is of concern. On the other hand, an allocation for toxic pollutants should be expressed as a shorter-term requirement because the concentration of these pollutants is typically of more concern than the total loading.[9]

As a result of the 1987 Amendments to the Act, Individual Control Strategies (ICSs) were established under section 304(l)(1) for certain point source discharges of priority toxic pollutants. ICSs consist of NPDES permit limits and schedules for achieving such limits, along with documentation showing that the control measures selected are appropriate and adequate (i.e., fact sheets including information on how water quality-based limits were developed, such as total maximum daily loads and wasteload allocations). Point sources with approved ICSs are to be in compliance with those ICSs as soon as possible or in no case later than three years from the establishment of the ICS (typically by 1992 or 1993).

The Clean Water Act (and corresponding State statutes) authorizes imposition of monitoring and data collection requirements on the owner or operator of a point source discharge. Requirements may include ambient and biological assessments, toxicity reduction evaluations, in-plant monitoring, etc. Needed data collection may be initiated through a direct request under Section 308 if there is a reasonable need for the information for EPA to carry out the objectives of the Clean Water Act. The request must also meet the Paperwork Reduction Act requirements. Information may also be collected through permit reporting requirements, or an administrative order. These authorities can be used to collect data from point sources when developing or assessing the effectiveness of a TMDL.

Examples of Best Management Practices	
AGRICULTURE Animal waste management Conservation tillage Contour farming Contour strip cropping Cover crops Crop rotation Fertilizer management Integrated pest management Livestock exclusion Range and pasture management Sod-based rotations Terraces **CONSTRUCTION** Disturbed area limits Nonvegetative soil stabilization Runoff detention/retention Surface roughening **URBAN** Flood storage Porous pavements Runoff detention/retention	**SILVICULTURE** Ground cover maintenance Limiting disturbed areas Log removal techniques Pesticide/herbicide management Proper handling of haul roads Removal of debris Riparian zone management Road and skid trial management **MINING** Block-cut or haul-back Underdrains Water diversion **MULTICATEGORY** Buffer Strips Detention/sedimentation basins Devices to encourage infiltration Grassed waterway Interception/diversion Material ground cover Sediment traps Streamside management zones

Street cleaning	Vegetative stabilization/mulching

Permit requirements for data collection should be established when longer term data (e.g., for several seasons) are needed. The permit should include a statement that the permit can be modified or revoked and reissued if the data indicate an exceedance of State water quality standards.

State or Local Process for Nonpoint Sources

In addition to permits for point sources, nonpoint source controls may be established by implementing Best Management Practices (BMPs) so that surface water quality objectives are met. These controls should be based on LAs developed using the TMDL process. When establishing permits for point sources in the watershed, the record should show that in the case of any credit for future nonpoint source reductions, (1) there is reasonable assurance that nonpoint source controls will be implemented and maintained or (2) that nonpoint source reductions are demonstrated through an effective monitoring program. Assurances may include the application or utilization of local ordinances, grant conditions, or other enforcement authorities. For example, it may be appropriate to provide that a permit may be reopened for a WLA which requires more stringent limits because attainment of nonpoint source load allocation was not demonstrated.

In order to fully address waterbodies that are impaired or threatened by nonpoint source pollution, States should implement their nonpoint source management programs and ensure adoption of control measures (best management practices) by all contributors of nonpoint source pollution in those watersheds. Example BMPs are listed on the following page. State nonpoint source management programs may include, as appropriate, nonregulatory or regulatory programs for enforcement, technical assistance, financial assistance, education, training, technology transfer, and demonstration projects.

It is difficult to ensure, a priori, that implementing nonpoint source controls will achieve expected load reductions. Nonpoint source control measures may fail to achieve projected pollution or chemical load reductions due to inadequate selection of BMPs, inadequate design or implementation, or lack of full participation by all contributing sources of nonpoint pollution. [10]States should describe nonpoint source load reductions and establish a procedure for reviewing and revising BMPs in TMDL documentation. The key objective for documenting load reduction goals and review procedures is to establish a rational procedure for site-specific evaluation of waterbodies with significant nonpoint source pollution loads. States should consult additional nonpoint source guidance for assistance in developing appropriate monitoring and evaluation approaches.[11] [12]

Assessment of the TMDL

Once control measures have been implemented, the impaired waters should be assessed to determine if water quality standards have been attained or are no longer threatened. The monitoring program used to gather the data for this assessment should be designed based on the specific pollution problems or sources. For example, past experience has shown that several years of data are necessary from agricultural nonpoint source watershed projects to detect trends (i.e., improvements) in water quality. As a result, long term monitoring efforts must be consistent over time in order to develop a data base adequate for analysis of control actions.

As shown in Figure 2, a TMDL that allocates loads and wasteloads to meet water quality standards must be established. If the waterbody does achieve the applicable State water quality standards, the waterbody may be removed from the 303(d) list of waters still needing TMDLs. If the water quality standards are not met, the TMDL and allocations of load and wasteloads must be modified. This modification should be based on the additional data and information gathered as required by the phased approach for developing a TMDL, where appropriate, as part of routine monitoring activities, and when assessing the waterbody for water quality standards attainment.

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-- the reader is referred to the Permit Writer's Guide to Water Quality-based Permitting for Toxic Pollutants (July, 1987) and the Technical Support Document for Water Quality-based Toxics Control (1985) for additional information on deriving actual permit limits. Back

10 -- USEPA. July, 1987. Setting Priorities: The Key to Nonpoint Source Control. OW/OWRS, EPA. Washington D.C. Back

11 -- USEPA. February, 1988. Draft Nonpoint Source Monitoring and Evaluation Guide. OW/NPS Branch, Washington D.C. Back

12 -- USEPA. September 19, 1989. Nonpoint Source Monitoring and Reporting Requirements for Watershed Implementation Grants. OW/NPS Branch, Washington D.C. Back

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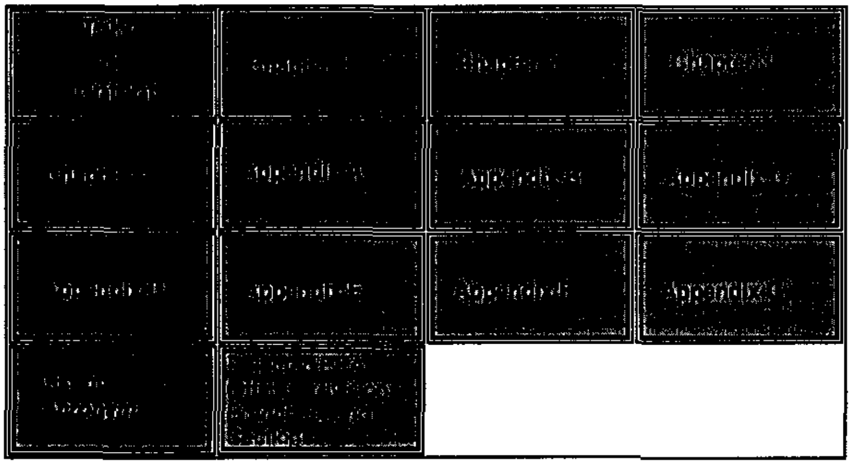

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Appendix D - Selected Technical Considerations

Guidance for Water Quality-Based Decisions: The TMDL Process

Design Conditions

When developing a TMDL, design conditions are those critical conditions that must be specified in order to determine attainment of water quality standards. In specifying conditions in the waterbody, an attempt is made to use a reasonable "worst case" condition. For example, stream analysis often uses a low flow (e.g., 7-day low flow, once in 10-years commonly known as 7Q10 or biologically-based 4-day 3-year flows) high temperature design condition.

In situations where nonpoint source loadings at wet weather flow conditions are more significant than the point source loadings, the use of low flow-related design conditions is inappropriate. Wet weather flow conditions may be appropriate for analysis of nonpoint and intermittent point source discharges such as storm sewers. Other factors such as rainfall intensity and duration, time since previous rainfall, pollutant accumulation rates, and stream flow previous to rainfall should be considered in selecting design conditions for nonpoint source analysis. In some instances (e.g., carcinogenic pollutants), it is appropriate to use the harmonic mean flow to estimate loading capacity.

Often conditions of best management practices may be specified for factors other than physical conditions. For example, assumptions about cropping patterns, logging rates, or grazing practices may be necessary to determine the pollution loading estimates of a waterbody. Design conditions are less standardized for these factors and a reasonable worst case condition often must be developed on a case-by-case basis.

In general, for point sources, continuous discharges present the greatest stress under low flow, dry weather conditions. For pollutants transported in runoff, critical conditions will be rainfall-related, but may occur under a variety of flow conditions. For NPSs or intermittent point sources, generally, high flow, wet weather conditions need to be evaluated. For carcinogenic pollutants, harmonic mean flows may be appropriate. Additional details for selecting design conditions are provided in technical guidance.[33]

Mathematical Models

When the analyst is calculating a numerical TMDL, several mathematical models can be used to evaluate alternative pollutant loading scenarios. Models supported by the EPA Center for Exposure and Assessment Modeling (CEAM) are summarized in Appendix E. While it is beyond the scope of this guidance to provide a detailed rationale for model selection, the following briefly presents a discussion on model characteristics and selection.

Model characteristics

Models can be characterized in numerous ways such as by their data requirements, ease of application, etc. This section summarizes models based on four categories: temporal characteristics, spatial characteristics, specific constituents and process simulated, and transport processes.

- Temporal characteristics - This includes whether the model is steady-state (inputs and outputs constant over time), time-averaged (for example, tidally-averaged), or dynamic. If the model is dynamic, an appropriate time step needs to be selected. For example, streams may require short time steps (hourly or less) while lakes, which typically have residence times in excess of weeks, can generally be modeled with longer time steps (e.g., daily or more). Similarly, loads from NPS models are often lumped together into event or annual loadings.

- Spatial characteristics - This includes the number of dimensions simulated and the degree of spatial resolution. In most stream models, one-dimensional models are used since typically vertical and horizontal gradients are small. For large lakes and estuaries, two- or three-dimensional models may be more appropriate because both vertical and horizontal concentration gradients commonly occur. Segmented or multiple catchment models may be more appropriate for heterogeneous watersheds, whereas, lumped single-catchment models are more appropriate for homogeneous or less complex situations.

- Specific constituents and processes simulated - Models vary in the types of constituents and processes simulated and in the complexity of the formulations used to represent each process. For example, simple DO models include only reaeration and BOD decay while more complex models include other processes such as nitrification, photosynthesis, and algal respiration.

- Transport processes - These include advection, dispersion, runoff, interflow, ground water interactions, and the effects of stratification on these processes. Most river models are concerned only with downstream advection and dispersion. Lake and estuary models may include advection and dispersion in one or more dimensions, as well as the effects of density stratification. For toxic modeling, it may be important to use models which account for near-field mixing since many of these pollutants may exert maximum toxicity close to the point of discharge. To incorporate both point and nonpoint sources into TMDLs, it will be important to consider integrated watershed models.

Model selection

A model should be selected based on its adequacy for the intended use, for the specific waterbody, and for the critical conditions occurring at that waterbody. While the selection of an appropriate model should be made by a water quality analyst, it is useful for program managers to be familiar with the decisions which must be made. Four basic steps have been identified that an analyst would go through to select an appropriate model:

- Identify models applicable to the situation.
- Define the appropriate level of analysis.
- Incorporate practical constraints into the selection criteria.
- Select a specific model.

Identify models applicable to the situation. An obvious choice for narrowing the selection of an appropriate model is based on the waterbody type (river, estuary, or lake) and the type of analysis (BOD/DO, toxics, etc.) A preliminary list of models may also be screened by selecting models which consider the appropriate constituents and processes that are important for the pollutant being studied.

Define the appropriate type of analysis. Four types of models are:

- Simple calculator models - These include dilution and mass balance calculations, Streeter-Phelps equations and modifications thereof, analytical solutions to transport equations, steady-state nutrient loading models, regression models, and other simplified modeling procedures that can be performed on desk top calculators.

- Steady state computer models - These models compute average spatial profiles of constituents along a river or estuary assuming everything remains constant with time, including loadings, upstream water quality conditions, stream flow rates, meteorological conditions, etc.

- **Quasi-dynamic models** - These models are a compromise between steady-state models and dynamic models. Quasi-dynamic models assume most of the above factors remain constant, but allow one or more of them to vary with time, for example waste loading rates or stream flow rates. Some of the models hold the waste loading and flow rates constant, but predict effects such as the diurnal variations in dissolved oxygen due to algal photosynthesis and respiration.

- **Dynamic models** - These models predict temporal and spatial variations in water quality due to varied loadings, flow conditions, meteorological conditions, and internal processes within the watershed or waterbody. Dynamic models are useful for analyzing transient events (e.g., storms and long term seasonal cycles) such as those important in lake eutrophication analyses.

The above model types are listed in order of increasing complexity, data requirements, and cost of application. In addition, lognormal probabilistic models and Monte Carlo simulation techniques have been used to modify some of the above approaches. Probabilistic models use lognormal probability distributions of model inputs to calculate probability distributions of model output. Since this method does not incorporate fate and transport processes, it can only be used to predict the concentration of a substance after complete mixing and before decay or transformation significantly alters the concentration. Monte Carlo simulations combine probabilistic inputs with deterministic models. A fate and transport model is run a large number of times based on randomly selected input values. The output from these models are then rank ordered to produce a frequency distribution. These frequency distributions may then be compared to instream criteria (e.g., criteria maximum concentration (CMC) and criteria continuous concentration (CCC)) to determine if water quality standards are met.

Incorporate practical constraints. In general, the analyst should consider the data requirements for each level of analysis, the availability of historical data, the modeling effort required for each level of analysis, and available resources. Availability of historical data for calibration and verification is one of the key cost savings considerations.

Select a specific model. The analyst should consider model familiarity, technical support and model availability, documentation quality, application ease, and professional recognition and acceptance of a model.

Pollutant Allocation Schemes

Individual States use various load allocation schemes appropriate to their needs and may specify that a particular method be used. Methods of allocating loads have been historically applied to point sources. Application of these methodologies to nonpoint sources has not been well studied to date. Three common methods for allocating loads (equal percent removal, equal effluent concentrations, and a hybrid method) are discussed below. Other methods are detailed in another EPA document.[34] The first method is equal percent removal and exists in two forms. In one, the overall removal efficiencies of the sources are set so they are all equal. In the latter, the incremental removal efficiencies beyond the current discharge are equal. This method is appropriate when the incremental removal efficiencies are relatively small, so that the necessary improvement in water quality can be obtained by minor improvement in treatment at each point source, at little cost.

The second common allocation method specifies equal effluent concentrations. This is similar to equal percent removal if influent concentrations at all sources are approximately the same. However, if one source has substantially higher influent levels, then equal effluent concentrations will require higher overall treatment levels than the equal percent removal approach.

The third commonly used method of allocating loads can be termed a hybrid method. With this method, the criteria for waste reduction may not be the same from one source to the next. One source may be allowed to operate unchanged while another may be required to provide the entire load reduction. More generally, a proportionality rule may be assigned that requires the percent removal to be proportional to the input source loading or flow rate.

Multiple Discharges

TMDLs are particularly critical for waterbodies when the effect from multiple pollution sources overlap. The key concern associated with multiple point or nonpoint pollution sources is the potential for combined impacts. To perform this analysis, it may be necessary to apply near-field mixing models (mixing zone analysis) in addition to a far-field model which considers pollutants from numerous point or nonpoint sources (after the mixing zone). A recommended procedure for evaluating toxicity from multiple discharges is summarized in EPA guidance.[35]

Allocation Tradeoffs

Where appropriate and technically feasible, certain cost-effective benefits may be gained by making tradeoffs among wasteload allocations. Such a practice is similar to what would be done during the initial considerations of tradeoffs of loads between point and nonpoint sources. In the case of watershed or estuary management, this may be particularly useful to achieve pollution reduction in the most cost-effective manner possible.

The incentive for trading load allocations is to achieve the required level of control by choosing to control one pollutant source over another. Technological feasibility, economic issues, and regulatory authority are all factors to consider when trading allocations. For example, to reduce nutrient loads to a receiving water, nonpoint source controls that can be adequately maintained and enforced, may be much more cost effective than increasing the level of control on a point source discharger.

Pollutant trades are most likely to occur between point and nonpoint sources. However, where effluents from different point source dischargers are comparable, trades may be acceptable so long as water quality standards (including antidegradation regulations and policies) and minimum applicable technology-based controls are met. Similarly, tradeoffs between nonpoint sources are also acceptable.

The Dillon Reservoir (west of Denver, Colorado) is an example of point and nonpoint source phosphorus load tradeoffs. In this example, the cost associated with point source reduction was $1.5 million per year, whereas the cost associated with NPS controls was $0.2 to $1.0 million per year. Because of this cost differential, tradeoffs allowed publicly-owned treatment works to achieve reductions in phosphorus loads to the Dillon Reservoir by controlling NPSs rather than expanding the sewage treatment system.

Persistent and/or Highly Bioaccumulative Toxic Pollutants

Persistent and/or bioaccumulative toxic pollutants require special attention during analysis of toxicity and TMDL development. The primary concern is that toxic pollutants that enter a waterbody at levels that are non-toxic in the water column may accumulate in sediment or aquatic life. These pollutants may then adversely affect aquatic/wildlife or pose a risk to humans by exposure to hazardous chemicals through consumption of contaminated fish or shellfish. Chemicals that bioaccumulate at high rates include some metals, organic compounds, and organometallic compounds. Current technical guidance for wasteload allocation (see Appendix A) summarize a number of models which are appropriate for modeling the fate and transport of toxics in streams/rivers, lakes, and estuaries. Additional details for assessing and controlling risk have been addressed in technical support documentation.

Use of Two-number Criteria

Because of inherent variation in effluent and receiving water flows and pollutant concentrations, specifying a concentration that must not be exceeded at any time or place may not be appropriate for the protection of aquatic life. The format usually selected for expressing water quality criteria to protect aquatic life consists of recommendations concerning concentration magnitudes, duration of averaging periods, and average frequencies of allowed excursions. Use of this magnitude-duration-frequency format allows water quality criteria for aquatic life to be adequately protective without being as overprotective as if criteria were expressed using a simpler format. In many cases, these considerations are evaluated during the standards setting process and TMDLs are used to develop controls that result in attainment of applicable water quality standards.

Duration of exposure considers the amount of time organisms will be exposed to toxicants. It is expressed as that period of time over which the instream concentration is averaged for comparison with criteria concentrations. Frequency is defined as how often exposures that exceed the criteria can occur during a given period of time (e.g., once every three years) without unacceptably affecting the community. To account for acute toxic effects, States may adopt acute criteria expressed as the criteria maximum concentration (CMC) occurring in a one-hour averaging period. Similarly, chronic criteria expressed as the criteria continuous concentration (CCC) should be developed as toxicant concentrations which should not be exceeded over longer periods of time. For the purposes of modeling, the ambient concentration should not exceed the CMC more than once every three years. (If the biological community is under stress because of spills, multiple dischargers, or has a low recovery potential, or if a local species is very important, the frequency should be decreased.)

Although these criteria are mostly used for application to low flow conditions, the toxicological basis for the criteria is equally valid for high flow conditions. It is important for States to protect designated water uses during all flow conditions; therefore, the two-number criteria should be used for all flow conditions unless separate guidance for adopting wet weather criteria is available. However, States should apply duration and frequency parameters to account for the high flow, intermittent nature of nonpoint source loadings.

Sediment Issues

The problems associated with clean and contaminated sediment are not the same. Clean sediment can impair fish reproduction by silting-up spawning areas, and can increase turbidity. Draft (clean) sediment criteria have been developed in Idaho that include turbidity, inter-gravel dissolved oxygen, and cobble embeddedness. The criteria developed may be most appropriate for salmonid streams, but the framework may have wide application. The major concerns regarding contaminated sediment are pollutant releases to the water column, bioaccumulation, and biomagnification. Sediment criteria being developed by EPA have centered on evaluating and developing an understanding of the principal factors that influence the sediment/contaminant interactions with the water column (Equilibrium Partitioning Approach). (The Science Advisory Board will be reviewing methods for establishing sediment criteria for metal contaminants and procedures for establishing standardized bioassays in 1991.) Through such an understanding, exposure estimates of benthic and other organisms can be made. Chronic water quality criteria, or possibly other toxicological endpoints, can then be used to predict potential biological effects.

In some cases, sediment criteria alone would be sufficient to identify and to establish clean up levels for contaminated sediments. In other cases, the sediment criteria should be supplemented with biological or other types of analysis before clean-up decisions can be made. Additionally, ground water inputs through sediments should be distinguished from inputs from the sediment alone, so that proper control measures are implemented.

33.USEPA. 1985. Technical Support Document for Water Quality-based Toxics Control. OW/OWEP and OWRS, EPA 440/4-85-032. Washington, D.C. A revised draft (April 23, 1990) is available and will replace the 1985 Guidance when finalized. Back.

34.USEPA. 1985. Technical Support Document for Water Quality-based Toxics Control. OW/OWEP and OWRS, EPA 440/4-85-032. Washington, D.C. A revised draft (April 23, 1990) is available and will replace the 1985 Guidance when finalized. Back.

35.USEPA. 1985. Techical Support Document for Water Quality-based Toxics Control. OW/OWEP and OWRS, EPA 440/4-85-032. Washington, D.C. A revised draft (April 23, 1990) is available and will replace the 1985 Guidance when finalized. Back.

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Appendix E - Mathematical Model Support

Guidance for Water Quality-Based Decisions: The TMDL Process

The Center for Exposure Assessment Modeling (CEAM) was established in July, 1987 to meet the water quality and exposure modeling needs of States and EPA program and Regional offices. CEAM provides exposure assessment technology, training, and consultation for analysts and decisions-makers operating under various legislative mandates, including the Clean Water Act.

With support and resources from the Monitoring Branch in the Assessment and Watershed Protection Division, Office of Water Regulations and Standards, CEAM maintains a distribution center for water quality models and databases for the user community. Users are kept up to date through user group meetings, a newsletter, and an electronic bulletin board. For the major wasteload allocations models, CEAM offers 2- to 5-day training courses at EPA Headquarters, Regional sites, and the Athens Environmental Research Laboratory facility. Longer-term "on-the-job" training at CEAM for individuals is also available. Technical assistance and review are provided by CEAM scientists and engineers, as well as by affiliated academics and consultants. Exposure calculations and assessments for especially difficult or unusual discharge situations can be arranged as resources allow.

The center currently distributes 21 simulation models and databases. These can be applied to urban runoff (SWMM4, HSPF9), leaching and runoff from soils (PRZM, HSPF9), transport through soil and ground water (MULTIMED, RUSTIC), conventional pollution of streams (QUAL2E, HSPF9, WASP4), toxic pollution of streams (HSPF9, WASP4, EXAMS2, DYNTOX), toxic pollution of lakes and estuaries (WASP4, EXAMS2), conventional pollution of lakes and estuaries (WASP4), near-field mixing and dilution in rivers, lakes, estuaries, and oceans (CORMIX1), cohesive sediment transport (SED2D-V), river and tidal hydrodynamics (DYNHYD5, HYDRO2D-V, HYDRO3D), geochemical equilibrium (MINTEQA3), and aquatic food chain bioaccumulation (FGETS). Software and databases distributed to aid in data analysis include ANNIE-IDE, DBAPE, and the CLC Database. Currently available models are summarized below. Those with no version number are available as test code, and will be routinely distributed when fully tested.

Table E-1 CEAM Supported Models

Model Name	Version No.
DYNTOX	1.0
EXAMSII	2.94
HSPF	9.01
MINTEQA3/PRODEFA3	3.00
PRZM	1.00
QUAL2E-UNCAS	3.11
SWMM	3.3
WASP4/TOXI/EUTRO	4.22

DYNHYD5	5.02
GCSOLAR	1.10
FGETS	1.00
CORMIX1	1.00
ANNIE-IDE	1.11
DBAPE	1.05
CLC Database	2.00
RUSTIC	-
MULTIMED	-
HYDRO2D-V	-
SED2D-V	-
HYDRO3D	-

Center for Exposure Assessment Modeling
U.S. EPA
College Station Road
Athens, GA 30613

Via email: ceam@epa.gov
Web site: http://www.epa.gov/ceampubl/

Chapter 4 - EPA And State Responsibilities

Guidance for Water Quality-Based Decisions: The TMDL Process

Effective implementation of water quality-based controls requires an integrated and cooperative partnership between EPA and the States. The main responsibility for water quality management resides with the States in the implementation of water quality standards, the administration of the NPDES program (where the State has received EPA approval to do so), and the management of nonpoint sources of pollution. When the authority to implement nonpoint source control measures is at the local level, interagency and intergovernmental coordination is especially important. The State should take the lead in facilitating and encouraging the cooperation of local authorities. EPA is responsible for ensuring that the Clean Water Act requirements are met through the enactment and enforcement of regulations, issuing program guidance, and providing technical assistance. The partnership developed between States and EPA should be tailored to meet individual State needs while also meeting the requirements of the Clean Water Act. This chapter describes specific State and EPA responsibilities in the partnership.

EPA/State Agreements

EPA and the State should agree on the process to develop TMDLs and this process should be consistent with EPA technical guidance documents unless deviation from the guidance is technically justified. An agreement should be written which describes technical and administrative procedures (i.e., how backgrounddata are applied, how and which models are to be used, how TMDLs are developed, how loads should be allocated, etc.). (See Appendix F for a general EPA/State Agreement outline.) This agreement reduces the administrative burden of the EPA review and approval process (see Figure 3).

State Responsibilities

Identification of Water Quality-Limited Waters Still Requiring TMDLs

According to section 303(d) of the Clean Water Act and EPA water quality planning and management regulations, States are required to identify waters that do not meet or are not expected to meet water quality standards even after technology-based or other required controls are in place. The waterbodies are considered water quality-limited and require TMDLs.

When a State reports its list of 303(d) waters, it is important that this list contain only those water quality-limited waters that still require TMDLs. Some water quality-limited waters may already have had sufficient controls established for them and currently meet water quality standards. These should not be on the list. In addition, the EPA regulations (40 CFR 130.7(b)) recognize the applicability of other appropriate pollution control requirements that can provide a more stringent level of control than technology-based effluent limitations.

When not listing a water quality-limited water a State must show that the controls specified by 40 CFR 130.7 (b) (see Chapter 2) are enforceable, specific to the pollution problems, and stringent enough to meet water quality standards. If the controls are not yet implemented, a State must provide a schedule for timely implementation.

The waters identified should be reported to EPA in the 305(b) water quality assessment reports due April 1 every even year. If a State prefers, the 303(d) list of waters can be submitted separately at the same time. While initially it may be convenient to build upon the reporting processes described in Chapter 2, the 303(d) list should be updated to reflect the latest monitoring and assessment data available.

To facilitate the reporting of 303(d) waters, the current section 305(b) Waterbody System (WBS), a tool used for reporting 305(b) information, contains fields already designated for this identification. The WBS provides a geographically based framework for entering, documenting, and reporting information on the quality of individual waterbodies as they are defined by each State. The primary function of the WBS is to document water quality assessments and the water quality status of waterbodies, including causes and sources of use impairment. As a convenience to the States, the WBS has been modified and will continue to be updated to include data fields on whether TMDLs are still needed or are in place. The WBS will also provide information to EPA to assist in tracing the development of TMDLs and overall program implementation.

Identification of Causes and Sources of Pollution - When identifying the 303(d) waters, the causes of the impairment also should be identified for each segment listed. The Waterbody System has two separate fields that provide further information on a particular water segment: "nonattainment causes" and "nonattainment sources." The "cause" field consists of a list of constituents or conditions that are causing nonattainment of water quality standards by a waterbody. The Waterbody System's Users Guide (third edition, version 2.0) contains 23 standard causes (see Appendix G) and includes such parameters or categories as pesticides, metals, ammonia, and pathogens. States may develop their own user-defined codes by specifying additional codes under each standard cause.

Similarly, a field exists in the Waterbody System for identifying the sources of the pollutants or conditions that are listed under causes for the nonattainment of uses in the waterbody. Twelve general source categories are identified (see Appendix G) and include such things as industrial point sources, municipal point sources, combined sewer overflow, agriculture, and silviculture. The User's Guide also identifies 45 subcategories. Again the States may develop their own subcategories to describe causes of impairment of each water segment identified with this system. States should consult with the Guidelines for the Preparation of the 305(b) Report (to be issued every odd numbered year) and the Waterbody System User's Guide for guidance in developing and formatting their information.

Documentation and Rationale for Listing - Along with the list of 303(d) waters submitted to EPA, adequate documentation to support the listing of waters should be submitted. States have a number of readily available sources of data and information to use when compiling their lists (see pages 12 and 13). These sources, listed in Appendix C, should be used by States to develop their lists of 303(d) waters. However, additional information may be required under certain circumstances.

Documentation for listing should also provide a description of the methodologies used to develop the list, a description of the data and information used to identify water quality-limited waters, and a rationale for any decision to not use any one of the categories listed in Appendix C. It is not expected that each and every waterbody listed by a State be accompanied by the detailed documentation as described.

Adequate public participation should be a part of the listing process to make sure all water quality-limited waters are identified. This will support the State in defending its list of such waters should the need to do so arise, since, in its oversight responsibilities, EPA reserves the right to ask for additional information regarding the State's decision to not list particular waterbodies.

Identification and Scheduling of Targeted Waterbodies

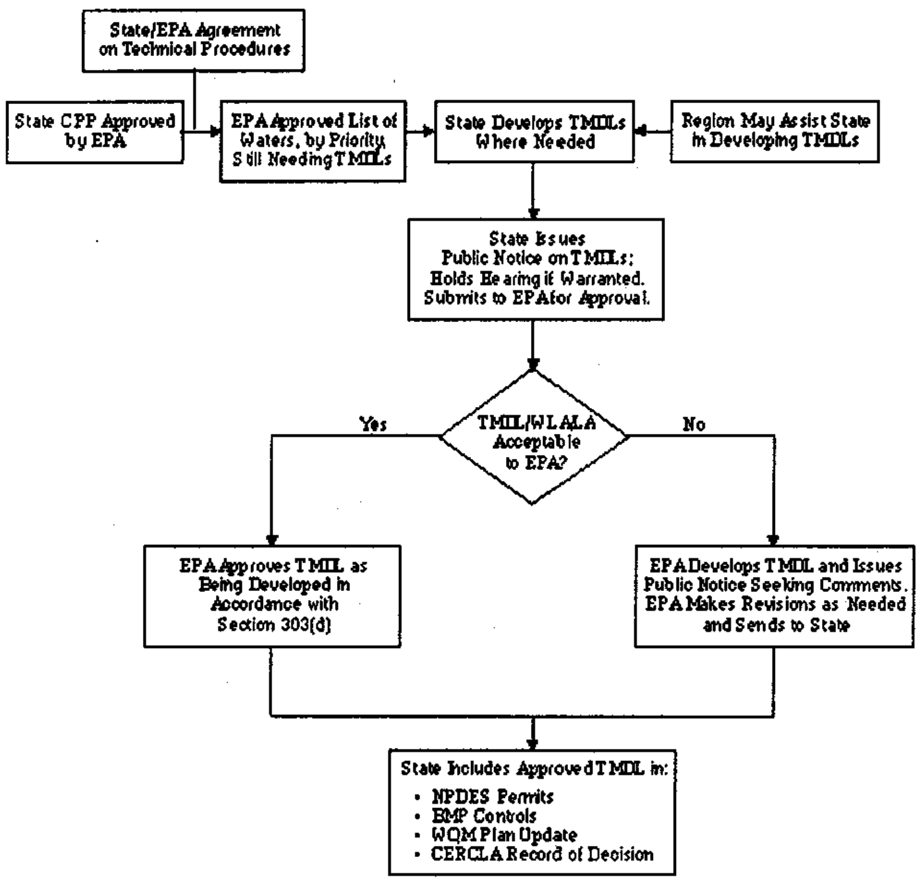
Targeted waterbodies scheduled for TMDL development over the next two years are to be identified and reported along with the 303(d) list of waters that are submitted during the 305(b) reporting process. These high priority TMDLs are to be based on State developed priorities that consider the severity of the impact and the uses of the water along with the other considerations described in Chapter 2. State submissions which include the identification of 303(d) targeted waters are subject to review and approval or disapproval by EPA. EPA will expect the States to include public participation in the development of the list of high priority targeted waterbodies. Targeting waterbodies for control action should be a key component of a State's water quality management and planning programs. Waters that are identified in State annual work plans will be compared to the targeted waterbodies and will be considered by EPA during its review and approval of the annual work plans.

TMDL Development

Each State develops TMDLs for its water quality-limited waters. The procedure for TMDL approval by EPA is depicted in Figure 3. States should use EPA's technical support document and WLA technical guidance series (see Appendix A) when developing TMDLs. Alternative approaches can be used if they are technically defensible and approved by EPA.

Figure 3

TMDL Development and Approval Procedure



For their TMDL submissions, States should include the proposed TMDLs, WLAs, LAs, and the supporting information that the Region will need to evaluate the State's water quality analysis and determine whether to approve or disapprove the submitted TMDLs. Regions and States should reach an agreement on the specific information needed prior to their submission. For a TMDL developed under the phased approach, States should also submit to EPA a description of the controls to be established, the schedule for data collection, establishment of the control measures, assessment for water quality standards attainment, and additional modeling if needed.

Quality assurance (QA) and quality control (QC) requirements should also be met. Specific technical QA/QC is necessary in the use of environmental data and models. However, when using models, such as wasteload allocation models which involve "real" environmental data as well as parametric and mathematical relationships, model sensitivity studies can help establish the levels of QA/QC required for specific data. For example, the allowable range of uncertainty in the data can be established through model sensitivity studies. This allowable range of uncertainty may indicate, for example, the need for tight limits on precision for a particular pollutant parameter. Further discussion is provided elsewhere. 13 14 15

Continuing Planning Process

Each State is required to establish and maintain a continuing planning process (CPP) as described in section 303(e) of the Clean Water Act. A State's CPP contains, among other items, a description of the process that the State uses to identify waters needing water quality-based controls, a priority ranking of these waters, the process for developing TMDLs, and a description of the process used to receive public review of each TMDL. Descriptions may be as detailed as the Regional office and the State determine is necessary to describe each step of the TMDL development process. This process may be included as part of the EPA/State Agreement for TMDL development.

Water Quality Management Plan

The State incorporates EPA approved and EPA established TMDLs into its Water Quality Management Plan (WQMP). The Water Quality Management and Planning regulation provides that when EPA approves or establishes a TMDL under section 303(d), the TMDL is automatically incorporated into the State's WQMP. 16

Public Notice and Participation

In accordance with the Water Quality Management and Planning regulation and as described in a State's CPP, the TMDLs should be made available for public comment. States and involved local communities should participate in determining which pollution sources should bear the treatment or control burden needed to reach allowable loadings. By involving the local communities in decision making, EPA expects that a higher probability of successful TMDL implementation will result.

In the identification of water quality-limited waterbodies, States need to involve the public as part of their review of all existing and readily available data and information. This is especially true in such cases where a waterbody may be perceived as being at risk due to new dischargers and changes in land use. In such cases a waterbody's water quality may be "threatened" and therefore should be given consideration for listing as a 303(d) water. EPA expects States to include public participation in its development of high priority targeted waterbodies that will proceed with TMDL development within two years following the listing process.

In the development of a TMDL, a State should issue a public notice offering an opportunity for a public hearing pertinent to the TMDL under review. It is recommended that this be done in conjunction with public notices and hearings on NPDES permits, construction of municipal wastewater treatment works, water quality standards revisions, and Water Quality Management Plan updates. Each notice should identify TMDLs as part of the subject matter.The State may wish to proceed to issuance of a final TMDL without a hearing once notice is given and there has been little or no response by the public.

Also, if a State determines that the water quality-based controls may be controversial, the State should involve the EPA Regional office, as well as the public, early in the process and continue to involve them throughout the process.

Reporting

State submission of a list of waters still needing TMDLs and loads established is required by the Clean Water Act and the Water Quality Planning and Management regulations (40 CFR 130.7). These lists should complement EPA/State Agreements and the CPP, and be incorporated into the WQMP. States should submit the 303(d) lists either as part of or at the same time as the biennial section 305(b) reports. As part of this reporting requirement, States are expected to identify those waters targeted for TMDL development in the next two years. Targeted waterbodies are then scheduled for TMDL development through the annual work plan. In addition, the pollutants or conditions causing violations of water quality standards and the point and nonpoint sources of the pollution causing those conditions should be identified for each waterbody on the 303(d) list (see page 28). States should consult the Section 305(b) Waterbody System's Users Guide (August, 1989) to appropriately categorize sources and causes of pollutants.

Other Specific Responsibilities

Other State responsibilities are to

- Ensure that needed environmental data are provided to EPA, including appropriate assessment data; appropriate screening data; and all regulatory data including data needed for approvals of the 303(d) lists and TMDLs, and

- Ensure that appropriate quality assurance/quality control procedures are used for all data used in State decision making and for all data reported to EPA, including data reported by dischargers.

EPA Responsibilities

Review of 303(d) Lists

Section 303(d) and the Water Quality Planning and Management Regulation (40 CFR 130.7(d)) requires EPA to review and approve or disapprove States' lists of water quality-limited waters and the established pollutant loads. The lists are expected to be submitted biennially and will be approved or disapproved based in part on the State's documentation and rationale for developing such lists as described under the State Responsibilities section of this chapter.

If, after reviewing the State lists and documentation, EPA is satisfied that the State has identified and appropriately listed all impaired waters and those targeted for action, EPA will then approve the lists and send a letter approving the submittal to the State. During this approval process, EPA may request a State to provide additional information if there is "good cause" to do so. "Good cause" may include, but is not limited to, more recent or accurate data; more accurate water quality modeling; flaws in the original analysis that led to the water being identified pursuant to 40 CFR 130.7; or changes in conditions (e.g., elimination of discharges).

If the EPA disapproves (via a letter of disapproval to the State) a State's list of waters needing new or revised TMDLs and those targeted for action, the Region (working closely with the State) then identifies those waters where new or revised, and targeted TMDLs are necessary.

TMDL Review and Approval

Section 303(d) and the Water Quality Planning and Management regulation (40 CFR 130.7(d)) requires EPA to review all TMDLs for approval or disapproval. EPA may tailor its review to what is reasonable and appropriate. For example, where a State has clearly described its TMDL process in its approved CPP (and EPA/State Agreement), EPA may conduct an in-depth review of a sample of the State's TMDLs to determine how well the State is implementing its approved process and conduct a less detailed review of the remaining TMDLs. This in-depth review of samples of the State submissions, in conjunction with a less detailed review of all other TMDLs submitted to EPA by the State, will provide a reasonable basis for EPA approval or disapproval of individual TMDLs. The in-depth sample review may include TMDLs supporting major construction projects and other major control measures. For those States that do not have an approved process, Regions are expected to conduct in-depth reviews of all TMDLs. The Region's review should also consider how well the States are following applicable technical guidance for establishing TMDLs, WLAs, and LAs.

EPA must, at a minimum, determine whether the State's TMDLs are "established at a level necessary to implement the applicable water quality standards with seasonal variations and a margin of safety that takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality." [17] No TMDL will be approved if it will result in a violation of water quality standards.

If the State chooses not to develop the needed TMDLs for appropriate pollutants on a timely basis or, if the TMDLs are unacceptable to EPA, EPA has a role under the Act to develop the TMDLs in cooperation with the State. [18] This will be done by focusing available EPA resources on the most critical water quality problems.

EPA must either approve or disapprove the State's TMDL within 30 days after submission by the State. Where a TMDL is approved, EPA transmits a letter of such approval. If EPA disapproves a State's submission and the State does not agree to correct the problems, then EPA shall, within 30 days of the disapproval date, establish such TMDLs as necessary to implement the water quality standards. EPA solicits public comment and after considering public comment and making appropriate revisions, EPA transmits the revised TMDL to the State for incorporation in the State's Water Quality Management Plan.[19] EPA prefers to discharge this duty through a cooperative effort with the States.

Program Audits

EPA expects to measure performance on the basis of environmental results and administrative goals by means of program audits. To achieve this performance measurement, EPA will periodically conduct audits of State water quality programs primarily through Regional visits to the States, review of State toxics control programs, and State action plan summaries of EPA's Surface Water Toxics Control Program.[20] These program audits will serve to determine where additional training or other assistance may be needed and to determine implementation of program objectives.

Technical Assistance and Training

EPA Headquarters and Regional offices are available to provide technical assistance and advice to the States in developing TMDLs. EPA Headquarters in coordination with the EPA Center for Exposure Assessment Modeling (CEAM) provides for training and assistance on modeling. EPA Headquarters also provides training and technical assistance to users of the Waterbody System (WBS).

Guidance Documents and Reports

EPA Headquarters is responsible for developing associated program guidance, technical support with assistance from EPA research laboratories, and producing the biennial National Water Quality Inventory Report to Congress developed from the State section 305(b) assessment reports.

EPA Headquarters Responsibilities

EPA Headquarters is responsible for making sure the CWA mandates regarding TMDLs are carried out, providing oversight of the Regional offices and the States, developing program policy and guidance, supporting the development of computer software for calculating TMDLs, developing technical guidance documents, and providing technical training and assistance. Other responsibilities of EPA Headquarters are summarized on the next page.

EPA Regional Responsibilities

The EPA Regional offices are responsible for assisting Headquarters in developing policy and guidance, distributing policy and guidance to the States, awarding grants to the States for developing and implementing water quality-based controls, and providing technical assistance to the States. In addition, the Regional offices are responsible for reviewing and approving or disapproving the following: each State's TMDL process, the annual work program, the list of waters where TMDLs are needed, the list of targeted waters, and specific TMDLs, WLAs, and LAs. The EPA Regional offices are also responsible for reporting on State implementation to Headquarters. Other responsibilities of EPA Regional offices are summarized below.

Other EPA Headquarters Responsibilities
• Prepare guidance and ensure that appropriate technical training and technical assistance is available for monitoring, water quality analysis, and data reporting.
• Perform national assessments and evaluate the national water quality effects of CWA programs.
• Make national data systems more useful for national, regional, and State manages by upgrading and cross-linking the existing systems and developing interactive data retrieval and analysis mechanisms for line managers. Continue support of the River Reach and Industrial Facility Discharge Files.
• Ensure the appropriate quality assurance/quality control procedures are used in all national data collection efforts and provide laboratory support for national studies of pollutants requiring special analyses.
• Prepare headquarters budget requests, and in consultation with the Regions, prepare requests for Regional and State water quality monitoring and analysis programs.
• Peer review major agency program activities involving water monitoring and consult with other program offices on water monitoring activities.

Other EPA Regional Responsibilities
• Ensure that the appropriate regulatory monitoring is performed by the States and dischargers needed for developing and implementing water quality-based controls and identifying needed nonpoint source controls. This includes data required to identify water needing water quality-based controls, data needed to develop controls, and data needed to assess the effectiveness of controls.
• Provide technical assistance and training to the Sates on water quality monitoring and analyses. For work involving toxics, provide assistance in both the pollutant specific and the biomonitoring approaches and whole effluent toxicity.
• Ensure that appropriate quality assurance/quality control procedures are used for all Regional and State water quality data and for all data used in Regional decision making including data reported by permittees.
• Perform Regional water quality assessments primarily based on State data, as needed to prepare Environmental Management Reports.
• Ensure that Regional data systems are compatible with and do not unnecessarily duplicate national data systems.

13.USEPA. September, 1980. Guidelines and Specifications for Preparing Quality Assurance Project Plans. QAMS-004/80. Washington, D.C. Back.

14.USEPA. December, 1980. Interim Guidelines and Specifications for Preparing Quality Assurance Plans. QAMS-005/80. Washington, D.C. Back.

15.USEPA. May, 1984. Guidance for Preparation of Combined Work/Quality Assurance Project Plans for Environmental Monitoring. OWRS QA-1. Washington, D.C. Back.

16.50 FR 1777, January 11, 1985 and 40 CFR 130. Back.

17.CWA section 303(d)(1) Back.

18.See Scott Decision: Scott v. Hammond, 741 F.2d 992(7th Cir. 1984) Back.

19.40 CFR 130.7(d) Back.

20.40 CFR 122, 123, 130; Surface Water Toxics Control Program. Back.

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Appendix B - Supporting Programs

Guidance for Water Quality-Based Decisions:
The TMDL Process

EPA Water Quality Criteria andStandards

The water quality standards program, as envisioned in Section 303(c) of the Clean Water Act, is a joint effort between the States and EPA. The States have primary responsibility for setting, reviewing, revising and enforcing water quality standards. EPA develops regulations, policies, and guidance to help States implement the program and oversees States activities to ensure that State adopted standards are consistent with the requirements of the Act and the implementing Water Quality Standards regulation (40 CFR Part 131). EPA has authority to review and approve or disapprove State standards and, where necessary, to promulgate Federal water quality standards.

A water quality standard defines the water quality goals of a waterbody, or portion thereof, by designating the use or uses to be made of the water, by setting criteria necessary to protect the uses, and by preventing degradation of water quality through antidegradation provisions. States adopt water quality standards to protect public health or welfare, enhance the quality of water, and serve the purposes of the Clean Water Act. "Serve the purposes of the Act" (as defined in Sections 101(a), 101(a)(2), and 303(c) of the Act) means that water quality standards should: 1) include provisions for restoring and maintaining chemical, physical, and biological integrity of State waters, 2) provide, wherever attainable, water quality for the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water ("fishable/swimmable"), and 3) consider the use and value of State waters for public water supplies, propagation of fish and wildlife, recreation, agriculture and industrial purposes, and navigation.

In the current Water Quality Standards regulation, section 131.11 encourages States to adopt both numeric and narrative criteria. Criteria protect both short-term (acute) and long-term (chronic) effects. Numeric criteria are important where the cause of toxicity is known or for protection against pollutants with potential human health impacts or bioaccumulation potential. Numeric water quality criteria may also be the best way to address nonpoint source pollution problems. Narrative criteria can be the basis for limiting toxicity in waste discharges where a specific pollutant can be identified as causing or contributing to the toxicity but there are no numeric criteria in the State standards, or where toxicity cannot be traced to a particular pollutant. Whole effluent toxicity (WET) testing is also appropriate for discharges containing multiple pollutants because WET testing provides a method for evaluating synergistic and antagonistic effects on aquatic life. Biological criteria provide a means to measure aquatic community structure and function. EPA considers a combination approach of narrative, numeric, and biological criteria necessary to protect beneficial uses fully from the broad range of point and nonpoint sources of pollution.

In addition, the Clean Water Act in Section 303(c)(2)(B) requires States to adopt numeric criteria for priority toxic pollutants for which EPA has published criteria guidance when the discharge or presence of these pollutants could reasonably be expected to interfere with the designated uses in affected waters. States may adopt criteria with Statewide application or site-specific criteria.

EPA's regulation requires each State to adopt, as part of its water quality standards, an antidegradation policy consistent with 30 CFR 131.12. The regulation also requires each State to have implementation methods for its antidegradation policies, i.e., decision criteria for assessing activities that may impact the integrity of a waterbody. Activities covered by the antidegradation policy and implementation methods include both point and nonpoint sources of pollution. Section 131.12 effectively sets out a three-tiered approach for the protection of water quality. "Tier 1" (40 CFR 131.12 (a)(1)) of antidegradation maintains and protects existing uses and the water quality necessary to protect these uses. "Tier II" (section 131.12(a)(2)) protects the water quality in waters whose quality is better than that necessary to protect "fishable/swimmable" uses of the waterbody. Outstanding national resource waters (ONRWs) are provided the highest level of protection under the antidegradation policy ("Tier III").

States may, at their discretion, adopt policies in their standards affecting the application and implementation of standards. EPA specifically recognizes mixing zones, variances, low flow exemptions, and schedules of compliance for water quality-based permit limits. Guidance on these subjects is available from EPA's Office of Water Regulations and Standards, Criteria and Standards Division.

Section 305(b) -- Water Quality Assessment

Section 305(b)[28] establishes a process for reporting information about the quality of the nation's water resources to EPA and Congress. Each State, Territory, and Interstate Commission develops a program to monitor the quality of its surface and ground waters and report the current status of water quality biennially to EPA. This information is compiled into a biennial report to Congress. The 305(b) report allows EPA to:

- Determine the status of water quality.
- Identify water quality problems and trends.
- Evaluate the causes of poor water quality and the relative contributions of pollution sources.
- Report on the activities underway to assess and restore water quality.
- Determine the effectiveness of control programs.
- Ensure that pollution control programs are focused on achieving environmental results in an efficient manner.
- Determine the workload remaining in restoring waters with poor quality and protecting threatened waters.
- Use information from the lists of waters developed under sections 304(l) and 319 and continue to maintain and update the statutorily-required lists of waters identified under sections 303(d) and 314.

For each assessed waterbody, information is provided on the water quality-limited status, use nonattainment causes and sources, cause magnitude, and source magnitude. Much of the information from the 305(b) assessments provide useful information for developing lists of water quality-limited segments asked for in section 303(d).

Section 304(l) -- Impaired Waters

Section 304(l)[29] required lists of impaired waters and sources to be submitted to EPA as a "one time" effort. These lists of waters (known as the short, long, and mini lists) provide three types of designations for impaired waters and source impacts. The mini list (section 304(l)(1)(A)(i)) is a list of waters that the State does not expect to achieve numeric water quality standards for priority pollutants (section 307(a)) after technology-based requirements have been met, due to point or nonpoint source pollution. The long list (section 304(l)(1)(A)(ii)) is a comprehensive list of waters that are not meeting the fishable and swimmable goals of the Act whether due to toxicity or other impairments; point or nonpoint sources; or toxic, conventional, or nonconventional pollutants. A waterbody which meets its designated use criteria and does not meet fishable/swimmable criteria would be listed on the section 304(l) long list but not necessarily on the section 303(d) list of waters needing TMDLs. It would be appropriate for a State to use the information on all waters from its long lists and apply these data in developing the section 303(d) list of waters that still do not meet applicable water quality standards. The short list (section 304(l)(1)(B)) is a list of State waters that are not expected to meet applicable standards after technology-based controls have been met, due entirely or substantially to discharge of toxic pollutants from point sources. A fourth list is the list of point source dischargers of priority toxic pollutants to waters listed under section 304(l).

Section 319 -- Nonpoint Source Program

One key initiative of the 1987 Water Quality Act Amendments to the Clean Water Act was the addition of section 319 which established a national program to control nonpoint source pollution. Under this program, States are asked to assess their NPS pollution problems and submit that assessment to EPA. These assessments include a list of "navigable waters within the State which, without additional action to control nonpoint sources of pollution, cannot reasonably be expected to attain or maintain applicable water quality standards or the goals and requirements of this Act." Other paragraphs of section 319 require the identification of categories and subcategories of NPS pollution which contribute to the identification of impaired waters; descriptions of the procedures for identifying and implementing BMPs; control measures for reducing NPS pollution; and descriptions of State and local programs used to abate NPS pollution. Based upon the assessments, State nonpoint source management programs are prepared and presented to EPA for approval. Once these programs are approved, grant funds are made available for the implementation of the program.

Section 319 assessments identify waters with impairments due primarily to NPSs for which TMDLs (including LAs) may need to be developed to establish protection of water quality. States are encouraged to use these tools where appropriate to achieve or protect beneficial uses of the water.

Section 314 -- Clean Lakes Program

Historically, the Clean Lakes Program has been active in awarding grants for the study and restoration of publicly-owned lakes. Under this program, states are encouraged to develop integrated water quality strategies that include lake and reservoir management, restoration, and protection activities. EPA provides financial assistance as available; however, greater emphasis is now on developing technical support material (e.g., a Lake and Reservoir Restoration Guidance Manual).

Section 320 -- National Estuary Program

Authorized by Congress in 1985, and formally established in 1987 by amendments to the Clean Water Act, the National Estuary Program (NEP) builds upon the lessons of the Chesapeake Bay, Great Lakes, and other earlier programs in a geographic, basin-wide approach to environmental management. The EPA Administrator selects estuaries for NEP participation through State governors' nominations. To be selected estuaries must demonstrate a likelihood of success and evidence of institutional, financial, and political commitment to solve their problems.

Among the environmental problems addressed in the NEP estuaries are the loss of aquatic habitats, toxic contamination of estuarine sediments, increases in nutrient levels, bacterial contamination, and hypoxia. As methods for assessing and successfully managing these estuaries are developed, this national demonstration program aims to communicate its lessons to the more than 150 estuaries located along our coasts.

For approved estuaries, the Administrator convenes management conferences, a grouping of interested Federal, Regional, State, and local governments, affected industries, scientific and academic institutions, and citizen organizations. Management conferences strive for an open, consensus-building approach to defining program goals and objectives, identifying problems to address, and designing pollution prevention/control and resource management strategies to meet each objective. Management conferences are required to create and begin implementation of a Comprehensive Conservation and Management Plan (CCMP) designed to protect and restore the estuary.

Monitoring Program

Ambient water quality monitoring is a data gathering tool used for almost all water quality assessment. Monitoring programs serve to identify waters needing TMDLs, quantify loads, verify models, and evaluate effectiveness of water quality controls (including BMP effectiveness). Once TMDLs have been established for a given waterbody, follow-up monitoring is recommended to document improvement or lack of improvement. Since the TMDL process is iterative, monitoring data can provide the information for updating and revising current TMDLs. Ambient monitoring is used for setting permit conditions, compliance, and enforcement, and detecting new problems and trends.

Effluent Limitation Guidelines and Standards

EPA develops effluent limitation guidelines and new source performance standards for industrial dischargers. These are uniform technology-based limitations for industrial facilities discharging directly into the nation's waters. EPA also develops pretreatment standards for those facilities which discharge into Publicly Owned Treatment Works (POTWs).

During the effluent guidelines promulgation process, EPA develops a profile of the industry to determine pollutant loadings of untreated wastewater for which effluent limitation guidelines are being developed. Pollutants of concern and technologies for treating them are then identified. EPA then prepares estimates of total investment, operation and maintenance costs of complying with each technology option, and evaluates the regulatory options, both technically and economically, to select a technology as the basis for the guidelines.

Effluent limitations, guidelines, and standards are established for three types of industrial pollutants: conventional, toxic, and nonconventional. Effluent guidelines generally limit the amount of pollutant that can be discharged at an individual facility. The numerical limits in the guidelines are determined using industry-specific production data and the treatability data for the selected technology.

NPDES Permits and Individual Control Strategies

All discrete sources of wastewater must obtain a National Pollutant Discharge Elimination System (NPDES) permit that regulates the facility's discharge of pollutants. The approach to controling and eliminating water pollution is focused on the pollutants determined to be harmful to receiving waters and on the sources of such pollutants. Authority for issuing NPDES permits is established under section 402 of the CWA.[30] Point sources are generally divided into two types: "industrial" and "municipal." Nationwide, there are approximately 50,000 industrial sources which include commercial and manufacturing facilities. Municipal sources, also known as POTWs, number about 15,700 nationwide. Wastewater from municipal sources results from domestic wastewater discharged to POTWs as well as the "indirect" discharge of industrial wastes to sewers.

Section 304(l)(1)(D) required, at a minimum, the development of individual control strategies (ICSs) for point source discharges of priority toxic pollutants to waters identified on the short list. (The short list is composed of State waters for which applicable section 307(a) priority pollutant standards are not expected to be achieved after technology-based controls have been met, due entirely or substantially to point sources.) An ICS consists of NPDES permit limitations and schedules for achieving established limitations, along with other documentation to demonstrate that the controls selected are appropriate and adequate.[31]

Marine and Estuarine Waters

In January 1990, EPA published its National Coastal and Marine Policy, which establishes EPA's goals for coastal and marine protection. They include:

- Recover full use of the nation's shores, beaches, and water.

- Restore the nation's shell fisheries and salt-water fisheries.
- Minimize the use of coastal and marine water for waste disposal.
- Improve and expand coastal science.
- Support international efforts to protect coastal and marine resources.

EPA's programs to protect ocean and coastal waters and the Great Lakes from nutrient and toxic pollutants emanating from point and nonpoint sources are implemented under the Clean Water Act and the Marine Protection, Research, and Sanctuaries Act (Ocean Dumping Act).

Marine and estuarine waters are, in many cases, the ultimate sink for pollutants which emanate from upland sources. Estuarine and marine waters are particularly complex and it is often difficult to predict pollutant fate and transport. To address the increased complexity and effect on aquatic life, water quality management efforts must increase accordingly. TMDLs can be a useful tool for management of marine and estuarine waters. Technical guidance is currently being revised to support estuarine modeling.[32]

Groundwater

Contaminated ground water discharge to surface water may be a source of contaminants in water quality-limited surface waters. While ground water and surface water are often treated as separate systems, they are in reality highly interdependent components of the hydrologic cycle. Subsurface interactions with surface waters occur in a variety of ways. In several studies, ground water discharge accounted for as much as 90% or more of stream flow in humid regions. Therefore, the potential pollutant contributions from ground water to surface waters should be investigated when developing TMDLs. Additional information is available from the EPA Office of Ground Water Protection.

CERCLA

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or "Superfund" provides broad federal authority to respond directly to releases or threatened releases of hazardous substances. This law also provides for the cleanup of inactive or abandoned hazardous waste sites. Under CERCLA, EPA assesses the nature and extent of contamination at a site, determines the public health and environmental threats posed by a site, analyzes the potential cleanup alternatives, and takes action to clean up the site. In instances where a CERCLA site has impact on a nearby waterbody, the level of cleanup needed to maintain water quality standards of surface waters should have a direct relationship to the TMDL for the affected surface waters. As part of the CERCLA process, all "applicable or relevant and appropriate requirements" of statutes such as the CWA must be followed. Load allocations developed pursuant to section 303(d) may, in appropriate circumstances, be "applicable or relevant and appropriate."

POTWs that discharge CERCLA hazardous substances in effluent at levels that equal or exceed NPDES permit limitations, or for which no specific limitations exist, or in spills or other releases, may be subject to the notification requirements and liability provisions under CERCLA. In addition, POTWs that disposed of sludge in impoundments or landfills that are Superfund sites may be required to pay for cleanup of those sites. At times, POTWs may be requested to accept wastewaters from Superfund cleanup activities. If discharge of CERCLA wastewaters to a POTW is deemed appropriate, the discharger must ensure compliance with substantive and procedural requirements of the national pretreatment program and all local pretreatment regulations before discharging wastewater to the POTW.

The provisions of CERCLA extend well beyond the regulation of POTW discharges. The most common types of Superfund sites governed by CERCLA include abandoned hazardous waste sites and inactive mines, many of which do not discharge to POTWs.

SARA

The Superfund Amendments and Reauthorization Act (SARA, Hotline 800-535-0202), which amended CERCLA, also established in Title III a new program to increase the public's knowledge of and access to information on the presence of hazardous chemicals in their communities and releases of these chemicals into the environment. Title III (Community Right to Know Program) requires facilities to notify State and local officials if they have extremely hazardous substances present at their facilities in amounts exceeding certain "threshold planning quantities." If appropriate, the facility must also provide material safety data sheets on hazardous chemicals stored at their facilities, or lists of chemicals for which these data sheets are maintained, and report annually on the inventory of these chemicals used at their facility. The law may also require facilities to submit information each year on the amount of toxic chemicals released by the facilities to all media (air, water, and land), if they fall within Standards Industrial Classification Codes 20 to 39 and meet certain threshold limits.

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28 -- USEPA. 1989. Guidelines for the Preparation of the 1990 State Water Quality Assessment (section 305(b) Report). OW/OWRS. Washington, D.C. Back.

29 -- USEPA. March, 1988. Final Guidance for Implementation of Requirements under section 304(l) of the Clean Water Act as Amended. OWRS and OWEP. Washington, D.C. Back

30 -- USEPA. 1989. Overview of selected EPA Regulations and Guidance Affecting POTW Management. OW/OMPC, EPA 440/69-89/008. Washington, D.C. (Hotline: 800-424-9346) Back

31 -- USEPA. 1987. Permit Writer's Guide to Water Quality-based Permitting for Toxic Pollutants. OW/OWEP, EPA 440/4-87-005. Washington, D.C. Back

32 -- USEPA. Technical Guidance Manual for Performing Wasteload Allocations, Book III - Estuaries. Back

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Appendix C - Screening Categories

Guidance for Water Quality-Based Decisions: The TMDL Process

This list of screening categories is based on categories promulgated as the minimum data set a State should consider when developing their list of impaired waters pursuant to section 304(l) of the Clean Water Act. When developing lists pursuant to this guidance and to meet the requirements of section 303(d), a State should, at a minimum, use these categories to identify their water quality-limited waters. States should also consider additional information, such as TRI data, streamflow information collected by USGS, locally available data, and public comments on proposed 303(d) lists.

1. Waters where fishing or shellfish bans and/or advisories are currently in effect or are anticipated.
2. Waters where there have been repeated fishkills or where abnormalities (cancers, lesions, tumors, etc.) have been observed in fish or other aquatic life during the last ten years.
3. Waters where there are restrictions on water sports or recreational contact.
4. Waters identified by the State in its most recent State section 305(b) report as either "partially achieving" or "not achieving" designated uses.
5. Waters listed under sections 304(l) and 319 of the CWA.
6. Waters identified by the State as priority waterbodies. (State Water Quality Management plans often include priority waterbody lists which are those waters that most need water pollution control decisions to achieve water quality standards or goals.)
7. Waters where ambient data indicate potential or actual exceedances of water quality criteria due to toxic pollutants from an industry classified as a primary industry in Appendix A of 40 CFR Part 122.
8. Waters for which effluent toxicity test results indicate possible or actual exceedances of State water quality standards, including narrative "free from" water quality criteria or EPA water quality criteria where State criteria are not available.
9. Waters with primary industrial major dischargers where dilution analyses indicate exceedances of State narrative or numeric water quality criteria (or EPA water quality criteria where state standards are not available) for toxic pollutants, ammonia, or chlorine. These dilution analyses must be based on estimates of discharge levels derived from effluent guidelines development documents, NPDES permits or permit application data (e.g., Form 2C), Discharge Monitoring Reports (DMRs), or other available information.
10. Waters with POTW dischargers requiring local pretreatment programs where dilution analyses indicate exceedances of State water quality criteria (or EPA water quality criteria where State water quality criteria are not available) for toxic pollutants, ammonia, or chlorine. These dilution analyses

must be based upon data from NPDES permits or permit applications (e.g., Form 2C), Discharge Monitoring Reports (DMRs), or other available information.

11. Waters with facilities not included in the previous two categories such as major POTWs, and industrial minor dischargers where dilution analyses indicate exceedances of numeric or narrative State water quality criteria (or EPA water quality criteria where State water quality criteria are not available) for toxic pollutants, ammonia, or chlorine. These dilution analyses must be based upon estimates of discharge levels derived from effluent guideline development documents, NPDES permits or permit application data, Discharge Monitoring Reports (DMRs), or other available information.

12. Waters classified for uses that will not support the "fishable/swimmable" goals of the Clean Water Act.

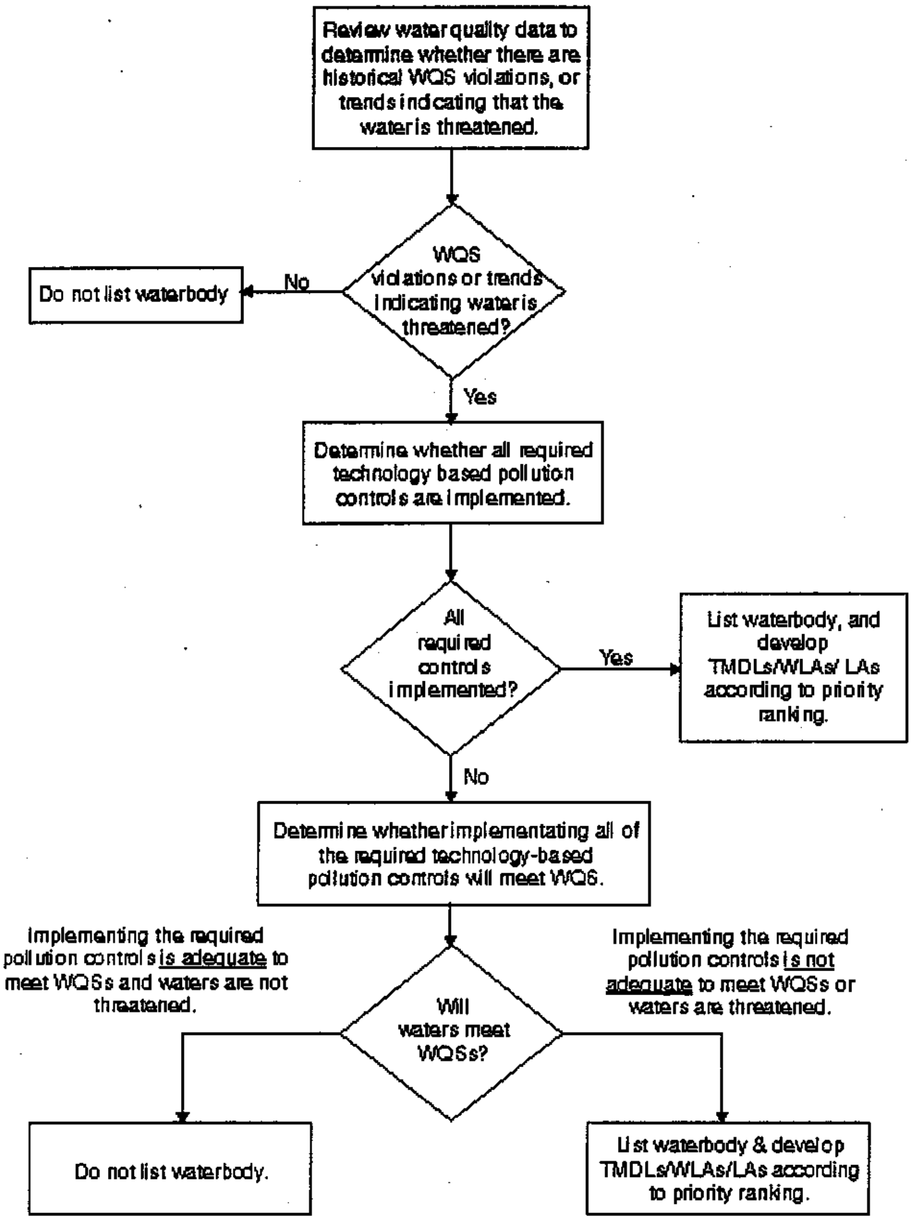
13. Waters where ambient toxicity or adverse water quality conditions have been reported by local, State, EPA, or other Federal agencies, the private sector, public interest groups, or universities. These organizations and groups should be actively solicited for research they may be conducting or reporting. For example, university researchers, the United States Department of Agriculture, the National Oceanic and Atmospheric Administration, the United States Geological Survey, and the United States Fish and Wildlife Service are good sources of field data and research.

14. Waters identified by the State as impaired in its most recent Clean Lake Assessments conducted under section 314 of the Clean Water Act.

15. Waters identified as impaired by nonpoint sources in **America's Clean Water: The States' Nonpoint Source Assessments 1985** (Association of State and Interstate Water Pollution Control Administrators (ASIWPCA)) or waters identified as impaired or threatened in a nonpoint source assessment submitted by the State to EPA under section 319 of the Clean Water Act.

16. Surface waters impaired by pollutants from hazardous waste sites on the National Priority List prepared under section 105(8)(A) of CERCLA.

Figure C-1
IDENTIFICATION PROCESS



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Appendix G - Causes And Sources Of Pollution

Guidance for Water Quality-Based Decisions:
The TMDL Process

Causes and Sources: Section 305(b) Waterbody System User's Guide, Third Edition (Version 2.0), August 1989, USEPA, Office of Water, Assessment and Watershed Protection Division, pages A-27 through A-31.

Causes		**Sources**	
Causes are the pollutants or conditions that are **causing** or expected to **cause** exceedances of water quality standards. One or more of the following categories should be used to identify causes of impairment:		Sources are the point and nonpoint **sources** of the pollution categories that are listed as causes identified above. One or more of the following categories should be used to identify sources of impairment:	
unknown toxicity	organic enrichment/DO	source unknown	
pesticides	salinity/TDS/chlorides	industrial point sources	municipal point sources
priority organics	thermal modifications	combined sewer overflow	agriculture
nonpriority organics	flow alterations	silviculture	construction
metals	other habitat alterations	urban runoff/storm sewers	resource extraction
ammonia	pathogens	land disposal	hydromodification
chlorine	radiation	habitat modification	
other organics	oil and grease	*Other categories:*	
nutrients	taste and odor	atmospheric deposition	storage tank leaks
pH	suspended solids	highway maintenance/ runoff	spills
siltation	noxious aquatic plants	in-place contaminants	natural
filling and draining	cause unknown	recreational activities	upstream impoundments
		salt storage sites	

[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]		

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