



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 1
1 Congress Street, Suite 1100
BOSTON, MA 02114-2023

May 22, 2007

Arleen O'Donnell, Commissioner
Department of Environmental Protection
1 Winter Street
Boston, MA 02108

Re: Approval of the Pathogen TMDL for the Charles River Watershed

Dear Commissioner O'Donnell:

Thank you for submitting the Final Pathogen TMDL for the Charles River Watershed on February 9, 2007. We appreciate your extensive efforts and involvement with our office to finalize this TMDL. We believe this TMDL combined with the other TMDLs in various stages of development on the Charles River will be a catalyst in the restoration of the Charles River Watershed.

The U.S. Environmental Protection Agency (EPA) has reviewed the document entitled "Final Pathogen TMDL for the Charles River Watershed" (Control number CN 0156.0) and it is my pleasure to approve the 20 TMDLs. EPA has determined, as set forth in the enclosed review document, that these TMDLs meet the requirements of Section 303(d) of the Clean Water Act (CWA) and EPA's implementing regulations at 40 Code of Federal Regulations (CFR) Part 130.

We commend your efforts again to develop "pollution prevention" TMDLs on water body segments not currently impaired. This approach can encourage the maintenance and protection of existing water quality and help prevent further degradation of water bodies that are downstream or linked to other water body segments. Although EPA does not approve pollution prevention TMDLs, EPA acknowledges the establishment of these TMDLs consistent with developing information as set forth in CWA Section 303(d)(3).

Please pass on to your staff in the Division of Watershed Management our congratulations for their excellent work in developing these TMDLs.

Sincerely,

/s/

Stephen S. Perkins, Director
Office of Ecosystem Protection

Enclosure

cc: Glenn Haas, MassDEP
Rick Dunn, MassDEP
Russ Isaac, MassDEP
Ann Williams, EPA
Ken Moraff, EPA
Steve Silva, EPA
Mike Hill, EPA

EPA NEW ENGLAND'S TMDL REVIEW

DATE: May 21, 2007

TMDL: Charles River Watershed Pathogen TMDL

STATUS: Final

IMPAIRMENT/POLLUTANT: Pathogen TMDL for 20 Water Body Segments (See Attachment 1)

BACKGROUND: Final Pathogen TMDL for the Charles River Watershed, January 2007, (Control Number: CN 0156.0). The documents submitted by MassDEP as part of the record for this TMDL include:

- Final Pathogen TMDL for the Charles River Watershed (Control Number: CN 0156.0);
- Charles River Hot Spot Monitoring Data (2002-2005), Appendix E;
- Public Meeting Information and Response to Comments, Appendix H;
- Massachusetts Surface Water Quality Standards;
- Mitigation Measures to Address Pathogen Pollution in Surface Waters: A TMDL Implementation Guidance Manual for Massachusetts;
- References set out in Section 12.0 of the Final Pathogen TMDL for the Charles River Watershed

REVIEWER: Mike Hill, telephone number 617.918.1398, e-mail address: hill.michael@epa.gov

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

Introduction

The Charles River Watershed Pathogen TMDL is designed to support reduction of waterborne disease-causing organisms, known as pathogens, to reduce public health risk. Waterborne pathogens enter surface waters from a variety of sources including sewage and the feces of warm-blooded wildlife. These pathogens can pose a risk to human health due to gastrointestinal illness through exposure via ingestion and contact with recreational waters, ingestion of drinking water, and consumption of filter-feeding shellfish.

The Charles River Watershed to which this TMDL applies includes 20 water bodies that are impaired for pathogens (see Attachment 1). The approach outlined in this pathogen watershed TMDL includes two types of daily TMDL targets: 1) the establishment of concentration-based targets (expressed as the number of indicator bacteria organisms (pathogens) per 100 ml) based on the Water Quality Standards (WQS) for each discharge source by category (e.g., storm water, CSO, etc.) and 2) maximum loads (expressed as the number of indicator bacteria organisms (pathogens) per day) for each stream segment and non-storm water related discharge. The maximum loads are expressed through a flow duration curve¹ and the allowable daily loadings for each stream segment are presented for high, medium and low stream flow conditions.

In addition, the TMDL document includes estimates of percent reductions needed to meet the WQS based on comparing ambient pathogen concentrations to the water quality criteria for each stream segment.

The TMDL includes: a) monitoring data related to water quality impairments in each segment (i.e., the TMDL report provides specific data describing the range of pathogen concentrations in each water body), b) a prioritization of discharge outfall sources and river segments based on the concentration of pathogens present, c) a supplementary TMDL Implementation Guidance Manual that suggests ways in which the TMDL can be implemented, and d) the development of "pollution prevention" TMDLs by MassDEP (see Section 13).

¹ The flow duration curve represents the characterization of water quality concentrations (or water quality data) at different flow regimes. The method provides a visual display of the relationship between stream flow and loading capacity. Using the flow duration curve framework, the frequency and magnitude of water quality standard exceedances, allowable loadings, and size of load reductions may be presented for better understanding.

The TMDL document provides monitoring data with links to additional data sources and descriptions of sources and estimated load and reduction percentages that will help agencies/local governments make appropriate prioritization decisions to implement this TMDL. For example, for each water body segment there is a description of the segment and links to additional segment descriptions and additional data sources, a summary of all of the pathogen data, identification of potential sources and recommendations to address the sources. In addition, MassDEP's decision to define small water body segments, designed to correspond to major potential sources of pollution and landuse -- further facilitates the identification and prioritization of sources of impairment.

MassDEP provides TMDL targets as concentrations (Table 7-1), percent reductions for information (Table 7-2) and daily mass load TMDL targets (Figure 7-1, and Tables 7-3 and 7-4), but believes that concentration based targets are most useful for guiding implementation. Load allocations based on concentration are advantageous for several reasons. In particular, a concentration limit is more readily understandable to the public, and will allow interested citizens and/or watershed groups to more easily determine whether any particular source is exceeding its allocation. This is particularly true for storm water sources because the link between pathogen discharges and rainfall creates a complex relationship between loadings and flow conditions.

Finally, while not required as part of the TMDL approval process, MassDEP, in the document, "Mitigation Measures to Address Pathogen Pollution in Surface Waters: A TMDL Implementation Guidance Manual for Massachusetts" (TMDL Implementation Guidance Manual) which accompanies the TMDL, presents a broad array of implementation tools to address pathogen control. As discussed more fully below, Massachusetts has a variety of regulatory requirements to mitigate pathogens within the Commonwealth.

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 TMDL document describes the Charles River Watershed and specifically the water body segments identified as not attaining designated uses (primarily contact recreation) due to exceeding Massachusetts' WQS for pathogens. The document identifies a total of

20 impaired segments (Attachment 1) included on Massachusetts' 2002 Integrated 303(d) list for pathogens.

The TMDL document adequately identifies the non-point and point sources of pathogens that are present and contribute to exceedances of Massachusetts' WQS. As set forth in Sections 4 and 5, the TMDL document articulates both general categories and specific sources of pathogen contributions from the range of possible pathogen source categories, which include storm water runoff, leaking sewer pipes, failing septic systems, wildlife including birds, combined sewer overflows and wastewater treatment plants. In addition, MassDEP prioritizes the segments and sources of pathogen impairment in need of mitigation measures (see Sections 5 and 6 of the TMDL document). On a broader scale, MassDEP has determined that all pathogen impaired segments in the Commonwealth are a high priority (see Massachusetts Integrated List of Waters at: <http://www.mass.gov/dep/water/priorities/priorities.htm>). Approximately 24% of the Commonwealth's assessed waters are impaired for pathogens.

Sources of data, collected and highlighted by MassDEP in the TMDL, suggest that much information is available to assist the public in understanding the sources of pathogen contamination in the Charles River Watershed. First, ambient data collected during both dry and wet weather conditions provide an insight into the overall magnitude of sources contributing to the impairment in the Charles River Watershed. Second, MassDEP summarizes and provides links to extensive data sets that indicate the nature of the impairment and ranges of pathogens present within each water body segment. As stated above, MassDEP prioritized discharge outfall sources and river segments based on the concentration of pathogens present (see Sections 5 and 6 of the TMDL document). Since MassDEP divides the water bodies within the watershed into small, manageable segments, the link of the sources of pathogens to the impairment within each water body segment is more apparent because of the association of landuse and the types of sources of pathogens. The assessments and monitoring that occurs in these spatially-refined water body segments allows for a higher degree of association with the sources and their ultimate remediation.

Assessment:

During the comment period some commenters expressed concern that the draft TMDL did not contain the most recent data available or that all of the data was not contained in the TMDL document. MassDEP made a number of changes to the final TMDL document to address those and other concerns (e.g., about the specificity of the document). In the final TMDL, MassDEP included additional site specific information, including information on specific sources of bacteria, wherever information was available. MassDEP incorporated additional information into the final TMDL including Charles River Watershed Association (CRWA) data up to August 2005 and updated the individual summary segment tables in the Problem Assessment, Section 4.0 of the TMDL. There is a large amount of sampling data that has been collected in the Charles River watershed. Although all of the data are not physically incorporated into the document, all of the data was reviewed, data were summarized and the TMDL document

provides links and references to the original sources of the data. The final TMDL includes a new Section 6.0, Prioritization and Known Sources. In this section, Table 6-1 provides a prioritized list of pathogen-impaired segments that will require additional work and Table 6-2 lists outfall pipes that should be a high priority for remediation. The final TMDL document is adequate to address the description of the water bodies, pollutant of concern, pollutant sources and priority ranking and fulfill the required elements for EPA approval.

EPA concurs with MassDEP's determination to address pathogen impaired waters in the Charles River as a high priority given the growing use of the river for recreation. EPA concludes that the Charles River Watershed TMDL document adequately characterizes the nature of the pathogen impairments and causes by summarizing ambient pathogen and storm water outfall data including new data provided during the comment period. MassDEP has relied on the best available information including extensive ambient monitoring during both dry and wet weather conditions and information from other studies and references to characterize the source categories. EPA believes that MassDEP has consequently appropriately documented the extent of the impairments due to pathogen contamination, as well as the types of sources that are likely to be present that are in need of abatement (see Sections 5 and 6 of the 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.

There are both Class A and B segments of the Charles River included in this TMDL. The Massachusetts Surface Water Quality Standards include water quality criteria for fecal coliform, E. coli, total coliform and enterococci as indicator organisms of potential harmful pathogens for fresh water. The TMDL document presents the applicable Massachusetts WQS in Section 3.0 of the document.

Section 4.0 of the TMDL document describes each of the 20 tributaries to the Charles River and Charles River segments that are impaired. This section also indicates the water quality classification (A or B) for each segment. The water quality criteria applicable to the A and B segments of the Charles River and its tributaries are included in the TMDL document in Tables ES-1 and 6-1. Section 4.0 describes each water body segment -- including the water body's designated use, applicable WQS, summary of data, sources of pathogens when available and other characteristics. For all waters and during the non bathing season, these criteria may be applied on a seasonal basis at the discretion of MassDEP.

The EPA approved numeric water quality criteria for each segment are the targets upon which both the daily concentration and load TMDL targets of the TMDL are based.

Assessment:

EPA concludes that MassDEP has properly described and interpreted the applicable water quality standards to set the TMDL targets as indicated in Section 4.0 of the TMDL document. Section 4.0 describes each water body segment -- including the water body's designated use, applicable WQS, summary of data, sources of pathogens when available and other characteristics such as which segments and sources of pathogens are a priority. MassDEP is directly applying the numeric criteria in its WQS to derive the TMDL targets.

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.

In the Charles River watershed, storm water is a significant cause of pathogen criteria water quality impairment. The draft TMDL expressed the loading capacity as concentration targets. In response to public comments and to maximize the utility of the TMDL, MassDEP added aggregate stream segment loadings along with percent reduction estimates for each stream segment to the final TMDL. As stated above, MassDEP believes the concentration targets are most useful for evaluating whether a particular source is exceeding its allocation because it does not require complex simultaneous flow measurement. The aggregate mass loadings and percent reduction estimates by stream segment provide information on the degree of relative assimilative capacity available and estimated reduction in pathogens required for each segment of the river.

As discussed below, both formats (concentration and load) express targets designed to attain the designated use of primary contact recreation based on a straight forward derivation of TMDL targets from the water quality criteria adopted by the Commonwealth to assure use attainment. They will achieve water quality criteria for both dry and wet weather and for all storm events whenever they occur (e.g. on any given day), whenever the bacteria criteria are in effect. These approaches have been used by states for TMDL development and approved by EPA in the past.

1) MassDEP chose to express the loading capacities in terms of concentrations (Table 7-1) set equal to or less than the WQS for several reasons. First, as stated in the TMDL, “MassDEP believes that expressing a loading capacity for bacteria in terms of concentrations set equal to the Commonwealth’s adopted criteria provides the clearest and most understandable expression of water quality goals to the public and to groups that conduct water quality monitoring.” MassDEP also estimated percent reductions (Table 7-2) needed in each water body segment necessary to meet WQS based on comparing ambient pathogen concentrations to the water quality criteria. MassDEP included the percentage reduction estimates to illustrate the magnitude of reduction needed for each segment as a guide for implementation and for public education. The Charles River Watershed TMDL document describes the general source reductions needed to achieve WQS by land use type, for example, as indicated in Tables 5-2 and 5-3 of the TMDL document. In addition, specific water body segment data are provided that indicate the range in magnitude of the pathogen concentrations for each impaired segment. Based on the data available, MassDEP prioritized the water body segments and specific outfall pipes in need of remediation (See Section 5 and 6 of the TMDL document; specifically Table 6-1, Priority Segments and Table 6-2, High Priority Outfalls, in particular).

2) MassDEP also expressed the loading capacity in terms of maximum daily loads based on flow duration curves – a series of calculations based on flow and the allowable water quality criteria concentration for pathogens in the water body (Figure 7-1, Tables 7-3 and 7-4). “MassDEP believes that expressing the loading capacity for bacteria in terms of loadings (e.g., numbers of organisms per day), although provided, is more difficult for the public to interpret and understand because the “allowable” loading number ... is very large (i.e. billions or trillions of organisms per day) and therefore cannot be easily understood in the context of the State Water Quality Standards or public health criteria” (see Section 7.1 of TMDL). Additionally, the number would vary according to flow rate since the loading capacity is dependent on stream flow rates which are constantly changing.

Assessment:

There is nothing in EPA’s regulations that forbids expression of a TMDL in terms of multiple TMDL targets. TMDLs can be expressed in various ways, including in terms of toxicity, which is a characteristic of one or more pollutants, or by some “other appropriate measure.” 40 C.F.R. § 130.2(i). The target loading capacities expressed in the TMDL document are set at levels which assure WQS will be met (criteria at point of

discharge and loading based on meeting ambient water quality criteria). The concentration loading capacity is based on the concentration criteria for each water body. If all sources of pathogens are below the water quality criteria then it follows that the receiving water will meet the WQS for bacteria.

The percent reduction loading capacity estimate provided for information purposes, while not a TMDL, is based on a conservative calculation comparing the highest ambient bacteria data point to the criterion without factoring in the fact that the criterion is a geometric mean rather than a single sample maximum value.

The daily maximum load was calculated by multiplying the mean concentration criterion by stream flow to calculate a daily mass loading. The loading capacity expressed in this way is mathematically derived to assure that the sum of the loads to the receiving water diluted by the stream flow will result in a concentration at the water quality standard.

All of the above loading capacity targets are directly linked to the Commonwealth's WQS' bacteria criteria and the bacteria levels (pollutants) that must be reduced to achieve full primary contact recreation use (or other designated uses) of the water bodies covered by this TMDL.

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 TMDL sets the target load allocations for non-NPDES regulated point sources, non-point sources and background equal to either the applicable water quality standard of the receiving water or to zero if the origin of the source is prohibited (e.g., failing septic systems) (Table 7-1). The difference between the LAs and WLAs (discussed in the next Section) is the source of the discharge and whether it is regulated under the NPDES program. The TMDL also included, for public information purposes, estimated combined LA and WLA (i.e. all sources) percent reductions needed in each water body segment necessary to meet WQS based on comparing ambient pathogen concentrations to the water quality criteria (Table 7-2).

Maximum daily loads as a function of stream flow (Figure 7-1), aggregate LA and WLAs (Table 7-3) and separate LA and WLAs (Table 7-4) based on flow duration curves – a series of calculations based on flow and the allowable water quality criteria concentration for pathogens in the water body – are provided. The total allowable load to a segment is

calculated as a function of stream flow by multiplying the applicable criterion by the stream flow and a conversion factor providing total load (LA + WLA) for all stream flows (Figure 7-1). Total loads (LA + WLA) for low, median and high stream flow are provided in Table 7-3 based on Charles River flow data and a flow duration curve. The fraction of runoff load allocated to unregulated sources (LA) was computed by multiplying the total load by the fraction of the watershed that is pervious and therefore less likely to discharge to a MS4 regulated storm sewer system (79.7%). The LA for storm water at average flow is provided in Table 7-4. The equations provided in Section 7.4.3 and Figure 7-1 may be used to calculate the LA for any other stream flow.

Assessment:

As discussed in Section 3, MassDEP used the applicable numeric water quality criteria directly related to the primary contact use impairment (or other designated use impairment) which the TMDL is designed to address. As discussed in Section 6 under margin of safety, MassDEP set conservative targets based on meeting criteria at the point of source discharge. The aggregate mass load allocation is derived from the applicable criteria, flow and land cover data. EPA concludes that load allocations are adequately specified in the TMDL at levels necessary to attain and maintain WQS.

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.

Point source discharges subject to the NPDES permit program must be addressed by the wasteload allocation component of a TMDL, as required by 40 C.F.R. § 130.2(h). MassDEP has established WLA targets for concentration (colonies/100ml) by discharge source category (Table 7-1). Discharges involving process wastewater, non-contact cooling water, and other non-storm water discharges are assigned individual concentration and mass waste load allocations pursuant to 40 C.F.R. § 130.2(h). The WLAs for non-storm water sources (e.g., wastewater treatment plants) are established as both a concentration equal to the water quality criteria for each source by discharge

category, and a daily load (the daily discharge flow times the concentration target and a conversion factor to provide a mass per time expression of the TMDL as well).

Storm water discharges are less amenable to individual wasteload allocations. In recognition of this fact, EPA's November 22, 2002 guidance entitled "Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) for Stormwater Sources and NPDES Permit Requirements Based on Those WLAs," provides that it is reasonable to express allocations for NPDES-regulated storm water discharges from multiple point sources as a single categorical or aggregate wasteload allocation when data and information are insufficient to assign each source or outfall individual WLAs. In the case of this pathogen TMDL, MassDEP did establish concentration (colonies/100ml) TMDL targets on a discharge by discharge basis, but daily loads (colonies/day) were established on an aggregate basis by segment because of insufficient flow data on each storm water source outfall.

The TMDL sets the target load allocations for storm water sources equal to the applicable water quality criteria of the receiving water (Table 7-1). The difference between the WLAs and LA (discussed in the previous Section) is the source of the discharge and whether it is regulated under the NPDES program. As mentioned in the previous Section, the TMDL also included, for public information purposes, estimated combined LA and WLA (i.e. all sources) percent reductions needed in each water body segment necessary to meet WQS based on comparing ambient pathogen concentrations to the water quality criteria (Table 7-2).

In addition to the concentration targets, the TMDL includes maximum daily loads as a function of stream flow (Figure 7-1), aggregate LA and WLAs (Table 7-3) and separate LA and WLAs (Table 7-4) based on flow duration curves – a series of calculations based on flow and the allowable water quality criteria concentration for pathogens in the water body. The total allowable load to the segment is calculated as a function of stream flow by multiplying the applicable criterion by the stream flow and a conversion factor providing total load (LA + WLA) for all stream flows (Figure 7-1). Total loads (LA + WLA) for low, median and high stream flow are provided in Table 7-3 based on Charles River flow data and a flow duration curve. The fraction of runoff load allocated to regulated storm water sources (WLA) was computed by multiplying the total load by the fraction of the watershed that is impervious and therefore more likely to discharge to a MS4 regulated storm sewer system (20.3%). The WLA for storm water at average flow is provided in Table 7-4. The equations provided in Section 7.4.3 and Figure 7-1 may be used to calculate the WLA for any other stream flow.

MassDEP believes the concentration targets are most useful for guiding implementation because the concentration targets are independent of storm water flow volume. The aggregate percent reduction estimate and mass per time daily loadings are provided to illustrate the assimilative capacity and the magnitude of reductions required for the various stream segments.

Assessment:

MassDEP established concentration-based WLAs by applying the numeric criteria directly to each discharge. Some public comments expressed concern that the TMDL did not allocate loads to each source of pathogens on the Charles River. MassDEP has established WLA/LA targets for concentration (colonies/100ml) by discharge source category (Table 7-1), applicable to each individual source (wastewater treatment plants, CSO, storm water, etc). Individual mass loading targets were also established for all regulated continuous sources (i.e. non-storm water related) as the product of each discharger's daily flow and the concentration target.

Aggregate mass WLAs were established for the storm water sources because it is impossible to determine with any precision or certainty the actual and projected loadings for individual discharges or groups of discharges. MassDEP divided the aggregate storm water loading targets into WLA and LA components as a function of impervious cover, which is reasonable assuming runoff from impervious cover is more likely to reach regulated MS4s. EPA's November 22, 2002 TMDL guidance suggests that it is acceptable in such cases to allocate storm water by gross allotments.

EPA concludes that the wasteload allocations are adequately specified in the TMDL at levels necessary to attain and maintain WQS.

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 TMDL provides for an implicit margin of safety. The TMDL sets the target loading capacity, load allocations, and wasteload allocations equal to either the applicable water quality standard of the receiving water, or zero if the sources are prohibited. Therefore, there is a high level of confidence that the TMDL is established at levels that are consistent with the WQS. In addition, in establishing the concentration WLAs and LAs, the approach used by MassDEP does not rely on in-stream processes such as bacteria die-off and settling which are known to reduce in-stream bacteria concentrations. For the percent reduction informational estimates, MassDEP used the highest monitored value available at each location compared to the fecal coliform standard (e.g., 200 FC/100ml for Class B, which normally applies as a geometric mean) to conservatively calculate the percent reduction target. The loading targets are mathematically calculated based on the concentration water quality criteria to assure the numeric bacteria criteria are met for continuous dischargers as well as instream (as described above) and share the same direct connection to WQS and implicit margin of safety.

Assessment:

EPA concludes that the approach used in developing the TMDL provides for an adequate implicit MOS. There is not a lack of knowledge concerning the relationship between allocations and water quality in this case, where the TMDL applies the criteria as allocations for each source. Setting the concentration TMDL targets at the water quality criteria with no allowance for in-stream bacteria die-off and settling provides an implicit margin of safety. The daily load TMDL expressions are derived from the same water quality criteria and concentration TMDL targets multiplied by the appropriate flow factor to obtain a mass TMDL expression with the same implicit MOS. In addition, the mass loads are based on the criteria calculated as a maximum rather than a mean, providing an additional margin of safety.

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 applies throughout the year when seasonal pathogen WQS apply. The WQS criteria may be applied on a seasonal basis at the discretion of the MassDEP (see 314 CMR 4.05(3)(a)4 and 4.05(3)(b)4.)

Assessment:

The pathogen TMDL applies over the entire season that the pathogen criteria apply. There is no reason to apply different targets on a seasonal basis because the measures implemented to meet the TMDL targets will reduce pathogen concentrations to water quality criteria levels for all seasons for which the WQS apply. Therefore, the TMDL adequately accounts for all seasons. EPA concludes that the TMDL documents have adequately addressed seasonal variability.

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), and EPA's 2006 guidance, Clarification Regarding "Phased" Total Maximum Daily Loads, recommend a monitoring plan when a TMDL is developed using the phased approach. The guidance indicates that a State may use the phased approach for situations where TMDLs need to be developed despite significant data uncertainty and where the State expects that the loading capacity and allocation scheme will be revised in the near future. EPA's guidance provides that a TMDL developed under the phased approach should include, in addition to the other TMDL elements, a monitoring plan that describes the additional data to be collected and a scheduled timeframe for revision of the TMDL.

The pathogen TMDL for the Charles River Watershed is not a phased TMDL, but the document includes a description of a monitoring plan designed to measure attainment of WQS.

The TMDL and companion TMDL Implementation Guidance Manual document describe post-TMDL monitoring activities including various community efforts and MassDEP's commitment for monitoring every five years. The monitoring plan is designed to identify and eliminate specific sources and track improvements in water quality. In addition, the TMDL document recommends additional monitoring that should be conducted.

Assessment:

EPA concludes that the anticipated monitoring by and in cooperation with MassDEP is sufficient to evaluate the adequacy of progress toward attainment of WQS, although not a required element of EPA's TMDL approval process.

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 implementation plan set out in the Charles River Watershed Pathogen TMDL document and the identification of priority outfall pipes and water body segments along with the TMDL Implementation Guidance Manual set forth an approach to addressing the pathogen impaired water body segments. Table 6-1 sets out the priority water body segments and Table 6-2 prioritizes the outfall pipes in need of remediation. In addition, the companion document sets forth the priority for addressing pathogen impairments based on land use and the types of pathogen sources. The TMDL segments are small so that outfall pipe elevated bacteria data, and ambient stream data can be related back to potential sources and implementation needs.

MassDEP and EPA have historically required wastewater treatment plants to meet criteria based concentration effluent limits at the point of discharge and will continue to do so, consistent with the TMDL. Phase I and II storm water communities are or will be required to implement aggressive illicit discharge detection and elimination programs. Watershed stakeholders are providing valuable assistance in defining hot spots and sources of pathogen contamination as well as with the implementation of mitigation or preventative measures.

Through Phase I and II NPDES regulations, EPA has the authority to 1) require general and/or individual permits for many types of storm water discharges and 2) enforce storm water permits to assure adequate progress in storm water pollution abatement is being made. In addition, EPA has the authority to require non-regulated point source storm water discharges to obtain NPDES permits if it determines that such storm water

discharge causes or contributes to a water quality violation, or is a significant contributor of pollutants, or where controls are needed based on a waste load in an EPA approved TMDL. MassDEP has similar authority under the Commonwealth's law.

Although the TMDL targets are expressed in a variety of numeric terms, EPA anticipates that NPDES permits for regulated storm water discharges will contain Best Management Practice (BMP) based requirements rather than numeric effluent limits. This approach is consistent with EPA's November 22, 2002 guidance entitled "Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) for Stormwater Sources and NPDES Permit Requirements Based on Those WLAs." The guidance states "WQBELs [water quality based effluent limits] for NPDES-regulated storm water discharges that implement WLAs in TMDLs may be expressed in the form of best management practices (BMPs) under specified circumstances. See 33 U.S.C. 1342(p)(3)(B)(iii); 40 C.F.R. 122.44(k)(2)&(3)." This memorandum goes on to state:

...because storm water discharges are due to storm events that are highly variable in frequency and duration and are not easily characterized, only in rare cases will it be feasible or appropriate to establish numeric limits for municipal and small construction storm water discharges. The variability in the system and minimal data generally available make it difficult to determine with precision or certainty actual or projected loadings for individual dischargers or groups of dischargers. Therefore, EPA believes that in these situations, permit limits typically can be expressed as BMPs, and that numeric limits will be used only in rare instances. ... [i]n light of 33 U.S.C. §1342(p)(3)(B)(iii), EPA recommends that for NPDES-regulated municipal and small construction storm water discharges effluent limits should be expressed as best management practices (BMPs) or other similar requirements, rather than as numeric effluent limits. See *Interim Permitting Approach for Water Quality-Based Effluent Limitations in Storm Water Permits*, 61 FR 43761 (Aug. 26, 1996). The Interim Permitting Approach Policy recognizes the need for an iterative approach to control pollutants in storm water discharges. Specifically, the policy anticipates that a suite of BMPs will be used in the initial rounds of permits and that these BMPs will be tailored in subsequent rounds.

Assessment:

MassDEP has included an outline of implementation plans, priorities and authorities, although not a required element of the TMDL approval. EPA is taking no action on the implementation plan.

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.”

Although no regulated point source was given a less stringent allocation based on the assumption that non-point source load reduction would occur, MassDEP provides reasonable assurance that both point and non-point allocations will be achieved. The TMDL will be implemented through enforcement of regulations, availability of financial incentives and local, state and federal programs for pollution control. Combined sewer overflows and wastewater treatment facilities are regulated under existing NPDES and Commonwealth permits. Communities subject to storm water NPDES permit Phase I and II coverage will address discharges from municipally-owned storm water drainage systems. Enforcement of regulations controlling non-point discharges include local implementation of the Commonwealth’s Wetlands Protection Act, the Rivers Protection Act, Title 5 regulations for septic systems and other local regulations. Financial incentives include federal and state funds available under Sections 319 and 104(b) programs of the CWA as well as the State Revolving Loan Program. Other potential funds and assistance are available through Massachusetts’ Department of Agriculture’s Enhancement Program and the United States Department of Agriculture’s Natural Resources Conservation Services. Additional financial incentives include income tax credits for Title 5 upgrades and low interest loans for Title 5 septic system upgrades available through municipalities participating in this portion of the state revolving loan fund program.

As stated above, MassDEP has in place a number of state regulatory and financial programs that will help to assure implementation of the TMDL will be achieved. These programs are more fully discussed in Sections 8 and 10 of the TMDL document.

Finally, it should be noted that MassDEP has had some experience implementing pathogen TMDLs. A previous TMDL was developed and approved by EPA for the Neponset River Watershed. The implementation recommendations outlined in that TMDL were similar to the Charles River TMDL. Since the time of approval, MassDEP has worked closely with a local watershed group (Neponset River Watershed Association) to develop a 319 project to implement the recommendations of the TMDL. The total project cost was approximately \$472,000 of which \$283,000 was provided through federal 319 funds and the additional 40% provided by the watershed association and two local communities. Although the project is not yet completed, the towns and watershed association have worked closely together to identify and install several new structural BMPs (enhanced wetland treatment, bioretention cells and vegetated buffers) to reduce storm water and bacterial inputs into Pine Tree Brook which was impaired due to pathogens.

In the spring of 2005, BMPs were installed along Pine Tree Brook. These BMPs effectively eliminated the discharges of four outfalls to Pine Tree Brook. By removing known sources of pathogens, water quality improvements are expected to occur. Additional BMPs are being evaluated for future implementation at this time. In addition, extensive public education on pet waste management has occurred in the form of fliers inserted into bills, canvassing neighborhoods and posting signs. Areas where people walked their pets were cleaned up to encourage individuals to look after their pets. The Neponset River Association has reported significant behavioral changes in the area resulting in a substantial reduction in pet waste.

In summary, MassDEP's existing programs set out a wide variety of tools communities can use to address pathogens, based on land use and the commonality of pathogen sources (e.g., combined sewer overflows (CSOs), failing septic systems, storm water and illicit connections, pet waste, etc.) Since there are only a few categories of sources of pathogens, the necessary remedial actions to address these sources are well established.

Since pathogen impairment in many communities has a significant economic impact, for example due to shellfish and beach closures, watershed stakeholders are often eager to implement measures to mitigate pathogen impairments. The TMDL provides a mechanism and incentive for community administrators to among other things seek funding, educate the public and prioritize remedial action. Moreover, for sources beyond the scope of federal and state jurisdiction (e.g., storm water not subject to Phase II NPDES regulation), this TMDL and the companion document, "*Mitigation Measures to Address Pathogen Pollution in Surface Water: A TMDL Implementation Guidance Manual for Massachusetts*," provides communities with information for mitigating pathogen sources.

Assessment:

Although not required because MassDEP did not increase WLAs based on expected LA reductions, MassDEP has provided reasonable assurance that WQS will be met.

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.

Two public informational meetings were held on August 9, 2005, to review the findings of the draft TMDL reports and to solicit public comment. The public comment period began on July 23, 2005 and was extended from September 5, 2005 to September 15, 2005 when the public comment period closed. MassDEP has involved the public during the development of the TMDL and has provided ample opportunity for the public to comment. Finally, MassDEP has provided a comprehensive record of the comments received and provided clear responses to those comments.

Assessment:

EPA concludes that MassDEP has done a sufficient job of involving the public in the development of the TMDL, provided adequate opportunities for the public to comment and has fully addressed the comments received as set forth in the response to comment section of the TMDL document. As discussed above, MassDEP made a number of changes and clarifications to the final TMDL in response to comments received during the public comment period. These modifications included the incorporation of additional monitoring data, identifying priority outfall pipes and stream segments in need of mitigation measures and the addition of a mass-loading expression of the TMDL.

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.

Assessment:

On February 9, 2007, MassDEP submitted final TMDL documents for Pathogens for the Charles River Watershed (Control Number CN 0156.0) for EPA approval. The documents contained all of the elements necessary to approve the TMDL.

13. "Pollution Prevention" TMDL for the Charles River Watershed

MassDEP recommends that the information contained in this TMDL guide management activities for all other waters throughout the watershed to help maintain and protect existing water quality. For these non-impaired waters, Massachusetts is proposing "pollution prevention" TMDLs consistent with CWA § 303(d)(3).

Pollution prevention TMDLs on water body segments can encourage the maintenance and protection of existing water quality and help prevent further degradation to water bodies. Although EPA does not approve pollution prevention TMDLs, EPA acknowledges the establishment of these TMDLs consistent with developing information as set forth in CWA Section 303(d)(3). Therefore, EPA's approval of the TMDL submitted by MassDEP applies only to the 20 water body segments set out in Attachment

1 that are currently listed for pathogens (bacteria) on the 2002 CWA § 303(d) list of impaired waters.

In terms of how these pollution prevention TMDLs would be implemented, MassDEP proposes that the analyses conducted for the pathogen impaired segments in this TMDL would apply to the non-impaired segments, since the sources and their characteristics are equivalent. Thus, the waste load and/or load allocation for each source and designated use would be the same as specified in the TMDL document. Therefore, the pollution prevention TMDL would have identical concentration waste load and load allocations based on the sources present and the designated uses of the water body segments.

Finally, MassDEP is also recommending that the Charles River Watershed TMDL may, in appropriate circumstances, apply to other Charles River watershed segments that are listed for pathogen impairment in subsequent Massachusetts CWA § 303(d) Integrated List of Waters. EPA agrees that for such segments, the approaches set forth in this TMDL may apply if, after listing the waters for pathogen impairment and taking into account all relevant comments submitted on the CWA § 303(d) list, MassDEP determines with EPA approval of the CWA § 303(d) list that this TMDL should apply to future pathogen impaired segments.

**Data for entry in EPA's National TMDL Tracking System & Region 1 TMDL Webpage
Version (6/27/05)**

TMDL Name *	Charles River Watershed Pathogen TMDLs
20 Water body segment names and List ID(s)	See Attachment 1
Water body segment names with TMDL completed, but not on current list (use unlisted water and/or unlisted impairment code)	None
Number of TMDLs *	20
Lead State	Massachusetts
TMDL Status	Final
Pollutant ID(s)	Pathogens
TMDL End Point	See TMDL
TMDL Type	Point and Nonpoint Source
Point source ID (permit) #s	--
Impairment ID(s) (from system)	Pathogens
Cycle (list date)	2002
Establishment Date (approval) *	May 22, 2007
EPA Developed	No
Towns affected *	See Below
Pollution Prevention TMDLs for all unimpaired segments.	

* = data needed for Region 1 "Approved TMDLs" web page

Affected Towns In Charles River Watershed: Arlington, Ashland, Bellingham, Belmont, Boston, Brookline, Cambridge, Dedham, Dover, Foxborough, Franklin, Holliston, Hopedale, Hopkinton, Lexington, Lincoln, Medfield, Medway, Mendon, Milford, Millis, Natick, Needham, Newton, Norfolk, Quincy, Sherborn, Somerville, Walpole, Waltham, Watertown, Wayland, Wellesley, Weston, Westwood, Wrentham.

Attachment 1
TMDL Addressing 20 Pathogen Impaired Water Body Segments
Charles River Watershed

Segment ID	Segment Name	Length (miles)	Segment Description
MA72-01	Charles River – 01	2.4	Source, outlet Echo Lake, Hopkinton to Dilla Street, Milford.
MA72-02	Charles River – 02	3.1	Dilla Street, Milford to Milford WWTP, Hopedale.
MA72-03	Charles River – 03	3.1	Milford WWTP, Hopedale to outlet Box Pond, Bellingham.
MA72-04	Charles River – 04	11.4	Outlet Box Pond, Bellingham to outlet Populatic Pond, Norfolk/Medway.
MA72-05	Charles River – 05	17.9	Outlet Populatic Pond, Norfolk/Medway to South Natick Dam, Natick.
MA72-10	Stop River	4.1	Norfolk-Walpole MCI, Norfolk to confluence with Charles River, Medfield.
MA72-16	Bogastow Brook	9.3	Outlet Factory Pond, Holliston to inlet South End Pond, Millis.
MA72-06	Charles River – 06	8.0	South Natick Dam, Natick to Chestnut Street, Needham.
MA72-18	Fuller Brook	4.4	Headwaters south of Route 135, Needham to confluence with Waban Brook, Wellesley.
MA72-07	Charles River – 07	23.2	Chestnut Street, Needham to Watertown Dam, Watertown.
MA72-21	Rock Meadow Brook	3.8	Headwaters in Fisher Meadow, Westwood through Stevens Pond and Lee Pond, Westwood to confluence Charles River, Dedham.
MA72-23	Sawmill Brook	2.7	Headwaters, Newton to confluence with Charles River, Boston.
MA72-24	South Meadow Brook	2.1	Isolated, interrupted, urban brook with 'headwaters' south of Route 9, Newton to confluence of Charles River, Newton.
MA72-25	Rosemary Brook	3.2	Headwaters, outlet Rosemary Lake, Needham to confluence with Charles River, Wellesley.
MA72-28	Beaver Brook	8.0	Headwaters, south of Route 2, Lexington through culverting to Charles River, Waltham.
MA72-29	Cheese Cake Brook	1.4	Headwaters, West Newton to confluence with Charles River, Newton.
MA72-08	Charles River - 08	8.6	(Charles Basin) Watertown Dam, Watertown to Science Museum, Boston.
MA72-30	Unnamed Tributary	0.1	Unnamed tributary locally known as Laundry Brook. Emerges north of California Street, Watertown and flows north to confluence with Charles River, Watertown.
MA72-32	Unnamed tributary	0.5	Locally known as Sawins Brook. Headwaters east of Elm Street to confluence with Charles River, Watertown (sections culverted).
MA72-11	Muddy River	4.2	Outlet of unnamed pond, Olmstead Park, Boston to confluence with Charles River, Boston.