UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
5 POST OFFICE SQUARE, SUITE 100
BOSTON, MASSACHUSETTS 02109-3912

October 25, 2012

Kenneth L. Kimmell, Commissioner
Department of Environmental Protection
1 Winter Street
Boston, MA 02108

Re: Approval of the Final Pathogen TMDL for the North Coastal Watershed

Dear Commissioner Kimmell:

Thank you for your Department's submittal of *Final Pathogen TMDL for the North Coastal Watershed* (Control Number 155.0) on April 2, 2012. We appreciate your efforts and involvement with our office to finalize this TMDL. We believe this TMDL combined with the other pathogen watershed TMDLs in various stages of development within the Commonwealth will be a catalyst in the restoration of this and other watersheds.

The U.S. Environmental Protection Agency (EPA) has reviewed the document entitled "Final Pathogen TMDL for the North Coastal Watershed", March 2012 and it is my pleasure to approve the 43 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 are very pleased with the quality of your TMDL submittal from the Division of Watershed Management, and commend your efforts to address bacteria-related impacts to the North Coastal Watershed. My staff and I look forward to continued cooperation with the Massachusetts DEP in exercising our shared responsibility of implementing the requirements under Section 303(d) of the CWA.

Sincerely,

/s/

Stephen S. Perkins, Director
Office of Ecosystem Protection

Enclosure

cc:
Rick Dunn, MassDEP
Kim Groff, MassDEP
Art Johnson, MassDEP
Steve Silva, EPA
Andrea Traviglia, EPA

EPA NEW ENGLAND'S TMDL REVIEW

DATE: October 25, 2012

TMDL: Final Pathogen TMDL for the North Coastal Watershed

STATUS: Final

IMPAIRMENT/POLLUTANT: These 43 water body segments are not meeting criteria for fecal coliform, *Enterococci* and *E. coli* bacteria concentrations, and are not supporting the designated uses of shellfishing and primary and secondary contact recreation. The segments are classified as shown in Attachment 1. A year-around TMDL submission is presented for e. coli, enterococci and fecal coliform bacteria.

BACKGROUND: MassDEP submitted to EPA Region 1 the *Final Pathogen TMDL for the North Coastal Watershed* (Control Number: CN 155.0) with a transmittal letter dated April 2, 2012. In addition to the Final Pathogen TMDL itself, the submittal included, either directly or in reference, the following documents:

- Final Pathogen TMDL for the North Coastal Watershed (CN 155.0)
- Public Meeting Information and Response to Comments, Appendix A
- Massachusetts Surface Water Quality Standards (WQS)
- Mitigation Measures to Address Pathogen Pollution in Surface Waters: A TMDL Implementation Guidance Manual for Massachusetts

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 EPA's implementing regulations in 40 CFR Part 130.

REVIEWERS: Andrea Traviglia (617-918-1993) e-mail: traviglia.andrea@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.

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.

A. Description of Waterbody, Priority Ranking, and Background Information

The North Coastal watershed drains approximately 168 square miles of Massachusetts' northshore. All or part of 26 Commonwealth communities, and a small portion of Seabrook New Hampshire (not covered by this TMDL), are within the North Coastal Drainage area. It extends from Salisbury to the City of Revere and includes the following communities: Amesbury, Everett, Malden, Melrose, Saugus, Stoneham, Reading, Wakefield, Lynnfield, Lynn, Nahant, Swampscott, Marblehead, Salem, Peabody, Danvers, Beverly, Manchester, Wenham, Hamilton, Essex, Ipswich, Gloucester, and Rockport. A total of 43 bacteria-impaired segments are listed in Massachusetts' 2010 303(d) list (see Attachment 1). Tables ES-1 and 4-3 of the TMDL document lists each of the 43 impaired water segments (organized by sub-watersheds and harbors), including each waterbody's assessment unit identifier, segment name and type, segment size, and classification, which determines the applicable water quality criteria.

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, Table 6-1 in particular). 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/resources/10list6.pdf).

B. Pollutant of Concern

The bacteria impairment listings are based on monitoring data for various indicator organisms, depending on the resource type, and classification of the waterbody. This TMDL is based on the Massachusetts WQS (2007) for fecal coliform in approved shellfish areas, E. coli for fresh water and Enterococcus for either marine or fresh water bathing respectively.

C. Pollutant Sources

The TMDL document 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, 5, and 6, the TMDL document articulates both general categories and specific sources of pathogen contributions from the range of possible pathogen source categories. Likely bacteria sources in the North Coastal watershed including failing septic systems, combined sewer overflows (CSO), sanitary sewer overflows (SSO), sewer pipes connected to storm drains, certain recreational activities, wildlife including birds along with domestic pets and animals and direct overland stormwater runoff. MassDEP presents an overview of pathogen data collected during both dry and wet weather conditions to provide an insight into the overall magnitude of sources contributing to the impairment in the North Coastal watershed (Section 4). In addition, 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. Specific NPDES permit numbers of point source discharges (including discharges from CSOs, municipal wastewater treatment facilities, and general-permitted municipal stormwater), and indications of point source/nonpoint source involvement are also included for all impaired segments in Section 4.0.

Assessment: EPA Region 1 concludes that the TMDL document meets the requirements for describing the TMDL waterbody segments, pollutants of concern, identifying and characterizing sources of impairment, and priority ranking.

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 Class A, B, SA and SB segments of the North Coastal watershed included in this TMDL. Massachusetts' WQS include water quality criteria for fecal coliform, E. coli, and enterococci as indicator organisms of potential harmful pathogens for fresh water and fecal coliform and enterococci for marine waters. The TMDL document presents the applicable Massachusetts WQS in Section 3.0 of the document as well as Tables ES-1 and 7-1.

The fecal coliform shellfishing criteria for Class SA waters (salt waters) is a geometric mean value of 14 cfu/100 ml, with not more than 10% of the samples exceeding a value of 28 cfu/100 ml; for Class SB shellfishing waters (salt waters) the criteria are a geometric mean value of 88 cfu/100 ml, with not more than 10% of the samples exceeding a value of 260 cfu/100 ml. For Class SA and SB waters, beaches and nondesignated shellfish areas, the Enterococci criteria is a geometric mean value of 35 cfu/100 mL and single sample less than 104 cfu/100 mL. The e. coli freshwater Class A and B criteria are a geometric mean value of 126 cfu/100 ml, with a single sample maximum value of 235 cfu/100 ml.

Primary contact recreation criteria apply to all fresh water systems and will pertain for all river segments in the North Coastal watershed. For marine segments, shellfishing criteria are the most stringent and will be applied to all marine segments that are actively managed by Division of Marine Fisheries (DMF) for shellfishing. Two impaired waterbodies are not managed as active shellfishing areas by DMF (MA93-51 and MA93-40) and the primary contact recreation standard will be applied to these water bodies for the purposes of the TMDL.

Section 4.0 of the TMDL document describes each of the 43 impaired water segments of the North Coastal watershed -- including the water body's designated use, applicable WQS, summary of data, sources of pathogens when available and other characteristics. This section also indicates the water quality classification (A, B, SA or SB) for each segment.

Water Quality Target – Bacteria Criteria
The water quality criteria applicable to the A, B, SA and SB segments of the North Coastal watershed are included in the TMDL document in Table 7-2. Massachusetts' WQS for bacteria are used as the numeric water quality targets for the bacteria TMDLs. The numeric targets vary depending on the specific waterbody's use (either recreation or shellfish harvesting) and waterbody classification.

Assessment: EPA concludes that MassDEP has properly described and interpreted the applicable water quality standards to set the TMDL targets as indicated in Sections 3.0 and 7.3.3 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 priorities. 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.

For this TMDL, MassDEP developed two types of daily TMDL targets. First, MassDEP set daily concentration TMDL targets for all potential pathogen sources by category (e.g., storm water,

NPDES, etc.) and surface water classification (see Table 7-1). MassDEP recommends that the concentration targets be used as the primary guide for implementation. Second, MassDEP estimated the total maximum daily load for each river or stream segment as a function of the flow and the concentration of the applicable Massachusetts WQS for bacteria in the river. This approach sets a target for reducing the loads so that water quality criteria for indicator bacteria are met at all flows equal to or greater than 7Q10. Alternatively, for embayments, total maximum daily pathogen loads are calculated based on long-term average runoff volumes. For the North Coastal embayment segments, the allowable loading was estimated using the same methodology employed in the Buzzards Bay Pathogen TMDL (Mass DEP 2009). The loading calculations for all 28 of the estuary segments were estimated by using: 1) the concentration allowed by the Massachusetts WQS and 2) the estimated volume of runoff entering the embayment from each contributing watershed. Runoff estimates for the region were extracted from historical precipitation and runoff records maintained by the USGS and the Massachusetts Department of Conservation and Recreation (DCR) (See Section 7.3.2 for detailed methodology).

As discussed below, both formats (concentration and load) express targets designed to attain the designated use based on a straight forward derivation of TMDL targets from the water quality criteria adopted by the Commonwealth to assure designated use attainment. They will achieve water quality criteria for both dry and wet weather and for all storm events whenever they occur (i.e., 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." 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 that will require additional bacterial source tracking work and implementation of BMPs (See Sections 4, 5 and 6 of the TMDL document; specifically Table 6-1, Priority Segments).

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 (Figures 7-1a&b, Table 7-3). "MassDEP believes that expressing the loading capacity for bacteria in terms of loadings (e.g., numbers of organisms per day, cfu/day), although valid as a TMDL, is more difficult for the public to understand because the "allowable" loading number … is very large (i.e. billions or trillions of organisms per day) and therefore are difficult to interpret as they do not relate directly to the State Water Quality Standards or public health criteria." (Section 7.1). Additionally, the number would vary according to flow rate since the loading capacity is dependent on stream flow rates which are constantly changing.

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 mass loadings for each waterbody segment provide information on the degree of

relative assimilative capacity available in each waterbody and identify the loads necessary to meet water quality standards.

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 of 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 at or below the water quality criteria, then it follows that the receiving water will meet the WQS for bacteria.

Both formats (concentration and load) express targets designed to attain the designated use of each waterbody segment based on a straightforward derivation of TMDL targets from the water quality criteria adopted by the Commonwealth. Both formats will achieve water quality criteria for both dry and wet weather and for all storm events whenever they occur (i.e., 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.

In summary, the above loading capacity targets are directly linked to the Commonwealth's WQS pathogen criteria to achieve the designated use 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.

In addition, maximum daily loads were developed as a function of watershed size and run-off volume. Total maximum daily loads for the river segments are presented in Figure 7-1 as a function of stream flow. For these segments, the TMDL is proportioned between the WLA and LA by multiplying the daily load by the percent impervious cover for the WLA, and by multiplying the daily load by the percent pervious cover for the contributing watershed for the LA. Table 7-3 summarizes the LA and WLA for the river segments in the North Coastal watershed, with e.coli as the indicator.

For embayments, maximum daily loads were calculated as a function of the observed long-term precipitation in the watershed, the estimated average run-off associated with the contributing watershed area for each segment and the most stringent water quality criteria based on segment classification (see Section 7.3.2 of the TMDL document for a more detailed description). Similar to the methodology developed for rivers, the LA and WLA for embayment segments is proportioned based on the amount of pervious and impervious area from the contributing watershed area. Table 7-4 summarizes the WLA and LA for the embayment segments in the North Coastal watershed, using either fecal coliform or enterococci as the indicator.

The equations provided in Section 7.3.4 may be used to calculate the LA for any other embayment segment, and when combined with Figure 7-1, for a river segment.

Assessment: As discussed in Section 7.3.3, MassDEP used the applicable numeric water quality criteria directly related to the designated use impairment which the TMDL is designed to address. As discussed in Section 7.5 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 a concentration equal to the water quality criteria for each source by discharge category (see Table 7-1).

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 Storm Water 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.

In addition to the concentration targets, the TMDL includes maximum daily loads as a function of stream flow and the applicable WQS (Figures 7-1a and 7-1b). Separate WLAs and LAs for each river segment were calculated for varying flow regimes based on the percent of pervious and impervious area contributing to the watershed (Table 7-3). Similarly, Table 7-4 sets out the WLA and LA for each embayment segment based on the amount of pervious and impervious area from the contributing watershed area. The fraction of run-off 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.

MassDEP believes the concentration targets are most useful for guiding implementation because the concentration targets are independent of storm water flow volume.

Assessment: MassDEP established concentration-based WLAs by applying the numeric criteria directly to each discharge. 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.

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.

MassDEP employs an implicit MOS in these TMDLs using conservative assumptions in the

calculation of bacteria loads (TMDL pp. 95-96). First, 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. 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.

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)).

This TMDL addresses seasonal variation through WLAs and LAs set for all known conditions and potential sources independent of season and climate. The sampling data underlying the TMDL calculations spanned wet and dry weather, and different times of the year. The water quality criteria concentrations are applied year round and the TMDLs should therefore be protective for all seasons and all weather events.

Assessment: EPA New England concludes that seasonal variations have been adequately accounted for in the TMDLs because the TMDLs were developed to be protective year round.

8. Monitoring Plan

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 report for the North Coastal watershed is not a phased TMDL, but the document includes a description of a monitoring plan designed to measure attainment of water

quality standards (page 113 TMDL report). The long-term monitoring plan includes a description of the ongoing and new monitoring that will take place to monitor changes in the water quality of the impaired segments as well as monitoring and assessment of BMPs and other control strategies.

Assessment: EPA concludes that the anticipated monitoring by and in cooperation with MassDEP is sufficient to evaluate the adequacy of the TMDL and attainment of water quality standards, although is 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.

MassDEP provides an implementation plan in the TMDL document (Chapter 8, pages 97-112), with a list of implementation task identified in Table 8-1. The DEP recommends using an iterative process to TMDL implementation, with realistic goals over a reasonable timeframe, and with ongoing adjustments based on monitoring results.

In order to address the numerous and diverse sources of pathogens, the implementation plan recommends a comprehensive control strategy that includes tracking and elimination of illicit discharges as well management of stormwater runoff, and elimination of sewer connections to drainage systems, leaking sewer pipes, sanitary sewer overflows, and failing septic systems in the North Coastal watershed. To support implementation of pathogen TMDLs and provide additional information for stakeholders, MassDEP references a document they developed: "Mitigation Measures to Address Pathogen Pollution in Surface Water: A TMDL Implementation Guidance Manual for Massachusetts".

The TMDL document also presents a summary of activities throughout the North Coastal watershed to address pathogen sources, including work already completed, currently underway, or planned for the future. This includes examples of the tremendous efforts undertaken by the municipalities covered in this watershed to control bacterial contamination of surface waters.

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."

The TMDL targets for point sources in this TMDL are not less stringent based on any assumed nonpoint source reductions, so documentation of reasonable assurance in the TMDL is not a requirement. However, MassDEP addresses reasonable assurances (Chapter 10, pp. 114-118) that pollution reductions will occur by providing information about its programs and policies, available financial tools, and the tools it has to combat the various pollution types and 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.

The public participation process for the bacteria TMDLs is described in Section 11.0 of the TMDL document. MassDEP publically announced the draft TMDL on August 10, 2005 and copies were distributed to key stakeholders. Two public meetings were held at 2:00 p.m. and 7:00 p.m. at Tufts University in Medford, Massachusetts on August 30th, 2005 to present the Draft Bacteria TMDL and to collect public comments. The public comment period began on August 10, 2005 and closed on September 15, 2005. The attendance list, public comments, and the MassDEP responses are included in Appendix A of the TMDL document. MassDEP fully addressed all comments received during public comment in Appendix A of the TMDL report.

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.

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 April 2, 2012, MassDEP submitted the Final Pathogen TMDL for the North Coastal Watershed (Control Number: CN 155.0) and associated documents for EPA approval. The documents contained all of the elements necessary to approve the TMDL.

Z:\Data\North Coastal TMDL\Draft North Coastal Bacteria TMDL Review doc.docx

Attachment 1: North Coastal Watershed Pathogen Impaired Segments

Segment ID	Segment Name, Class	Segment Type	Size[1]	Segment Description
Essex Bay System				
MA93-45	Alewife Brook, B	River	1.4	Headwaters, outlet Chebacco Lake, Essex to Landing Road, Essex.
MA93-46	Alewife Brook, SA	Estuary	0.01	Landing Road, Essex to confluence with Essex River, Essex.
MA93-11	Essex River, SA	Estuary	0.5	Source east of Southern Avenue to mouth at Essex Bay, Essex.
MA93-16	Essex Bay, SA	Estuary	1.0	Essex/Ipswich/Gloucester
Annisquam River System				
MA93-28	Mill River, SA	Estuary	0.1	Outlet Mill Pond, Gloucester to confluence with Annisquam River, Gloucester.
MA93-12	Annisquam River, SA	Estuary	0.82	The waters from the Gloucester Harbor side of the Route 127 bridge, Gloucester to Ipswich Bay at an imaginary line drawn from Bald Rocks to Wigwam Point, Gloucester.
MA-93-57 (formerly MA93-17)	Rockport Harbor, SB	Estuary	0.35	Waters landward of an imaginary line from Gully Point, Rockport to Granite Pier, Rockport (including Back Harbor and a portion of Sandy Bay) (includes area formerly reported as segment MA93-17)
MA93-18	Gloucester Harbor, SB	Estuary	2.3	The waters landward of an imaginary line drawn between Mussel Point and the tip of the Dog Bar Breakwater, Gloucester excluding the Annisquam River.
Salem Sound System				
MA93-47	Causeway Brook, B	River	1.1	Headwaters, outlet Dexter Pond, Manchester to confluence with Cat Brook, Manchester
MA93-29	Cat Brook, B	River	1.7	Headwaters north of Route 128 Manchester/Essex/Gloucester to confluence Manchester Harbor, Manchester.
MA93-19	Manchester Harbor, SB	Estuary	0.33	The waters landward of an imaginary line drawn between Gales Point and Chubb Point, Manchester excluding Cat Brook.
MA93-08	Bass River, SA	Estuary	0.12	Outlet of Lower Shoe Pond north of Route 62 to confluence with Danvers River, Beverley.
MA93-36	Frost Fish Brook, B	River	1.0	Cabot Road, Danvers to Porter River confluence at Route 62.
MA93-04	Porter River, SA	Estuary	0.13	Confluence with Frost Fish Brook at Route 62 to confluence with Danvers River, Danvers.
MA93-02	Crane Brook, B	River	1.8	Headwaters east of route 95, to inlet Mill Pond, Danvers.
MA93-41	Crane River, SA	Estuary	0.07	Outlet pump house sluiceway at Purchase Street, Danvers to confluence Danvers River, Danvers.
MA93-01	Waters River, SA	Estuary	0.09	Headwaters west of Route 128, Peabody/Danvers, to confluence with Danvers River, Danvers.

Segment ID	Segment Name, Class	Segment Type	Size[1]	Segment Description
MA93-05	Goldthwait Brook, B	River	3.3	Outlet Cedar Pond, Peabody to confluence with Proctor Brook, Peabody.
MA93-39	Proctor Brook, B	River	2.9	Outlet of small pond in wetland north of Downing Road, Peabody to Grove/Goodhue Street bridge, Salem (formerly part of 93-05).
MA93-42	North River, SA	Estuary	0.15	Downstream of Route 114 bridge (Proctor Brook becomes North River at this bridge), Salem to confluence with Danvers River, Salem (formerly part of MA93-06).
MA93-09	Danvers River, SA	Estuary	0.53	Confluence with Porter, Crane and Waters rivers, Danvers to mouth at Beverly Harbor, Beverly/Salem.
MA93-20	Beverly Harbor, SB	Estuary	1.02	From the mouth of the Danvers River, Salem/Beverly to an imaginary line from Juniper Point, Salem to Hospital Point, Beverly.
MA93-40	Proctor Brook, SA	Estuary	0.01	Grove/ Goodhue Street bridge, Salem to Route 114 culvert, Salem (formerly part of MA93-06)
MA93-54 (formerly MA93-21)	Salem Harbor, SB	Estuary	4.91	Waters landward of an imaginary line from Naugus Head, Marblehead to the northwest point of Bakers Island, Salem to Hospital Point, Beverly to Juniper Point, Salem (excluding Forest River) (formerly segment MA93-21 Salem Harbor and a portion of segment MA93-25 Salem Sound [waterbody code 93907])
MA93-22	Marblehead Harbor, SA	Estuary	0.56	The waters landward of an imaginary line drawn northwesterly from the northern tip of Marblehead Neck to Fort Sewall, Marblehead.
MA93-55 (formeryMA93-25)	Salem Sound, SA	Estuary	3.46	Northern portion of Salem Sound, waters landward of and within imaginary lines from Chubb Point, Manchester to Gales Point , Manchester to the northwest point of Bakers Island, Salem to Hospital Point, Beverly (formerly reported as a portion of segment MA93-25)
MA93-56 (formerly MA93-25)	Salem Sound, SA	Estuary	2.55	Southern portion of Salem Sound, waters landward of and within imaginary lines from Fort Sewall, Marblehead to the Marblehead Lighthouse on Marblehead Neck, Marblehead to the northwest point of Bakers Island, Salem to Saugus Head, Marblehead (formerly reported as a portion of segment MA93-25)
MA93-24	Nahant Bay, SA	Estuary	5.1	The waters landward of an imaginary line drawn between Galloupes Point, Swampscott and East Point, Nahant.
Saugus River System				
MA93-34	Saugus River, B	River	3.1	Headwaters, outlet of Lake Quannapowitt Wakefield (thru Reedy Meadow) to Lynn Water & Sewer Commission diversion canal, Wakefield/Lynnfield (canal diverts to Hawks Pond) (formerly part of segment MA93-13).
MA93-30	Beaverdam Brook, B	River	1.5	Headwaters west of Main Street, Lynnfield to confluence with Saugus River, Lynnfield.

Segment ID	Segment Name, Class	Segment Type	Size[1]	Segment Description
MA93-35	Saugus River, B	River	5.4	From the Lynn Water & Sewer Commission diversion canal, Wakefield/Lynnfield to Saugus Iron Works, Bridge Street, Saugus (formerly part of segment MA93-13).
MA93-31	Mill River, B	River	2.0	From headwaters in wetlands north of Salem Street in Wakefield to confluence with Saugus River, Wakefield.
MA93-32	Hawkes Brook, A	River	2.6	Headwaters at the Lynn/Lynnfield border to the outlet of Hawkes Pond in North Saugus.
MA93-33	Hawkes Brook, B	River	1.1	Outlet of Hawkes Pond, North Saugus to confluence with Saugus River, Saugus.
MA93-48	Bennetts Pond Brook, B	River	2.4	Headwaters east of Lynn Fells Parkway (in Bellevue Golf Course), Melrose to confluence with Saugus River, Saugus.
MA93-49	Shute Brook, SA	Estuary	0.01	Approximately 350feet downstream from Central St., Saugus to the confluence with the Saugus River, Saugus.
MA93-50	Shute Brook, B	River	0.89	From the confluence with Fiske Brook, Saugus to approximately 350 feet downstream from Central St., Saugus.
MA93-43	Saugus River, SB	Estuary	0.04	Saugus Iron Works, Bridge Street, Saugus, to Lincoln Avenue/Boston Street, Saugus/Lynn (formerly part of segment (MA93-14).
MA93-44	Saugus River, SB	Estuary	0.36	Lincoln Avenue/Boston Street, Saugus/Lynn to mouth (east of Route 1A) at Lynn Harbor, Lynne/Revere (formerly part of 93-14).
MA93-51	Unnamed Tributary, SA	Estuary	0.02	Unnamed tributary locally known as “Town Line Brook” from Route 99, Malden to the confluence with the Pines River, Revere.
MA93-15	Pines River, SB	Estuary	0.58	Headwaters east of Route 1, Revere/Saugus to confluence with the Saugus River, Saugus/Revere.
MA93-52	Lynn Harbor, SB	Estuary	1.6	The “inner” portion of Lynn Harbor; the waters landward of an imaginary line from Black Rock Point, Nahant to the eastern edge of Point of Pines, Revere excluding the Saugus River (formerly part of 93-23)..
MA93-53	Lynn Harbor, SB	Estuary	6.6	The "outer" portion of Lynn Harbor; the waters landward of an imaginary line drawn from Baileys Hill, Nahant to the eastern point of Winthrop Highlands, Winthrop to the seaward edge of the "inner" portion of Lynn Harbor (at an imaginary line drawn from Black Rock Point, Nahant to the eastern edge of Point of Pines, Revere) (formerly part of segment 93-23).

[1] Units = Miles for river segments and square miles for estuaries

Data for entry in EPA's National TMDL Tracking	
TMDL Name	**North Coastal Watershed**
Number of TMDLs*	43
Type of TMDLs*	Bacteria^
Number of listed causes (from 303(d) list)	43
Lead State	Massachusetts (MA)

Individual TMDLs listed below

TMDL Segment name	TMDL Segment ID #	TMDL Pollutant ID# & name	TMDL Impairment Cause(s)	Pollutant endpoint (Class: geometric mean;10% or SSM^{+})	Unlisted?	NPDES Point Source & ID#	Listed for anything else?
Alewife Brook	MA93-45	E. Coli	Pathogens (41)	B: 126 fc /100 ml; 235 fc /100 ml	N	NPDES MS4 General Stormwater permit: Essex (MAR041239)	n
Alewife Brook	MA93-46	259 (Fecal coliform)	Pathogens (41)	SA: 14 fc /100 ml; 28 fc /100 ml	N	Essex Housing Authority (MA0029564), NPDES MS4 General Stormwater permit: Essex (MAR041239)	n
Essex River	MA93-11	259 (Fecal coliform)	Pathogens (41)	SA: 14 fc /100 ml; 28 fc /100 ml	N	NPDES MS4 General Stormwater permit: Essex (MAR041239)	n
Essex Bay	MA93-16	259 (Fecal coliform)	Pathogens (41)	SA: 14 fc /100 ml; 28 fc /100 ml	N	NPDES MS4 General Stormwater permits: Essex (MAR041239), Ipswich (MAR041199), and Gloucester (MAR041192)	n
Mill River	MA93-28	259 (Fecal coliform)	Pathogens (41)	SA: 14 fc /100 ml; 28 fc /100 ml	N	Riverside Avenue Pumping Station Bypass (MA0100625); NPDES MS4 General Stormwater permits: Gloucester (MAR041192)	n
Annisquam River	MA93-12	259 (Fecal coliform)	Pathogens (41)	SA: 14 fc /100 ml; 28 fc /100 ml	N	The City of Gloucester Pumping Station Bypass (MA0100145); NPDES MS4 General Stormwater permits: Gloucester (MAR041192)	n
Rockport Harbor	MA-93-57 (formerly MA93-17)	259 (Fecal coliform)	Pathogens (41)	SB: 88 fc /100 ml; 260 fc /100 ml	N	Rockport WWTP (MA0100145), The Town of Rockport Cape Ann Lighthouse (MA0090654); NPDES MS4 General Stormwater permit: Rockport (MAR041217)	n
Gloucester Harbor	MA93-18	259 (Fecal coliform)	Pathogens (41)	SB: 88 fc /100 ml; 260 fc /100 ml	N	Gloucester Water Pollution Control Facility (MA0100625), United States Coast Guard Outfall #1 (MA0100625); NPDES MS4 General Stormwater permits: Gloucester (MAR041192)	Combined biota/Habitat Bioassessments, Dissolved oxygen
Causeway Brook	MA93-47	227 (E. Coli)	Pathogens (41)	B: 126 fc /100 ml; 235 fc /100 ml	N	NPDES MS4 General Stormwater permits: Manchester (MAR041207)	n
Cat Brook	MA93-29	227 (E. Coli)	Pathogens (41)	B: 126 fc /100 ml; 235 fc /100 ml	N	NPDES MS4 General Stormwater permits: Manchester (MAR041207)	pH, low
Manchester Harbor	MA93-19	259 (Fecal coliform)	Pathogens (41)	SB: 88 fc /100 ml; 260 fc /100 ml	N	Manchester WWTP (MA0100871); NPDES MS4 General Stormwater Permit: Manchester (MAR041207)	n
Bass River	MA93-08	259 (Fecal coliform)	Pathogens (41)	SA: 14 fc /100 ml; 28 fc /100 ml	N	Communications and Power Industries, Beverly Microwave Division, (MAG6250520); NPDES MS4 General Stormwater permit: Beverly (MAR041181)	n
Frost Fish Brook	MA93-36	227 (E. Coli)	Pathogens (41)	B: 126 fc /100 ml; 235 fc /100 ml	N	NPDES MS4 General Stormwater permit: Danvers (MAR041188)	n
Porter River	MA93-04	259 (Fecal coliform)	Pathogens (41)	SA: 14 fc /100 ml; 28 fc /100 ml	N	NPDES MS4 General Stormwater permit: Danvers (MAR041188)	n
Crane Brook	MA93-02	227 (E. Coli)	Pathogens (41)	B: 126 fc /100 ml; 235 fc /100 ml	N	NPDES MS4 General Stormwater permit: Danvers (MAR041188)	n
Crane River	MA93-41	259 (Fecal coliform)	Pathogens (41)	SA: 14 fc /100 ml; 28 fc /100 ml	N	NPDES MS4 General Stormwater permit: Danvers (MAR041188)	n
Waters River	MA93-01	259 (Fecal coliform)	Pathogens (41)	SA: 14 fc /100 ml; 28 fc /100 ml	N	NPDES MS4 General Stormwater permit: Danvers (MAR041188), Peabody (MAR041216)	n
Goldthwait Brook	MA93-05	227 (E. Coli)	Pathogens (41)	B: 126 fc /100 ml; 235 fc /100 ml	N	Eastman Gelatine Corporation (MA0003956), Coolidge Avenue Water Treatment Facility (MAG640006), Stahl Finishing Hazardous Waste Site (MA0028215). NPDES MS4 General Stormwater permit: Peabody (MAR041216)	Foam/Flocs/Scum/Oil Slicks, Dissolved oxygen, Phosphorus (total)
Proctor Brook	MA93-39	227 (E. Coli)	Pathogens (41)	B: 126 fc /100 ml; 235 fc /100 ml	N	Peabody Municipal Light Plant (MA640028), multisector general stormwater permit, from Federal Express (MA0033723). NPDES MS4 General Stormwater permits: Peabody (MAR041216), Salem (MAR041219)	Aquatic Macroinvertebrate Bioassessments, Foam/Flocs/Scum/Oil Slicks, Nitrogen (total), Phosphorus (Total), Sedimentation/Siltation, Taste and Odor
North River	MA93-42	259 (Fecal coliform)	Pathogens (41)	SA: 14 fc /100 ml; 28 fc /100 ml	N	NPDES MS4 General Stormwater permits: Salem (MAR041219)	Ammonia (un-ionized), Dissolved oxygen saturation
Danvers River	MA93-09	259 (Fecal coliform)	Pathogens (41)	SA: 14 fc /100 ml; 28 fc /100 ml	N	NPDES MS4 General Stormwater permits: Danvers (MAR041188), Beverly (MAR041181), Peabody (MAR041216), and Salem (MAR041219)	n
Beverly Harbor	MA93-20	259 (Fecal coliform)	Pathogens (41)	SB: 88 fc /100 ml; 260 fc /100 ml	N	NPDES MS4 General Stormwater permits: Danvers (MAR041188), Beverly (MAR041181), Peabody (MAR041216), and Salem (MAR041219)	n
Proctor Brook	MA93-40	605 (Enterococci)	Pathogens (41)	SA: 35 fc /100 ml; 104 fc /100 ml	N	NPDES MS4 General Stormwater permits: Salem (MAR041219)	Foam/Flocs/Scum/Oil Slicks, Taste and Odor
Salem Harbor	MA93-54 (formerly MA93-21)	259 (Fecal coliform)	Pathogens (41)	SB: 88 fc /100 ml; 260 fc /100 ml	N	South Essex Sewerage District Outfall (MA0100501), Dominion Energy Salem Harbor, LLC (MA0005096). NPDES MS4 General Stormwater permits: Salem (MAR041219), Marblehead (MAR041047)	Estuarine Bioassessments
Marblehead Harbor	MA93-22	259 (Fecal coliform)	Pathogens (41)	SA: 14 fc /100 ml; 28 fc /100 ml	N	NPDES MS4 General Stormwater permits: Marblehead (MAR041047)	n
Salem Sound	MA93-55 (formeryMA93-25)	259 (Fecal coliform)	Pathogens (41)	SA: 14 fc /100 ml; 28 fc /100 ml	N	Manchester By-The-Sea WWTP (MA0100871). NPDES MS4 General Stormwater permits: Manchester (MAR041207), Beverly (MAR041181), Danvers (MAR041188), Peabody (MAR041216), Salem (MAR041219), and Marblehead (MAR041047)	n

Salem Sound	MA93-56 (formerly MA93-25)	259 (Fecal coliform)	Pathogens (41)	SA: 14 fc /100 ml; 28 fc /100 ml	N	NPDES MS4 General Stormwater permits: Manchester (MAR041207), Beverly (MAR041181), Danvers (MAR041188), Peabody (MAR041216), Salem (MAR041219), and Marblehead (MAR041047)	n
Nahant Bay	MA93-24	259 (Fecal coliform)	Pathogens (41)	SA: 14 fc /100 ml; 28 fc /100 ml	N	Lynn Water and Sewer Commission Facility (MA0100552). NPDES MS4 General Stormwater permits: Swampscott (MAR041064), Lynn (MAR041044), and Nahant (MAR041051)	n
Saugus River	MA93-34	227 (E. Coli)	Pathogens (41)	B: 126 fc /100 ml; 235 fc /100 ml	N	New England Detroit Diesel (MA0026247). NPDES MS4 General Stormwater permits: Wakefield (MAR041065), Saugus (MAR041059)	Aquatic Plants (Macrophytes), Excess Algal Growth, Nitrogen (Total), Phosphorus (Total), Turbidity
Beaverdam Brook	MA93-30	227 (E. Coli)	Pathogens (41)	B: 126 fc /100 ml; 235 fc /100 ml	N	Lynnfield Center Water District (MA. NPDES MS4 General Stormwater permit: Lynnfield (MAR041045)	Dissolved oxygen
Saugus River	MA93-35	227 (E. Coli)	Pathogens (41)	B: 126 fc /100 ml; 235 fc /100 ml	N	NPDES MS4 General Stormwater permit: Saugus (MAR041059)	n
Mill River	MA93-31	227 (E. Coli)	Pathogens (41)	B: 126 fc /100 ml; 235 fc /100 ml	N	Wakefield Corporation (MA250965), Crystal Lake Water Treatment Plant (MA0105004). NPDES MS4 General Stormwater permit: Wakefield (MAR041065)	Dissolved oxygen, Total Suspended Solids, Turbidity
Hawkes Brook	MA93-32	227 (E. Coli)	Pathogens (41)	A: 126 fc /100 ml; 235 fc /100 ml	N	NPDES MS4 General Stormwater permit: Lynnfield (MAR041045)	n
Hawkes Brook	MA93-33	227 (E. Coli)	Pathogens (41)	B: 126 fc /100 ml; 235 fc /100 ml	N	NPDES MS4 General Stormwater permit: Lynnfield (MAR041045)	n
Bennetts Pond Brook	MA93-48	227 (E. Coli)	Pathogens (41)	B: 126 fc /100 ml; 235 fc /100 ml	N	NPDES MS4 General Stormwater permit: Melrose (MAR041050), Saugus (MAR041059)	n
Shute Brook	MA93-49	259 (Fecal coliform)	Pathogens (41)	SA: 14 fc /100 ml; 28 fc /100 ml	N	NPDES MS4 General Stormwater permit: Saugus (MAR041059)	n
Shute Brook	MA93-50	227 (E. Coli)	Pathogens (41)	B: 126 fc /100 ml; 235 fc /100 ml	N	NPDES MS4 General Stormwater permit: Saugus (MAR041059)	n
Saugus River	MA93-43	259 (Fecal coliform)	Pathogens (41)	SB: 88 fc /100 ml; 260 fc /100 ml	N	NPDES MS4 General Stormwater permit: Saugus (MAR041059)	Oil and Grease, Water Temperature
Saugus River	MA93-44	259 (Fecal coliform)	Pathogens (41)	SB: 88 fc /100 ml; 260 fc /100 ml	N	Lynn Water and Sewer Commission (MA0100552), Refuse Energy Systems Company (now Wheelabrator Saugus JV) (MA028193), General Electric Company (MA0003095). NPDES MS4 General Stormwater permits: Lynn (MAR041044), Saugus (MAR041059)	Oil and Grease, Water Temperature
Unnamed Tributary	MA93-51	605 (Enterococci)	Pathogens (41)	SA: 35 fc /100 ml; 104 fc /100 ml	N	NPDES MS4 General Stormwater permits: Malden (MAR041046), Revere (MAR041057)	Taste and Odor
Pines River	MA93-15	259 (Fecal coliform)	Pathogens (41)	SB: 88 fc /100 ml; 260 fc /100 ml	N	Refuse Energy Systems Company (MA0028193). NPDES MS4 General Stormwater permits: Saugus (MAR041059), Revere (MAR041057)	n
Lynn Harbor	MA93-52	259 (Fecal coliform)	Pathogens (41)	SB: 88 fc /100 ml; 260 fc /100 ml	N	Lynn Water and Sewer Commission (MA0100552). NPDES MS4 General Stormwater permits: Saugus (MAR041059), Revere (MAR041057), Wakefield (MAR041065), Lynn (MAR041044), Melrose (MAR041050), Malden (MAR041046)	n
Lynn Harbor	MA93-53	259 (Fecal coliform)	Pathogens (41)	SB: 88 fc /100 ml; 260 fc /100 ml	N	Lynn Water and Sewer Commission (MA0100552). NPDES MS4 General Stormwater permits: Saugus (MAR041059), Revere (MAR041057), Wakefield (MAR041065), Lynn (MAR041044), Melrose (MAR041050), Malden (MAR041046)	n

TMDL Type	Point and Nonpoint Sources
Establishment Date (approval)*	25-Oct-12
EPA Developed	No
Towns affected*	Amesbury, Everett, Malden, Melrose, Saugus, Stoneham, Reading, Wakefield, Lynnfield, Lynn, Nahant, Swampscott, Marblehead, Salem, Peabody, Danvers, Beverly, Manchester, Wenham, Hamilton, Essex, Ipswich, Gloucester, and Rockport