EPA NEW ENGLAND'S TMDL REVIEW 7/24/00

TMDL: **Madawaska Lake**, Aroostook County, Maine
(ME ID# 145 1802 located in T16 R04 WELS, Blooms/Trend, <2000)

STATUS: Final

IMPAIRMENT/POLLUTANT: Algae blooms due to excessive nutrient loading. The TMDL is proposed for total phosphorus.

BACKGROUND: The Maine Department of Environmental Protection (ME DEP) submitted to EPA-New England the final Madawaska Lake TMDL for total phosphorus (TP) with a transmittal letter dated June 20, 2000. All of EPA's April 18, 2000 comments (on the March 17, 2000 draft TMDL) were taken into account in the final submission.

The following review explains how the TMDL submission meets the statutory and regulatory requirements of TMDLs in accordance with §303(d) of the Clean Water Act, and 40 CFR Part 130.

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REVIEW ELEMENTS OF TMDLs

Section 303(d) of the Clean Water Act (CWA) and EPA's implementing regulations at 40 C.F.R. § 130 describe the statutory and regulatory requirements for approvable TMDLs. The following information is generally necessary for EPA to determine if a submitted TMDL fulfills the legal requirements for approval under Section 303(d) and EPA regulations, and should be included in the submittal package. Use of the verb "must" below denotes information that is required to be submitted because it relates to elements of the TMDL required by the CWA and by regulation.

1. Description of Waterbody, Pollutant of Concern, Pollutant Sources and Priority Ranking

The TMDL analytical document must identify the waterbody as it appears on the State/Tribe's 303(d) list, the pollutant of concern and the priority ranking of the waterbody. The TMDL submittal must include a description of the point and nonpoint sources of the pollutant of concern, including the magnitude and location of the sources. Where it is possible to separate natural background from nonpoint sources, a description of the natural background must be provided, including the magnitude and location of the source(s). Such information is necessary for EPA's review of the load and wasteload allocations which are required by regulation. The TMDL submittal should also contain a description of any important assumptions made in developing the TMDL, such as: (1) the assumed distribution of land use in the watershed; (2) population characteristics, wildlife resources, and other relevant information affecting the characterization of the pollutant of concern and its allocation to sources; (3) present and future growth trends, if taken into consideration in preparing the TMDL; and, (4) explanation and analytical basis for expressing the TMDL through surrogate measures, if applicable. Surrogate measures are parameters such as percent fines and turbidity for sediment impairments, or chlorophyl a and phosphorus loadings for excess algae.

The Madawaska Lake TMDL describes the waterbody and the cause of impairment as identified in the 1998 303(d) list. The document describes the pollutant of concern, total phosphorus, and

identifies the magnitude and location of phosphorus sources among atmospheric deposition and fourteen subcategories of land use within the watershed which include: forest, agriculture, camp/home, commercial, public, and roads (see Table 2 page 7 of 6/20/00 report). Groundwater contributions from septic systems are considered and included in Table 2. Internal sediment recycling is considered and determined to be insignificant. The TP export from shoreline erosion is calculated using actual data on the extent of erosion and phosphorus concentrations found in shoreline soils. The septic-field loading coefficients are also based on actual data from a sanitary survey (number of camps and homes, and the extent of their use).

It was not possible to separate natural background from nonpoint sources. In this case, not separating natural background is reasonable because of the limited and general nature of the information available (land-use categories) related to potential phosphorus sources to Madawaska Lake. Without more detailed site-specific information on nonpoint source loading, it would be very difficult to separate natural background from the total nonpoint source load, and attempting to do so would add little value to the analysis.

ME DEP provides an explanation and analytical basis for expressing the TMDL for nuisance algae blooms through surrogate measures using Secchi disk transparency (SDT), phosphorus loadings, and chlorophyl a. (See also section 2 which documents ME's statutory description of "trophic status based on measures of the chlorophyll a content, Secchi disk transparency, total phosphorus content and other appropriate criteria" as stated in Maine's water quality standards.) [38 MRSA §465-A (1)(B)].

Assessment: EPA - New England concludes that the ME DEP has done an admirable job of characterizing Madawaska Lake's sources of impairment.

2. Description of the Applicable Water Quality Standards and Numeric Water Quality Target

The TMDL submittal must include a description of the applicable State/Tribe water quality standard, including the designated use(s) of the waterbody, the applicable numeric or narrative water quality criterion, and the antidegradation policy. Such information is necessary for EPA's review of the load and wasteload allocations which are required by regulation. A numeric water quality target for the TMDL (a quantitative value used to measure whether or not the applicable water quality standard is attained) must be identified. If the TMDL is based on a target other than a numeric water quality criterion, then a numeric expression, usually site specific, must be developed from a narrative criterion and a description of the process used to derive the target must be included in the submittal.

The Madawaska Lake TMDL describes the applicable narrative water quality standards (see pp 11-12 of 6/20/00 report). The report defines applicable narrative criteria (p.11), designated uses and antidegradation policy (p.12).

ME DEP identifies a numeric water quality target for the TMDL of 14 ppb total phosphorus which ME DEP predicts will result in the attainment of water quality standards. The basis for selecting the numeric target (including the rationale for the use of best professional judgement) is provided in the TMDL in a discussion of the interrelationship among in-lake phosphorus, SDT, and chlorophyl a levels in lightly colored water (p. 12).

Assessment: EPA - New England concludes that ME DEP has properly presented its water quality standards and has made a reasonable interpretation of the narrative water quality criteria in the standards when setting a numeric water quality target.

The 14 ppb target concentration was selected based on review of statewide water quality data for naturally colored lakes in Maine, lake-specific data for Madawaska Lake, and on water-quality goals of ME DEP. EPA - New England is satisfied that this review was thorough and, based on our review, EPA concurs that the available data support the conclusion that an in-lake concentration of 14 ug/l TP will attain Maine's water quality standards.

3. Loading Capacity - Linking Water Quality and Pollutant Sources

As described in EPA guidance, a TMDL identifies the loading capacity of a waterbody for a particular pollutant. EPA regulations define loading capacity as the greatest amount of loading that a water can receive without violating water quality standards (40 C.F.R. § 130.2(f)). The loadings are required to be expressed as either mass-per-time, toxicity or other appropriate measure (40 C.F.R. § 130.2(i)). The TMDL submittal must identify the waterbody's loading capacity for the applicable pollutant and describe the rationale for the method used to establish the cause-and-effect relationship between the numeric target and the identified pollutant sources. In most instances, this method will be a water quality model. Supporting documentation for the TMDL analysis must also be contained in the submittal, including the basis for assumptions, strengths and weaknesses in the analytical process, results from water quality modeling, etc. Such information is necessary for EPA's review of the load and wasteload allocations which are required by regulation.

In many circumstances, a critical condition must be described and related to physical conditions in the waterbody as part of the analysis of loading capacity (40 C.F.R. § 130.7(c)(1)). The critical condition can be thought of as the "worst case" scenario of environmental conditions in the waterbody in which the loading expressed in the TMDL for the pollutant of concern will continue to meet water quality standards. Critical conditions are the combination of environmental factors (e.g., flow, temperature, etc.) that results in attaining and maintaining the water quality criterion and has an acceptably low frequency of occurrence. Critical conditions are important because they describe the factors that combine to cause a violation of water quality standards and will help in identifying the actions that may have to be undertaken to meet water quality standards.

Madawaska Lake has two basins that exhibit similar levels of phosphorus (TP), chlorophyl a, and Secchi disk transparency (SDT). The combined basin loading capacity for Madawaska Lake is set at 1,836 kg/yr of total phosphorus (see p. 13 in 6/20/00 report). The loading capacity is set to protect water quality and support uses during critical conditions which, for Madawaska Lake, occur during the summer season when environmental conditions (e.g., higher temperatures, increased light intensity, etc.) are most favorable for aquatic plant growth. Attainment of water quality standards will rely on reducing phosphorus loading from the watershed.

ME DEP links water quality to pollutant loading for Madawaska Lake by (1) applying phosphorus export coefficients to land area with specified land uses to estimate the load (see Table 2 on page 7 of 6/20/00 report), (2) picking a target in-lake phosphorus level, based on historic state-wide and in-lake water quality data, and (3) using an empirical model to determine the pollutant loading corresponding to the desired water quality in the lake (see pp. 13-15 of 6/20/00 report). These analytical methods are widely recognized as appropriate for lake TMDL development.

Madawaska Lake TMDL includes documentation supporting the technical approach, and

discussion of strengths and weaknesses in the analytical method used (see pp. 13-15 of 6/20/00 report).

Assessment: EPA - New England concludes that the loading capacity has been appropriately set at a level necessary to attain and maintain applicable water quality standards. The TMDL is based on a reasonable and widely accepted approach to establish the relationship between pollutant loading and water quality in lakes.

EPA - New England also concurs with expressing the TMDL as an annual loading based on the reasons provided by ME DEP.

4. Load Allocations (LAs)

EPA regulations require that a TMDL include LAs, which identify the portion of the loading capacity allocated to existing and future nonpoint sources and to natural background (40 C.F.R. § 130.2(g)). Load allocations may range from reasonably accurate estimates to gross allotments (40 C.F.R. § 130.2(g)). Where it is possible to separate natural background from nonpoint sources, load allocations should be described separately for background and for nonpoint sources.

If the TMDL concludes that there are no nonpoint sources and/or natural background, or the TMDL recommends a zero load allocation, the LA must be expressed as zero. If the TMDL recommends a zero LA after considering all pollutant sources, there must be a discussion of the reasoning behind this decision, since a zero LA implies an allocation only to point sources will result in attainment of the applicable water quality standard, and all nonpoint and background sources will be removed.

To achieve the in-lake level of 14 ug/l TP, ME DEP calculated that the total load of phosphorus contribution must be limited to 1,836 kg/yr. The TMDL allocates all of this loading capacity as a gross allotment to existing and future nonpoint sources and to natural background. Based on ME DEP's calculation of the current average loading of 1,939 kg/yr, an average reduction of 103 kg/yr, or 5.3% of current loadings must therefore be achieved. (If the upper value of loading range is used, a 22.8% reduction in TP is necessary.) Additional reductions for existing sources would be necessary to offset any future sources. The TMDL submission provides an extensive and detailed discussion of various steps that could be taken to implement these reductions (see Section 6 below, "Implementation Plans").

Assessment: EPA - New England concludes that the load allocation is adequately specified in the TMDL at a level necessary to attain and maintain water quality standards. The degree of load reductions necessary to achieve the in-lake phosphorus levels is based in part on an estimate of current loadings. EPA believes that ME DEP has made reasonable judgements about current loads, since the estimated values correlate well with modeled predictions and monitoring data.

5. Wasteload Allocations (WLAs)

EPA regulations require that a TMDL include WLAs, which identify the portion of the loading capacity allocated to existing and future point sources (40 C.F.R. § 130.2(h)). If no point sources are present or if the TMDL recommends a zero WLA for point sources, the WLA must be expressed as zero. If the TMDL recommends a zero WLA after considering all pollutant sources, there must be a discussion of the reasoning behind this decision, since a zero WLA implies an allocation only to nonpoint sources and background will result in attainment of the

applicable water quality standard, and all point sources will be removed.

In preparing the wasteload allocations, it is not necessary that each individual point source be assigned a portion of the allocation of pollutant loading capacity. When the source is a minor discharger of the pollutant of concern or if the source is contained within an aggregated general permit, an aggregated WLA can be assigned to the group of facilities. But it is necessary to allocate the loading capacity among individual point sources as necessary to meet the water quality standard.

The TMDL submittal should also discuss whether a point source is given a less stringent wasteload allocation based on an assumption that nonpoint source load reductions will occur. In such cases, the State/Tribe will need to demonstrate reasonable assurance that the nonpoint source reductions will occur within a reasonable time.

Madawaska Lake is a Class GPA water in Maine. According to Maine statute, "There may be no new direct discharge of pollutants into Class GPA waters." [38 MRSA 465-A (1) (c)] The TMDL report addresses only nonpoint and background sources of pollution. ME DEP states, "As there are no known existing point sources in the Madawaska Lake watershed, the waste load allocation for all existing and future point sources is set at 0 (zero) kg/yr of total phosphorus." (Page 16 of 6/20/00 report).

Assessment: EPA - New England concludes that the WLA component of the TMDL is appropriately set equal to zero based on ME DEP's determination that there are no point sources present in Madawaska Lake watershed.

6. Margin of Safety (MOS)

The statute and regulations require that a TMDL include a margin of safety to account for any lack of knowledge concerning the relationship between load and wasteload allocations and water quality (CWA § 303(d)(1)(C), 40 C.F.R. § 130.7(c)(1)). EPA guidance explains that the MOS may be implicit, i.e., incorporated into the TMDL through conservative assumptions in the analysis, or explicit, i.e., expressed in the TMDL as loadings set aside for the MOS. If the MOS is implicit, the conservative assumptions in the analysis that account for the MOS must be described. If the MOS is explicit, the loading set aside for the MOS must be identified.

The Madawaska Lake TMDL includes an implicit MOS through the conservative selection of the numeric water quality target of 14 ppb (see p.16 of 6/20/00 report).

Based on ME DEP's analysis of a state-wide limnological database for Maine, ME DEP believes that a target of 14 ug/l is a conservative goal because "nuisance algae blooms (plankton growth of algae which causes Secchi disk transparency to be less than 2 meters) are more likely to occur at 17 ppb or above, particularly in a colored lake. The difference between the in-lake target of 14 ppb and 16ppb represents a 12.5% (263 kg TP/yr) implicit margin of safety." (See pages 16-17 of 6/20/00 report.)

This MOS is supported by ME DEP's review of in-lake TP, Secchi disk transparency, and chlorophyll a data for Madawaska Lake from 1974-1997, which show that nuisance blooms resulting in non-attainment of Maine state water quality standards occurred during the late summers of 1987, 1988, 1991, and 1992 when in-lake water column TP concentrations of 17 - 19 ppb were evident and associated with elevated levels (16-27 ppb) chlorophyll a. "Notably, Maine water quality standards were not violated in 1990, when TP values were 14-16 ppb

throughout much of the summer period (14ppb in spring) and relatively low chlorophyll-a measures were recorded (2.6 to 7.1 ppb)." (Page 12 6/20/00 report.)

Assessment: EPA - New England concludes that adequate MOS is provided for the following reasons: (1) EPA believes a significant implicit MOS is provided in the selection of an in-lake TP concentration of 14 ppb based on a state-wide data base for naturally colored lakes, and (2) the adequacy of this MOS is supported by in-lake data.

7. Seasonal Variation

The statute and regulations require that a TMDL be established with consideration of seasonal variations. The method chosen for including seasonal variations in the TMDL must be described CWA § 303(d)(1)(C), 40 C.F.R. § 130.7(c)(1)

The Madawaska Lake TMDL is protective of all seasons, and was developed to be protective of the most environmentally sensitive period, summertime, when conditions are most favorable for plant growth (page 17 of 6/20/00 report). Madawaska Lake has two basins with varying flushing rates of 1.5/yr upper basin, and 4.7/yr lower basin, compared to the 5-6/yr flush level that ME DEP lake biologists use as a general rule-of-thumb threshold for consideration of seasonal variation as a major factor in the evaluation of TP loadings to Maine lakes. Best management practices (BMPs) for the Madawaska Lake watershed have been designed to address TP loading during all seasons. For these reasons, the TMDL will also be protective of water quality during all other seasons, as well.

Assessment: EPA - New England concludes that seasonal variation has been adequately accounted for in the TMDL because we agree that, given the hydraulic retention times, nonpoint source controls implemented to protect during the most vulnerable summer season will protect water quality throughout the year.

8. Monitoring Plan for TMDLs Developed Under the Phased Approach

EPA's 1991 document, Guidance for Water Quality-Based Decisions: The TMDL Process (EPA 440/4-91-001), recommends a monitoring plan when a TMDL is developed under the phased approach. The guidance recommends that a TMDL developed under the phased approach also should provide assurances that nonpoint source controls will achieve expected load reductions. The phased approach is appropriate when a TMDL involves both point and nonpoint sources and the point source is given a less stringent wasteload allocation based on an assumption that nonpoint source load reductions will occur. EPA's guidance provides that a TMDL developed under the phased approach should include a monitoring plan that describes the additional data to be collected to determine if the load reductions required by the TMDL lead to attainment of water quality standards.

The Madawaska TMDL describes the existing monitoring plan through Volunteer Lakes Monitoring Program (VLMP) which will be continued (May - October), as well as the monitoring of new deep hole parameters which will begin in the late spring - early summer of 2000 (late-May and mid-August). The planned monitoring is designed to track seasonal and inter-annual variation and long term trends in water quality.

Assessment: EPA - New England concludes that the ongoing monitoring by VLMP in

cooperation with the ME DEP is sufficient to evaluate the adequacy of the TMDL.

9. Implementation Plans

On August 8, 1997, Bob Perciasepe (EPA Assistant Administrator for the Office of Water) issued a memorandum, "New Policies for Establishing and Implementing Total Maximum Daily Loads (TMDLs)," that directs Regions to work in partnership with States/Tribes to achieve nonpoint source load allocations established for 303(d)-listed waters impaired solely or primarily by nonpoint sources. To this end, the memorandum asks that Regions assist States/Tribes in developing implementation plans that include reasonable assurances that the nonpoint source load allocations established in TMDLs for waters impaired solely or primarily by nonpoint sources will in fact be achieved. The memorandum also includes a discussion of renewed focus on the public participation process and recognition of other relevant watershed management processes used in the TMDL process. Although implementation plans are not approved by EPA, they help establish the basis for EPA's approval of TMDLs.

The Madawaska Lake TMDL implementation plan is described in pages 18-20 of the 6/20/00 report, with further detail provided in Appendix A: *Land Use Recommendations*. Specific recommendations for BMPs are outlined for several sources of phosphorus pollution, including forestry, non-forested roads, septic systems, and shoreline erosion.

Assessment: EPA - New England concludes that ME DEP has done an admirable job in developing and targeting BMPs to achieve the TMDL.

10. Reasonable Assurances

EPA guidance calls for reasonable assurances when TMDLs are developed for waters impaired by both point and nonpoint sources. In a water impaired by both point and nonpoint sources, where a point source is given a less stringent wasteload allocation based on an assumption that nonpoint source load reductions will occur, reasonable assurance that the nonpoint source reductions will happen must be explained in order for the TMDL to be approvable. This information is necessary for EPA to determine that the load and wasteload allocations will achieve water quality standards.

In a water impaired solely by nonpoint sources, reasonable assurances that load reductions will be achieved are not required in order for a TMDL to be approvable. However, for such nonpoint source-only waters, States/Tribes are strongly encouraged to provide reasonable assurances regarding achievement of load allocations in the implementation plans described in section 9, above. As described in the August 8, 1997 Perciasepe memorandum, such reasonable assurances should be included in State/Tribe implementation plans and "may be non-regulatory, regulatory, or incentive-based, consistent with applicable laws and programs."

ME DEP addresses reasonable assurances by: (1) providing information on past and current Clean Water Act §319-funded work in the watershed, (2) stating that a combination of BMPs have a very good chance of achieving the necessary reduction in phosphorus loading to the lake, and (3) explaining the priority ranking of Madawaska Lake in the context of Maine's state-wide EPA-approved NPS control program.

Assessment: EPA - New England concurs that the existence and track record of several road (land owner) associations in the Madawaska Lake watershed, combined with ME DEP's strong NPS strategy, provide reasonable assurance that load allocations will be achieved. We also note that the Maine Volunteer Monitoring Program, in cooperation with ME DEP, has a commitment to conduct regular, open water lake monitoring to assess the adequacy of the TMDL and, if

necessary, to revise the TMDL. This provides EPA with additional assurance that water quality standards will ultimately be met in Madawaska Lake.

11. Public Participation

EPA policy is that there must be full and meaningful public participation in the TMDL development process. Each State/Tribe must, therefore, provide for public participation consistent with its own continuing planning process and public participation requirements (40 C.F.R. § 130.7(c)(1)(ii)). In guidance, EPA has explained that final TMDLs submitted to EPA for review and approval must describe the State/Tribe's public participation process, including a summary of significant comments and the State/Tribe's responses to those comments. When EPA establishes a TMDL, EPA regulations require EPA to publish a notice seeking public comment (40 C.F.R. § 130.7(d)(2)).

Inadequate public participation could be a basis for disapproving a TMDL; however, where EPA determines that a State/Tribe has not provided adequate public participation, EPA may defer its approval action until adequate public participation has been provided for, either by the State/Tribe or by EPA.

The public participation process for Madawaska Lake TMDL is described on pages 20-21 of the 6/20/00 report. ME DEP issued public notice of the TMDL availability on March 15, 2000 (and subsequent dates) via local newspapers, ME DEP web-site, mailings to local stakeholders (road associations, volunteer monitors, etc.). ME DEP received comments only from EPA - New England, and responded to all of EPA's April 18, 2000 comments in the body of the final TMDL. The ME DEP also provided a public briefing on the TMDL at a June 13, 2000 road and camper association meeting.

Assessment: EPA - New England concludes that ME DEP has done an adequate job of involving the public during the development of the TMDL, provided adequate opportunities for the public to comment on the TMDL, and provided reasonable responses to the public comments.

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