



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1
1 CONGRESS STREET, SUITE 1100
BOSTON, MASSACHUSETTS 02114-2023

June 28, 2002

Lauren A. Liss, Commissioner
Department of Environmental Protection
1 Winter Street
Boston, MA 02108

Dear Commissioner Liss:

It is my pleasure to approve five Total Maximum Daily Loads (TMDL's) for lakes targeting total phosphorus. These are: Lake Boon, Leesville Pond, Lake Quinsigamond/Flint Pond, Salisbury Pond and Indian Lake.

EPA has determined, as set forth in the enclosed review document, that these phosphorus TMDL's meet the requirements of Section 303(d) of the Clean Water Act and EPA's implementing regulations (40 CFR part 130).

I want to congratulate you and the staff of the Division of Watershed Management for the excellent work in developing these TMDL's.

Sincerely,

Linda M. Murphy
Linda Murphy, Director
Office of Ecosystem Protection

cc: Cynthia Giles
Glenn Haas
Rick Dunn
Russ Isaac

*Lauren - 2 letters
in one week! Your
staff deserve a lot of
credit. Linda*

enclosures (5)

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TMDL Name: Indian Lake, Worcester, MA (MA51073)

Lead State: Massachusetts

TMDL Status: Approved

Pollutant ID: Total Phosphorus

TMDL end point: .027 mg/l Total Phosphorus (TP)

List ID: MA51073

Impairment ID: Noxious aquatic plants; Organic enrichment and low DO

Cycle: 1998

TMDL type: point source

TMDL (final) submittal date: May 14, 2002

Actual establishment date: June, 2002

Notice to public date: October, 2001

EPA NEW ENGLAND'S TMDL REVIEW

TMDL: Indian Lake, Worcester, MA (MA51073)

Date: May 14, 2002

STATUS: Final

IMPAIRMENT/POLLUTANT: Noxious Aquatic Plants (Code 2200); Organic enrichment and low DO (Code 1200) TMDL is developed for Total Phosphorus.

REVIEWERS: Bruce Rosinoff (617) 918-1698

BACKGROUND: The Massachusetts Department of Environmental Protection (MADEP) submitted to EPA New England the *Final Total Maximum Daily Load for Indian Lake, Worcester, MA, dated May 14, 2002*. The following is a summary of EPA's review which explains how the TMDL submission satisfies the statutory and regulatory requirements of TMDLs in accordance with Section 303(d) and 40 CFR Part 130. In addition to reviewing the TMDL document, EPA-New England also reviewed the 1989 *Diagnostic/Feasibility Study of Indian Lake*, conducted by Lycott Environmental Research, Inc., which provides the technical basis for the TMDL.

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 chlorophyll *a* and phosphorus loadings for excess algae.*

The Indian Lake TMDL adequately describes the waterbody, which is located in the headwaters of the Blackstone River Watershed in Worcester, MA. The lake is 193 acres in size and is owned by the City of Worcester. The Indian Lake TMDL of 524 kg/yr total phosphorus is based on a (1987) Diagnostic/Feasibility (D/F) study conducted by Lycott Environmental Research Inc., (Lycott), 1989). The lake has a mean depth of only 3.25.

The document notes that the causes of impairment, as identified on the MA 1998 303(d) list, are noxious aquatic plants and organic enrichment and low dissolved oxygen. (MA DEP, 1998). In addition, phosphorus loading from the lake's watershed causes the lake to experience nuisance algae blooms. The overall goal of the TMDL is to restore the uses of the pond for primary and secondary contact recreation. This will be accomplished by a combination of reducing total phosphorus loading direct control of macrophytes.

To estimate existing TP loadings, MADEP reviewed a mass-balance nutrient budget. Natural background loadings were not distinguished from the total nonpoint source load. EPA New England believes that the effort to collect site-specific information for the purpose of separating natural background from the total nonpoint source load would add little value to the analysis. Important assumptions made in developing the TMDL are discussed (See TMDL, p. 14). One of the major assumptions is that control of TP loading will reduce aquatic weed growth and the potential for algae blooms.

EPA concludes that the use of the 1989 Lycott D/F study provides a reasonable technical basis for the development of this TMDL.

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.

Water-quality standards (WQSs) have been violated for Nuisance aquatic plants and organic enrichment and low dissolved oxygen in Indian Lake. The TMDL describes the applicable WQSs, which include designated uses, narrative criteria, and an antidegradation policy. Indian Lake Pond is listed as a Class B water. (See TMDL pp.11-12).

The phosphorus ecoregion map of Griffith (1994) indicates the lake is in an ecoregion with concentrations of 15-19 ppb, based on spring/fall concentrations, while the phosphorus ecoregion map of Rohm (1995) suggests that typical lakes in this ecoregion would have concentrations between 30 and 50 ppb, based on summer concentrations. Based on the above ecoregion analysis and the very slow flushing rate (1.91 times per year) of the lake, DEP has set the target average summer TP concentration at .027mg/l. According to DEP, because of the slow flushing rate, and considering a margin of safety, the lower phosphorus concentration will lessen the chance of nuisance algal blooms, which may occur as macrophyte biomass is reduced by direct controls. This should meet the water transparency standard for swimming of 4 feet. EPA notes that ongoing monitoring will be needed to assess whether this TP is adequate for achieving the 4 ft. transparency standard.

EPA concludes that DEP has properly presented its water quality standards and has made a reasonable interpretation of the narrative criteria in the standards. EPA concludes that a reasonable judgment has been made that TP targets in conjunction with in-lake management practices to control nuisance macrophytes will attain 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.

MA DEP proposes to set the loading capacity for Indian Lake at 298 kg/yr of total phosphorus, a reduction of 222 kg/yr from current levels. In-lake TP concentrations will drop from 30-50 ppb to 27 ppb (See TMDL pps.12-13).

The loading capacity was set to protect water quality and support uses during critical conditions which, for Indian Lake, occur during the summer season when environmental conditions (e.g., higher temperatures, increased light intensity, etc.) are most favorable for growth of phytoplankton and macrophytes.

The Indian Lake submittal includes documentation supporting the technical approach (i.e. based on the Lycott study) and key assumptions used in the analysis. The approach used by DEP to link water quality to pollutants is widely used by lake managers in New England. Most of the D/F studies conducted throughout Massachusetts have followed similar approaches. In-lake nutrient concentrations were modeled to estimate how nutrient management may reduce in-lake concentrations and reduce the probability of algal blooms in the future. There is uncertainty of both the loading rate and the target load. However, EPA believes that it is reasonable to assume that the percentage phosphorus reduction will result in reaching the target concentration.

Principal strengths of this TMDL document are that it considers the flow dynamics of the pond and uses existing data to estimate current TP loading to the pond. Weaknesses in the approach are the lack of information about specific pollution sources, and the uncertainties concerning the relationship between pollutant loadings and aquatic macrophyte growth.

The TMDL is expressed in terms of allowable annual loadings. As specified in 40 CFR 130.2(i), TMDL's may be expressed in terms of either mass per unit time, toxicity or other appropriate measures. DEP justifies setting an annual load, as opposed to a daily load, because Indian Lake's overall water quality including excessive aquatic plant growth is a function of long-term average pollutant loadings rather than short-term daily loadings. The use of annual loading targets is a widely accepted practice in lake management. With respect to eutrophication it is important to consider annual loadings because of the long residence time and the fact that the phosphorus that is bound up in particulate matter accumulates, and may become available at much later times for plant growth.

EPA concludes that DEP has used a reasonable and widely-accepted approach to establish the relationship between pollutant loading and water quality, and concurs that it is appropriate to

express the TMDL as an annual loading based on the reasons provided by 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.

The Indian Lake TMDL sets the total of all load allocations for existing and future nonpoint sources to 141 kg/yr total phosphorus. Loads are allocated to: atmosphere, carp release and anoxic sediment release. EPA concludes that target load allocations are adequately specified in the TMDL at levels necessary to attain and maintain water quality standards (p.13).

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 designated 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 designated 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.

The waste load allocation is set at 383 kg/yr total phosphorus with the target load being set at 206 kg/yr. DEP includes all watershed sources of phosphorus in the waste load portion because of the highly commercial and dense residential nature of the area. This decision is explained in DEP's May 30, 2002, cover letter that accompanied the TMDL submittal. EPA agrees with DEP that due to the difficulty of breaking out the load allocation from the waste load allocation in this particular setting, it is appropriate to include the entire watershed loading in the waste load allocation portion. This is justified because the sources in these categories, are either covered under the Phase I NPDES Stormwater permit for Worcester, or although not currently subject to NPDES permits, probably discharge stormwater through pipes, ditches, or other point sources. The states have the discretion to include such discharges in either the waste load or load allocations.

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 Indian Lake TMDL includes an explicit MOS of 5% (16 kg/yr), which has been set aside as unallocated (See TMDL, p. 13). EPA concludes that MA DEP has set a sufficient MOS for this TMDL.

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 TMDL was developed to be protective of the most environmentally sensitive period (summer season), when the frequency and occurrence of nuisance algal blooms and macrophyte growth are the greatest. To assure protectiveness during the critical summer season, the total phosphorus load is the average summer concentrations. Therefore, the TMDL will also be protective of water quality during all other seasons.

DEP adequately justifies setting an annual rather than a daily load. Indian Lake's overall nutrient state is largely expressed by excessive aquatic plant growth and accumulation of nutrients in

sediments, both of which are a function of long-term average rather than short-term pollutant loadings.

EPA concludes that seasonal variations have been adequately accounted for in the TMDL.

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 TMDL describes the extent of MADEP's proposed monitoring and monitoring schedule. Monitoring will be done according to the 5-year MA watershed cycle. Monitoring will include nutrient analysis, temperature and oxygen profiles and aquatic vegetation maps of distribution and density, and Sechi Disk Transparency. Also, DEP will work with and encourage volunteer efforts to monitor the lake and identify pollution sources in the watershed.

EPA concludes that the proposed monitoring by DEP together with the on-going annual volunteer monitoring will be 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 Indian Lake implementation plan is described in the TMDL on pages 14-16. Many of the

proposed stormwater controls have already been incorporated in the Worcester NPDES permit. In addition, the plan outlines a process for collecting additional information to identify phosphorus sources, provide watershed residents with non point source pollution and lake water quality education, and give guidance to apply for grant and loan funding to control sources once they are identified. Tasks and responsible parties are identified in Table 2 (p.17).

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."

Reasonable assurances that the TMDL will be implemented are provided through current regulations, availability of financial incentives and the existence of various local, state, and federal pollution-control programs. Table 2 lists the posed implementation tasks and responsible groups. Many of the implementation tasks related to phosphorus reduction are the responsibility of either MADEP or the watershed team which is led by the MA Executive Office of Environmental Affairs (EOEA). EPA has the opportunity through the Performance Partnership Agreement (PPA) process to work with MADEP to provide reasonable assurances for implementing the TMDL. The responsible groups for tasks related primarily to outreach programs and developing funding proposals include the EOEA Watershed Team and the Indian Lake Watershed Association.

It was also noted that the city of Worcester has committed to implementation of an aggressive program designed to identify and correct sources of sewage to the storm drain system, as part of its NPDES Stormwater permit. EPA believes there is reasonable assurance that these practices will continue in the future.

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 is described on pages 19-20 of the document. DEP held a preliminary public meeting on November 10, 1999. The final public meeting was held on October 18, 2001. A clear record of comments and responses is included.

EPA concludes that DEP has done an adequate job involving the public during the development of the TMDL, and has provided adequate opportunities for the public to comment.

12. Submittal Letter

A submittal letter should be included with the TMDL analytical document, and should specify whether the TMDL is being submitted for a technical review or is a final submittal. Each final TMDL submitted to EPA must be accompanied by a submittal letter that explicitly states that the submittal is a final TMDL submitted under Section 303(d) of the Clean Water Act for EPA review and approval. This clearly establishes the State/Tribe's intent to submit, and EPA's duty to review, the TMDL under the statute. The submittal letter, whether for technical review or final submittal, should contain such information as the name and location of the waterbody, the pollutant(s) of concern, and the priority ranking of the waterbody.

DEP's May 30, 2002, letter clearly states that the TMDL is submitted under Section 303(d) for EPA approval.

