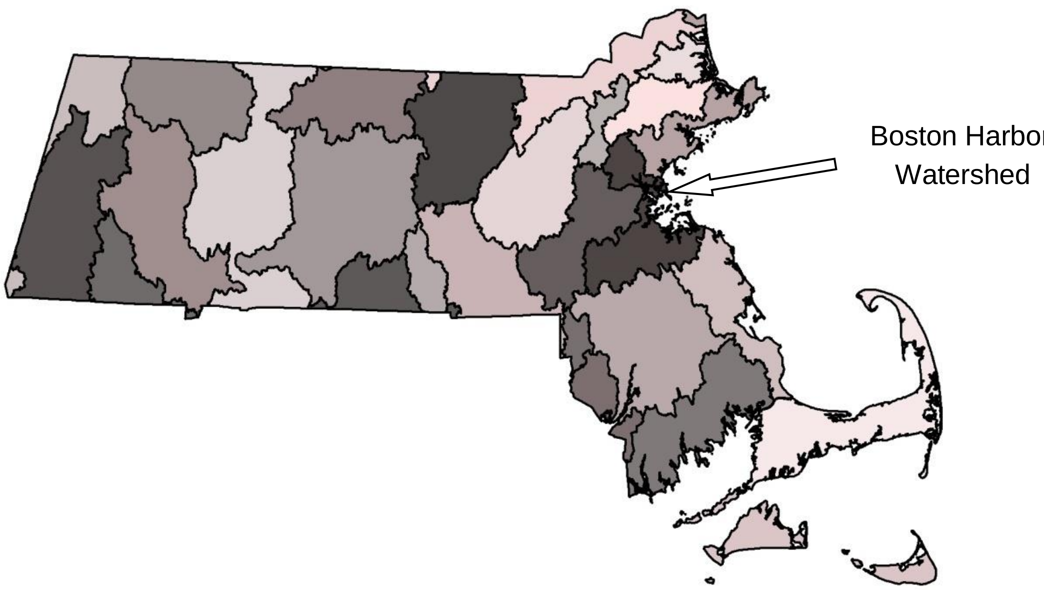
Final Pathogen TMDL for the
Boston Harbor, Weymouth-Weir, and Mystic Watersheds
October 2018
(Control Number CN 157.1)



Prepared as a cooperative effort by:

Massachusetts DEP
1 Winter Street
Boston, Massachusetts 02108

USEPA New England Region 1
1 Congress Street, Suite 1100
Boston, Massachusetts 02114

ENSR International (now AECOM)
2 Technology Park Drive, Westford, MA 01886

NOTICE OF AVAILABILITY

Limited copies of this report are available at no cost by written request to:

Massachusetts Department of Environmental Protection (MassDEP)
Division of Watershed Management
8 New Bond Street
Worcester, Massachusetts 01606

This report is also available on MassDEP's web page http://www.mass.gov/eea/agencies/massdep/water/watersheds/total-maximum-daily-loads-tmdls.html.

A complete list of reports published since 1963 is updated annually and printed in July. This list, titled "Publications of the Massachusetts Division of Watershed Management (DWM) – Watershed Planning Program, 1963-(current year)", is also available by contacting Robin Murphy at robin.murphy@state.ma.us or by writing to the DWM at the address above.

DISCLAIMER

References to trade names, commercial products, manufacturers, or distributors in this report constituted neither endorsement nor recommendations by the Division of Watershed Management for use.

Acknowledgement
This report was developed by ENSR through a partnership with Resource Triangle Institute (RTI) contracting with the United States Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental Protection Agency under the National Watershed Protection Program. The report follows the same format and methodology for previously approved bacteria TMDLs (Charles, Cape Cod, Buzzards Bay, North Coastal, and South Coastal).

Total Maximum Daily Loads for Pathogens
Boston Harbor, Weymouth-Weir, and Mystic Watersheds

Key Features: Pathogen TMDL for the Boston Harbor, Weymouth-Weir, and Mystic Watersheds
Location: EPA Region 1
Land Type: New England Coastal
303(d) Listings: Pathogens

Boston Harbor Sub-basin:
Winthrop Bay (MA70-10)
Boston Inner Harbor (MA70-02)
Pleasure Bay (MA70-11)
Dorchester Bay (MA70-03)
Quincy Bay (MA70-04; MA70-05)
Hingham Bay (MA70-06; MA70-07)
Hull Bay (MA70-09)
Boston Harbor (MA70-01)

Weymouth-Weir Sub-basin:
Cochato River (MA74-06)
Monatiquot River (MA74-08)
Town Brook (MA74-09)
Town River Bay (MA74-15)
Hingham Harbor (MA74-18 (formerly MA70-08))
Weymouth Fore River (MA74-14)
Old Swamp River (MA74-03)
Mill River (MA74-04)
Weymouth Back River (MA74-05; MA74-13)
Weir River (MA74-02; MA74-11)

Mystic River Sub-basin[1]:

Aberjona River (MA71-01)
Mystic River (MA71-02; MA71-03)
Alewife Brook (MA71-04)
Malden River (MA71-05)
Mill Brook (MA71-07)
Chelsea River (MA71-06)
Winn Brook (MA71-09)[2]
Mill Creek (MA71-08)[2]
Unnamed Tributary (MA71-13)[2]
Belle Isle Inlet (MA71-14)[2]

[1] Ell Pond (MA71014) and Judkins Pond (MA71021) were removed from the 2005 Draft Boston Harbor Watershed TMDL. The methodology used to determine the TMDLs provided in this report is for rivers and estuaries and is not appropriate for lakes and ponds.
[2] New Pathogen Impaired Segments that were identified in the Integrated Report (2006 through 2016) after the public comment period for this TMDL are included in the Boston Harbor Addendum, CN# 157.2 that is in the process of being developed.

Data Sources:

- MassDEP "Boston Harbor 1999, and 2004-2008 Water Quality Assessment Reports"
- Massachusetts Water Resources Authority (MWRA)
- Massachusetts Division of Marine Fisheries (DMF)
- Department of Public Health Beaches Data (DPH)
- Massachusetts Coastal Zone Management (CZM)
- Department of Conservation and Recreation (DCR)
- Boston Water and Sewer Commission, CSO and Stormwater Control Progress Information
- Mystic River Watershed Association (MyRWA);
- Environmental Monitoring for Public Access and Community Tracking Project (EMPACT) Water Quality Data

Data Mechanism: Massachusetts Surface Water Quality Standards for Bacteria; The Federal Beach Act; Massachusetts Department of Public Health Bathing Beaches; Massachusetts Division of Marine Fisheries Shellfish Sanitation and Management; Massachusetts Coastal Zone Management

Monitoring Plan: Massachusetts Watershed Five-Year Cycle; Division of Marine Fisheries; Massachusetts Coastal Zone Management

Control Measures: Watershed Management; Phase I and Phase II Stormwater Management (e.g., illicit discharge removals, public education/behavior modification); Combined Sewer Overflow (CSO) & Sanitary Sewer Overflow (SSO) Abatement; Best

Management Practices (BMPs); No Discharge Areas; By-laws; Ordinances; Septic System Maintenance/Upgrades

ACRONYM LIST

7Q10	Seven Day Ten Year Low Flow
ACEC	Area of Critical Environmental Concern
BMP	Best Management Practice
cfu	colony forming units
CSO	Combined Sewer Overflow
CWA	Clean Water Act, Federal
CWA § 303(d)	Section 303 (d) of the CWA and the implementing regulations at 40 CFR 130.7 require states to identify those waterbodies that are not expected to meet surface water quality standards after the implementation of technology-based controls and to prioritize and schedule them for the development of a total maximum daily load (TMDL).
CZM	Coastal Zone Management
DCR	Department of Conservation and Recreation
DFG or MA DFG	Division of Fish and Game
DMF or MA DMF	Division of Marine Fisheries
DWM	Division of Watershed Management
EEA	Energy and Environmental Affairs
EMC	Event Mean Concentration
EPA or US EPA	United States Environmental Protection Agency
EQIP	Environmental Quality Incentive Program
GIS	Geographic Information System
IDDE	Illicit Discharge Detection and Elimination System
LA	Load Allocation
LID	Low Impact Development
LTCP	Long Term Control Plan
MassBays	Massachusetts Bays Estuary Program
DPH or MADPH	Massachusetts Department of Public Health
MassDEP	Massachusetts Department of Environmental Protection
MWRA	Massachusetts Water Resources Authority
MDC	Metropolitan District Commission
MEP	Maximum Extent Practicable
MEPA	Massachusetts Environmental Policy Act
MG	Million Gallons
MHD	Massachusetts Highway Department
MOS	Margin of Safety
MPN	Most Probable Number
MSD	Marine Sanitary Device
MS4	Municipal Separate Storm Sewer Systems
NDA	No Discharge Area
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
ORW	Outstanding Resource Water
POTW	Publically Owned Treatment Works
SRF	State Revolving Fund
SSO	Sanitary Sewer Overflows
SWMP	Stormwater Management Plan
SWPP	Stormwater Program Plan
TBHA	The Boston Harbor Association
TMDL	Total Maximum Daily Load

TSS	Total Suspended Solids
USACOE	United States Army Corps of Engineers
WLA	Waste Load Allocation
WPP	Watershed Planning Program
WQA	Water Quality Assessment
WQS	Water Quality Standards
WWTP	Wastewater Treatment Plant

Executive Summary

Purpose and Intended Audience

This document provides a framework to address bacterial pathogens and other fecal-related pollution in surface waters of Massachusetts. Pathogens refers to the set of indicator bacterial organisms that includes fecal coliform, Escherichia coli (*E. coli*), and enterococci, and represent a threat to human health and the environment. Although not all bacteria are pathogenic the words "pathogens" and "bacteria" are used interchangeably in this TMDL. Pathogen contamination of our surface waters is most often a direct result of the improper management of human wastes, excrement from barnyard animals, pet feces and agricultural applications of manure. It can also result from large congregations of birds such as geese and gulls. Discharges of inadequately treated boat waste are of particular concern in urban coastal areas. Inappropriate disposal of human and animal wastes can degrade aquatic ecosystems and negatively affect public health. Pathogen contamination can also result in closures of shellfish beds, bathing beaches, and drinking water supplies. The closure of such important public resources can erode quality of life and diminish property values.

Coastal communities rely on clean, productive, aesthetically pleasing marine and estuarine waters for swimming, boating, fishing and tourism. Failure to reduce and control bacterial contamination results in illness in humans, closures of shellfishing areas and bathing beaches, fish kills, unpleasant odors and visible scum. Total Maximum Daily Loads (TMDLs) for pathogens have been established for waterbody segments within the Boston Harbor, Mystic, Weir and Weymouth Watersheds. This TMDL will be used to set permit limits and provide stakeholders a document to identify bacterial sources and take appropriate actions to reduce their effects.

Who should read this document?

The following groups and individuals can benefit from the information in this report:

a) Towns and municipalities, especially National Pollutant Discharge Elimination System (NPDES) Phase I and Phase II regulated communities, that are required by law to address stormwater and/or combined sewage overflows (CSOs), Sanitary Sewer Overflows (SSO) and other sources of contamination (e.g., broken sewerage pipes and illicit connections) that contribute to a waterbody's failure to meet Massachusetts Water Quality Standards for pathogens;

b) watershed groups that wish to pursue funding to identify and/or mitigate sources of pathogens in their watersheds;

c) harbormasters, public health officials and/or municipalities that are responsible for monitoring, enforcing or otherwise mitigating contamination that results in beach and/or shellfish closures or results in the failure of other surface waters to meet Massachusetts standards for pathogens;

d) citizens who wish to become more aware of pollution issues and who may be interested in helping build local support for implementation of remediation measures; and

e) government agencies that provide planning, technical assistance, and funding to groups for remediation of pollution including pathogens.

Boston Harbor Watershed

The Boston Harbor Watershed, encompassing 293 square miles (m^2) of land area, including all or part of 39 municipalities, as well as downtown Boston, is located in and around historic Boston Harbor. The watershed includes the Mystic River Watershed to the north, and the Neponset, Weymouth and Weir River Watersheds to the south. This report includes information regarding each of these sub-basins with the exception of the Neponset River sub-basin. The Massachusetts Department of Environmental Protection (MassDEP or DEP) prepared a TMDL for the Neponset River sub-basin in 2002 and an addendum in 2012. Both reports are available on the MassDEP website at http://www.mass.gov/eea/agencies/massdep/water/watersheds/total-maximum-daily-loads-tmdls.html. The Charles River is not included in this report because it has its own watershed and TMDLs. The TMDLs in this report do not include fresh water lakes or ponds.

Boston Harbor Subwatershed- The Boston Harbor Proper Watershed, is approximately 176 square miles and includes estuary segments totaling 40.65 mi^2. Subwatersheds in Boston Harbor include Boston Inner Harbor, Dorchester Bay, Quincy Bay, Hull Bay, Hingham Bay, Winthrop Bay, Pleasure Bay, and Boston Harbor. This TMDL includes ten impaired estuarine segments, or 100% of the estuaries within Boston Harbor proper.

Weymouth and Weir Subwatershed - The Weymouth and Weir River Basin is located in the southeast region of the Boston Harbor Watershed. The subwatershed includes roughly 38.2 river miles, 23.7 miles are pathogen impaired. The subwatershed includes Weymouth Fore and Back Rivers, Weir River, Monatiquot River, Old Swamp River, and Mill River and estuarine segments also include Hingham Harbor and Town River Bay. This TMDL covers five estuarine and seven impaired river segments.

Mystic River Subwatershed - The Mystic River is located in the northeast region of the Boston Harbor Watershed. The subwatershed includes roughly 24 impaired river miles out of a total of 27.6 river miles, including the Aberjona River, Alewife Brook, Malden River, Chelsea River, and the main stem of the Mystic River. Four out of a total of five estuaries are impaired in the subwatershed. This TMDL covers four estuarine and seven impaired river segments.

Boston Harbor is a highly urbanized watershed with >60% of its landuse developed. Historically, water quality problems have been attributed to point source discharges from wastewater treatment plants (WWTPs) and combined sewer overflows (CSOs) and stormwater runoff from urban areas. Growth pressures continue to affect the Boston Harbor Watersheds, as many of the communities face challenges to handle the new growth. Growth pressures are caused by population increases as well as increased encroachment on the land from high-density redevelopment, residential construction, commercial and industrial facilities. To support the increased growth, increased municipal services, roadways, and recreational facilities and parks are needed to support the growing populace. For example, between 2010 and 2015, the City of Boston alone, grew by nearly 50,000 people, or 7%, (617,680 in 2010 and 667,137 in 2015).

Bacteria pollution problems in the segments covered in this report persist over much of the area due to a combination of point and non-point source pollution. Point sources include wastewater treatment plant effluent, piped discharges of stormwater from Phase I and Phase II communities and discharges from CSOs and SSOs. Non-point sources may include stormwater runoff from, failing septic systems, illicit connections, wildlife and pet wastes, boat and marina wastes. Most of this watershed is geographically oriented to coastal estuarine areas, which historically were rich in shellfishing reserves. To protect human health the water quality standards for bacteria required to support shellfishing are particularly stringent, and therefore the water quality conditions have resulted in many of these areas being closed for decades for this particular use.

Progress in Reducing Bacteria Sources In the Watershed

Significant progress has been made in the last 15 years to address bacterial contamination of Boston Harbor. Interventions to address water quality issues have been carried out by water authorities (MWRA, Boston and Water Sewer Commission (BWSC)), Towns, organizations, state agencies, and citizens to resolve various water quality problems in the basin. Nutrient and bacteria identification and source discovery has been the emphasis of many of the interventions that have been carried out. The principal contributors in general are effects of CSOs, SSOs, and overland stormwater flows as these pick up various pollutants, such as wildlife and pet wastes, and garbage, etc. Sources of bacteria are in the process of being addressed through the focused efforts of MassDEP and the regulated community that have targeted remediation efforts to address the bacteria loads from CSO and illicit connections to stormdrain systems. Particularly strident efforts are necessary in controlling pollutants such as bacteria because the geography of this watershed is shaped as such that most of it is closely oriented (within a few miles) to coastal/ estuarine locations that have a high proportion of potential shellfishing usage. The following paragraphs include some highlights of work that has been done:

In August 2006, the Executive Office of Environmental Affairs formally announced the coastal area, encompassing Boston, Medford, Quincy, Braintree, Weymouth, Hingham, and Cohasset, became a No Discharge Area (NDA), meaning that any discharge of boat sewage is prohibited (Figure 2-3). This was enacted to better protect the waters from receiving nutrient and bacterial wastes from marine vessels operating within these waters (EOEA 2006).

By 2001, upgrades were completed to the Deer Island Wastewater Treatment Plant and relocation of the outfall discharge of treated wastewater was placed 9.5 miles out into the ocean. The Deer Island Wastewater Treatment Plant receives sewage from 43 greater Boston communities and has a higher capacity than the combined capacities of the former Deer Island and Nut Island facilities, greatly reducing back-ups and overflows throughout the system (MWRA 2008).

Implementation of the Massachusetts Water Resources Authority Long-Term CSO Control Plan (MWRA 2016) has dramatically reduced CSO flows and loads into the Boston Harbor watershed. The MWRA has completed all of the 35 projects in their Long-Term Control Plan, closed 34 of the 84 CSO outfalls that were active at plan inception, eliminated CSO discharges to sensitive use areas, and reduced system wide CSO discharge volume in a typical rainfall year by 86%, from 3.3 billion gallons in 1988 to 0.49 billion gallons as of 2015. Pursuant to the federal court order, MWRA is now planning an assessment phase during the years 2018 – 2020, where the MWRA will conduct field investigations and sewer system modeling and monitoring to confirm the CSO benefits estimated in the Long-Term CSO Control Plan.

There have been significant improvements to Boston Harbor since the wastewater upgrades were completed and the MWRA Deer Island WWTP discharge location was moved further offshore into Massachusetts Bay. These include: 30-55% reductions in concentrations of phosphorus and nitrogen, 25-30% reductions of chlorophyll, 30% reduction of particulate organic carbon, and 5% increases in bottom water dissolved oxygen levels (Taylor 2006). This translates to other data in Boston Harbor such as improvements in bacteria levels as well (NEERS 2006). Subsequent reports and studies show further improvements in all these parameters, with 2013 nitrogen and phosphorus concentrations the lowest measured since 1995, bottom-water concentrations of dissolved oxygen the highest since wastewater discharges ended in the Harbor, and symptoms of over-enrichment within the Harbor significantly improved (Taylor 2011; Taylor 2013).

Initiatives in the Weymouth and Weir sub-basin have been undertaken to reduce SSOs and infiltration and inflow (I&I). These initiatives include reducing overflows from the MWRA Braintree-Weymouth Interceptor and the Braintree and Weymouth municipal sewer systems. The MWRA Braintree-Weymouth Relief Facilities increased the system's capacity and streamlined the route the wastewater takes from the communities directly to the Deer Island Treatment Plant. (MWRA 2010, MWRA 2015).

The Mystic River Watershed Association (MyRWA) has sponsored water quality monitoring efforts throughout the watershed for more than 15 years. These data have helped identify and monitor areas with high bacteria counts. MWRA also has conducted receiving water sampling in Boston Harbor and the Alewife/Mystic River watershed since the 1990's, and has monitored water quality under both wet and dry weather conditions.

In the last several years, MyRWA has conducted hotspot outfall pipe monitoring, and has identified stormdrain outfalls discharging high bacteria counts. Water quality problems have been identified and mitigation actions implemented, with many more in progress. In December 2005, EPA issued administrative orders to the Cities of Chelsea, Everett, Malden, Revere, and Medford, based on evidence that those communities had illicit discharges to the Mystic River or its tributaries. The orders required each of these communities to develop comprehensive Illicit Discharge Detection and Elimination (IDDE) Plans (Brander 2015). MassDEP has active enforcement actions with the City of Cambridge, the town of Arlington, and the City of Somerville, all of which are targeting illicit wastewater connections to their stormdrain systems.

In the Alewife Brook segment (MA71-04), five formerly active CSO discharges have been permanently closed, with six presently active CSO discharges permitted to the cities of Somerville and Cambridge, as well as to the MWRA. The Alewife Brook CSO Control Plan is predicted to reduce annual CSO volume to the Alewife Brook by 85% in a typical year, from 50 million gallons in 1997 to 7.3 million gallons in 2016.

Bacterial Water Quality Indicators

The use of the terms “pathogens” or “bacteria” in this report is used to refer to bacteriological data collected and analyzed for Fecal coliform, *E. coli*, or Enterococci. Massachusetts Surface Water Quality Standards (WQS), 314 CMR 4.00 were revised in 2007, replacing Fecal coliform as the water quality indicator for both fresh and marine waters with ***E. coli* for fresh water** and **Enterococci for fresh and marine waters** (MassDEP 2007). MWRA and MyRWA also follow the Massachusetts WQS. **Fecal coliform** is the water quality indicator used by Division of Marine Fisheries (DMF) for shellfish harvesting in coastal-estuarine segments. Readily available data for the 303(d)[1] listed segments in Boston Harbor, Weir, Weymouth, and the Mystic subbasins are listed in tables in Section 4 of this report.

Bacterial Implementation Priorities

In an effort to provide guidance for setting bacterial implementation priorities within the Boston Harbor Watershed, a summary table is provided. Table ES-1 though ES-3 provides a prioritized lists of pathogen-impaired segments that may require additional bacterial source tracking work and stepwise implementation of structural (e.g., fixing failing infrastructure) and non-structural (e.g., administrative controls) Best Management Practices (BMP’s). Since limited source information and data are available in each impaired segment, a simple scheme was used to prioritize segments based on bacteria concentrations and designated uses. Depending on the particular bacteria indicator sampled and analyzed by the particular organization, the data listed are either Fecal coliform, *E. coli*, or Enterococci.

High priority was assigned to those segments where dry or wet weather concentrations were equal to or greater than 10,000 col/100 ml since such high levels generally indicate a direct sanitary source. Medium priority was assigned to segments where concentrations ranged from 1,000 to 9,999 col/100ml since this range of concentrations generally indicates a direct sewage source that may get diluted in the conveyance system. Low priority was assigned to segments where concentrations were observed less than 1,000 col/100 ml. It should be noted that in all cases, waters identified in Table ES-1 to ES-3 exceed the water quality standards for bacteria, and are thereby considered impaired.

Also, prioritization is adjusted upward based on proximity of waters, within the segment, to sensitive areas such as Outstanding Resource Waters (ORW’s), or designated uses that require higher water quality standards than Class B, such as public water supply intakes, public swimming areas, or shellfishing areas. Best professional judgment was used in determining this upward adjustment.

[1] Section 303(d) of the Clean Water Act requires states to identify those waterbodies that are not expected to meet surface water quality standards after the implementation of technology-based controls and to prioritize and schedule them for the derivation of total maximum daily loads (TMDLs).

Generally speaking, waters that were determined to be lower priority based on the numeric range identified above were elevated up one level of priority if that segment were adjacent to or immediately upstream of a sensitive use. An asterisk * in the priority column of the specific segment in Tables ES-1 to ES-3 would indicate this situation.

MassDEP believes that segments ranked as high priority in Tables ES-1 to ES-3 are indicative of the potential presence of raw sewage and therefore they pose a greater risk to the public. These segments should continue to be subject to aggressive efforts to identify and eliminate illicit wastewater connections to the stormdrain systems. CSOs and Sanitary Sewer Overflows (SSOs) have historically been a significant contributor to bacteria pollution to the Harbor area, and the MWRA CSO Program Assessment that will be conducted under the federal court order, together with the information being gathered under the terms and conditions of the CSO Variance should be focused on determining the impacts of remaining CSO discharges, and the feasibility of higher levels of CSO control. Eliminating illicit connections, reducing the risk of SSO events, and fixing failing infrastructure is tantamount to improving bacterial water quality. As the bacteria loads from SSOs and CSOs continue to decline it is anticipated that stormwater discharges from Phase I and Phase II regulated communities will remain the predominate source of bacteria pollution along with non-point sources such as failing septic systems.

A top priority activity for finding illicit connection sources should be bacteria source tracking activities during dry weather in those segments where sampling activities show elevated levels of bacteria. Identification and remediation of dry weather bacteria sources is usually more straightforward and successful than tracking and eliminating wet weather sources. Finding and eliminating direct and indirect illicit bacteria sources will result in a dramatic reduction of bacteria concentration in the segment in both dry and wet-weather.

Finding the bacteria related pollution sources from failed infrastructure and fixing these poses real challenges. Overland stormwater runoff greatly exacerbates the pollution from failed infrastructure sources. Segments that remain impaired during wet weather should be evaluated for stormwater BMP implementation opportunities starting with less costly non-structural practices first (such as street sweeping, catch basin cleaning, and/or managerial approaches using local regulatory controls), and lastly, more expensive structural measures. Unfortunately, many failed infrastructure problems require the more expensive structural repair measures to be considered. This would require additional study to identify the most cost efficient and effective technology.

Table ES 1-1 Pathogen Impaired Segment Priorities- Boston Harbor Subwatershed

Segment ID	Segment Name Waterbody Class	Segment Size(m^2)	Segment Description	Priority	Indicators
MA70-10	Winthrop Bay, Class SB	1.65 mi^2	From the tidal flats at Coleridge Street, Boston (East Boston) to a line between Logan International Airport and Point Shirley, East Boston/Winthrop	High*, Shellfishing, Public Swimming	Enterococci, Fecal Coliform
MA70-02	Boston Inner Harbor, Class SB/CSO[1]	2.56 mi^2	From the Mystic and Chelsea rivers, Chelsea/Boston, to the line between Governors Island and Fort Independence, Boston (East Boston), including Fort Point, Reserved, and Little Mystic Channels).	High*,Shell-fishing	Enterococci, Fecal Coliform
MA70-11	Pleasure Bay, Class SB	0.22 mi^2	A semi-enclosed bay, the flow restricted through two channels between Castle and Head islands, Boston	High*, Shellfishing, Public Swimming	Enterococci, Fecal Coliform,
MA70-03	Dorchester Bay, Class SB	3.46 mi^2	From the mouth of the Neponset River, Boston/Quincy to the line between Head Island and the north side of Thompson Island and the line between the south point of Thompson Island, Boston and Chapel Rocks, Quincy.	High*, Shell-Fishing, Public Swimming	Enterococci, Fecal Coliform
MA70-04	Quincy Bay, Class SA	1.52 mi^2	From Bromfield Street near the Wollaston Yacht Club, Quincy, northeast to N42 17.3 W71 00.1, then southeast to Houghs Neck near Sea Street and Peterson Road (formerly referred to as the "Willows") Quincy.	Medium* Shell-fishing	Enterococci, Fecal Coliform
MA70-05	Quincy Bay, Class SB	4.41 mi^2	Quincy Bay, north of the class SA waters (segment MA70-04), Quincy to the line between Moon Head and Nut Island, Quincy	High*, Dry Weather Problems, Shellfish, Public Swimming	Enterococci, Fecal Coliform
MA70-06	Hingham Bay, Class SB	0.96 mi^2	The area north of the mouth of the Weymouth Fore River extending on the west along the line from Prince Head just east of Pig Rock to the mouth of the Weymouth Fore River (midway between Lower Neck and Manot Beach), Quincy	Medium* Shellfish.	Fecal Coliform
MA70-07	Hingham Bay, Class SB	4.8 mi^2	The area defined between Peddocks Island and Windmill Point; from Windmill Point southeast to Bumkin Island; from Bumkin Island southeast to Sunset Point; from Sunset Point across the mouth of the Weir River to Worlds End; from Worlds End across the mouth of Hingham Harbor to Crow Point; from Beach Lane, Hingham across the mouth of the Weymouth Back River to Lower Neck; and from Lower Neck midway across the mouth of the Weymouth Fore River	Medium* Shellfish.	Fecal Coliform
MA70-09	Hull Bay, Class SB	2.48 mi^2	The area defined east of a line from Windmill Point, Hull to Bumpkin Island, Hingham and from Bumpkin Island to Sunset Point, Hull	Medium* Shellfish.	Fecal Coliform
MA70-01	Boston Harbor, Class SB	18.59 mi^2	The area defined by a line from the southerly tip of Deer Island to Boston Lighthouse on Little Brewster Island, then south to Point Allerton;	High*, Shellfish.	Fecal Coliform

Segment ID	Segment Name Waterbody Class	Segment Size(m^2)	Segment Description	Priority	Indicators
			across Hull and West guts; across the mouths of Quincy and Dorchester Bays, Boston Inner Harbor and Winthrop Bay (including Presidents Roads and Nantasket Roads)		

[1] The remaining CSO discharges in this segment are permitted under the SB/CSO designation, subject to the limitations on CSO activations and volumes in the final MWRA Long-Term CSO Control Plan.

Table ES 1-2 Pathogen Impaired Segment Priorities - Weir & Weymouth Subwatershed

Segment ID	Segment Name	Segment Size (mi or m^2)	Segment Description	Priority	Indicators
MA74-06	Cochato River, Class B	4.1 mi	Outlet Lake Holbrook, Holbrook to confluence with Farm and Monatiquot Rivers, Braintree (through former pond segment Ice House Pond MA74028). (SARIS note: the upper portion of this segment is comprised of three surface waters: unnamed tributary from the outlet of Lake Holbrook, portion of Mary Lee Brook, portion of Glovers Brook).	Medium	*E. coli*
MA74-08	Monatiquot River, Class B	4.4 mi	Headwaters at confluence of Cochato and Farm Rivers, Braintree to confluence with Weymouth Fore River at Commercial Street, Braintree	Medium, Wet and Dry Weather Problems	*E. coli*
MA74-09	Town Brook, Class B/SB	3.5 mi	Outlet Old Quincy Reservoir, Braintree to confluence with Town River Bay north of Route 3A, Quincy (includes "The Canal"/Town River) (portions culverted underground).	High, Wet and Dry Weather Problems	*E. coli*
MA74-15	Town River Bay, Class SA	0.46 mi^2	From the headwaters at the Route 3A bridge, Quincy to the mouth at the Weymouth Fore River between Shipyard and Germantown Points, Quincy.	High* Shellfishing, Public Swimming	Enterococci, Fecal Coliform
MA74-14	Weymouth Fore River, Class B/SB	2.29 mi^2	Commercial Street, Braintree to mouth (eastern point at Lower Neck, Weymouth and western point at Wall Street on Houghs Neck, Quincy	High* Shellfishing, Public Swimming	Enterococci, Fecal Coliform
MA74-03	Old Swamp River, Class A (PWS Trib, ORW)	5.2 mi	Headwaters just west of Pleasant Street and north of Liberty Street, Rockland to inlet Whitmans Pond, Weymouth	High*, Public Water Supply	*E. coli*, Enterococci
MA74-04	Mill River, Class A (PWS Trib, ORW)	3.4 mi	Headwaters, west of Route 18 and south of Randolph Street, Weymouth to inlet Whitmans Pond, Weymouth (portions culverted underground).	High* Public Water Supply Tributary	*E. coli*
MA74-05	Weymouth Back River, Class B (ORW)	0.4 mi	Outlet Elias Pond, Weymouth to the base of the fish ladder north of Commercial Street, Weymouth	High* ORW Wet and Dry Weather Problem	*E. coli*
MA74-13	Weymouth Back River, Class SA	0.86 mi^2	From the base of the fish ladder north of Commercial Street, Weymouth to mouth between Lower Neck to the west and Wompatuck Road, Hingham.	Medium* Shellfishing, Public Swimming	Enterococci, Fecal Coliform
MA74-18	Hingham	1.12 mi^2	Hingham Harbor, inside a line from Crows Point	Medium*	Enterococci,

Segment ID	Segment Name	Segment Size (mi or m^2)	Segment Description	Priority	Indicators
	Harbor, Class SA		to Worlds End, Hingham (formerly reported as MA70-08).	Shellfishing, Public Swimming	Fecal Coliform
MA74-02	Weir River, Class B/SA	2.7 mi	Headwaters at confluence of Crooked Meadow River and Fulling Mill Brook, Hingham to Foundry Pond Outlet, Hingham (through former pond segment Foundry Pond MA74011).	Medium	*E. coli*
MA74-11	Weir River, Class SA	0.83 mi	From Foundry Pond outlet, Hingham to mouth at Worlds End, Hingham and Nantasket Road near Beech Avenue, Hull (including unnamed tributary from outlet Straits Pond, Hingham/Hull).	Medium* Shellfishing, Public Swimming	Enterococci, Fecal Coliform

Table ES 1-3 Pathogen Impaired Segment Priorities- Mystic Subwatershed

Segment ID	Segment Name	Segment size(mi or m^2)	Segment Description	Priority	Indicator
MA71-01	Aberjona River, Class B	9.1 mi.	Source just south of Birch Meadow Drive, Reading to inlet Upper Mystic Lake at Mystic Valley Parkway, Winchester (portion culverted underground). (through former pond segments Judkins Pond MA71021 and Mill Pond MA71031).	High, Wet Weather	*E. coli*, Entercocci
MA71-04	Alewife Brook, Class B CSO Variance[1]	2.3 mi.	Outlet of Little Pond, Belmont to confluence with Mystic River, Arlington/Somerville (portion in Belmont and Cambridge identified as Little River with name changing to Alewife Brook at Arlington corporate boundary).	High, CSO, Dry Weather Problem Wet Weather	*E. coli*, Enterococci
MA71-05	Malden River, Class B	2.3 mi.	Headwaters south of Exchange Street, Malden to confluence with Mystic River, Everett/Medford.	High, Wet and Dry Weather Problems	*E. coli*, Enterococci
MA71-02	Mystic River, Class B** CSO Variance[1]	4.9 mi.	Outlet Lower Mystic Lake, Arlington/Medford to Amelia Earhart Dam, Somerville/Everett	High, CSO. Wet and Dry Weather Problems	*E. coli*, Enterococci
MA71-06	Chelsea River, Class SB/CSO[2]	0.38 mi^2	From confluence with Mill Creek, Chelsea/Revere to confluence with Boston Inner Harbor, Mystic River, Chelsea/East Boston/Charlestown	High*, Wet and Dry Weather Problems	Fecal Coliform
MA71-03	Mystic River, Class SB/CSO[2]	0.49 mi^2	Amelia Earhart Dam, Somerville/Everett to confluence with Boston Inner Harbor, Chelsea River, Chelsea/Charlestown (Includes Island End River)	High*, Shellfishing, Wet and Dry Weather Problems	Fecal Coliform
MA71-07	Mill Brook Class B	3.9 mi	Headwaters south of Massachusetts Avenue, Lexington to inlet of Lower Mystic Lake, Arlington (portions are culverted underground)	High, Wet and Dry Weather Problems	*E. coli*, Enterococci
MA71-08[3]	Mill Creek Class SB	0.02 mi^2	From Route 1, Chelsea/Revere to confluence with Chelsea River, Chelsea/Revere.	High, Wet Weather Problems	Fecal Coliform
MA71-09[3]	Winn Brook	1.4 mi	Headwaters near Juniper Road and the	High, Wet	*E. coli*,

Segment ID	Segment Name	Segment size(mi or m^2)	Segment Description	Priority	Indicator
	Class B		Belmont Hill School, Belmont to confluence with Little Pond, Belmont. (portions culverted underground).	and Dry Weather Problems	Enterococci
MA71-14[3]	Belle Isle Inlet Class SA	0.12 mi^2	From Tidegate at Bennington Street, Boston/Revere to confluence with Winthrop Bay, Boston/Winthrop.	High*, Wet Weather Problems, Shellfishing	Fecal Coliform
MA71-13[3]	Unnamed Tributary Class B**	0.1 mi	Unnamed tributary locally lnown as Local known as 'Meetinghouse Brook', from emergence south of Route 16/east of Winthrop St., Medford to confluence with Mystic River, Medford. (brook not apparent on 1985 Boston North USGS quad – 2005 orthophotos used to delineate stream)	Medium*, Wet Weather Problems	*E. coli*, Enterococci
** may have salt influx					

[1] Remaining CSO discharges are allowed under a variance of water quality standards, as analyses are conducted and progress is made to improve water quality.

[2] The remaining CSO discharges in this segment are permitted under the SB/CSO designation, subject to the limitations on CSO activations and volumes in the final MWRA Long-Term CSO Control Plan.

[3] New Pathogen Impaired Segments that were identified in the Integrated Report (2006 through 2014), after the public comment period for this TMDL, are included in the Boston Harbor Addendum, CN# 157.2 that is in the process of being developed.

TMDL Overview

The Massachusetts Department of Environmental Protection (MassDEP) is responsible for monitoring the waters of the Commonwealth, identifying those waters that are impaired, and developing a plan to bring them back into compliance with the Massachusetts Water Quality Standards (WQS). The Massachusetts Year 2014 Integrated List of Waters contains a list of impaired waters (Category 5 Waters) that require a TMDL (formerly known as the "303d list", which identifies impaired segments of rivers and streams, coastal waters, and the reasons for the impairment). It should be noted that all the waterbodies are influenced by seasonal variations in flow and temperature and the tidal cycles in the estuaries. All these variations will directly impact the extent to which these waterbodies are impaired.

Once a water body is identified as impaired, the MassDEP is required by the Federal Clean Water Act (CWA) to develop a "pollution budget" designed to restore the health of the impaired body of water. The process of developing this budget, generally referred to as a Total Maximum Daily Load (TMDL), includes identifying the source(s) of the pollutant from direct discharges (point sources) and indirect discharges (non-point sources), determining the maximum amount of the pollutant that can be discharged to a specific water body to meet water quality standards, and assigning pollutant load allocations to the sources. A plan to implement the necessary pollutant reductions is essential in order to reach the ultimate goal of restoring uses and meeting the water quality standards in stream.

Pathogen TMDL: This report represents a TMDL for bacteria indicators (e.g. Fecal coliform, *E. coli*, and Enterococci bacteria) in the Boston Harbor watershed. Certain bacteria, such as Fecal coliform, *E. coli*, and Enterococci bacteria, are indicators of contamination from sewage and/or the feces of warm-blooded wildlife (mammals and birds). Such contamination may pose a risk to human health. Therefore, in order to prevent further degradation in water quality and to ensure that waterbodies within the watershed meet state water quality standards, the TMDL establishes indicator bacteria limits and outlines corrective actions to achieve that goal.

Sources of indicator bacteria in the Boston Harbor watershed were found to be many and varied. Most of the bacteria sources are believed to be stormwater related. In Section 5, Table 5-1 provides a general compilation of likely bacteria sources in the Boston Harbor watershed including, combined sewer overflows (CSOs), sanitary sewer overflows (SSOs), sewer pipes connected to storm drains, certain recreational activities, wildlife including birds along with domestic pets and animals and direct overland stormwater runoff. Note that bacteria from wildlife would be considered a natural condition unless some form of human inducement, such as feeding, is causing congregation of wild birds or animals. A discussion of pathogen related control measures and best management practices are provided in the companion document: "*Mitigation Measures to Address Pathogen Pollution in Surface Water: A TMDL Implementation Guidance Manual for Massachusetts*" (ENSR 2005)[1] and on the interactive web site, Massachusetts Clean Water Toolkit, http://prj.geosyntec.com/npsmanual/default.aspx.

This TMDL applies to the 33 bacteria impaired segments of the Boston Harbor watershed that are currently listed on the CWA § 303(d) list of impaired waters (29 segments in this TMDL and 4 to be covered in an Addendum CN 157.2). MassDEP recommends however, 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.

The analyses conducted for the bacteria impaired segments in this TMDL would apply to the non-impaired segments, since the sources and their characteristics are equivalent. The concentration waste load and/or load allocation for each source and designated use would be the same as specified in this TMDL. Therefore, the pollution prevention TMDLs would have identical waste load and load allocations based on the sources present and the designated use of the water body segment (see ES-4 and Table 7.1). This Boston Harbor watershed TMDL may, in appropriate circumstances, also apply to segments that are listed for bacteria impairment in future Massachusetts CWA § 303(d) Integrated List of Waters. For such segments, this TMDL may apply if, after listing the waters for bacteria impairment and taking into account all relevant comments submitted on the CWA § 303(d) list, the Commonwealth determines with EPA approval of the future CWA § 303(d) Integrated List of Waters that this TMDL should apply to newly listed bacteria impaired segments.

Since accurate estimates of existing sources are generally unavailable, it is difficult to estimate the pollutant reductions for specific sources. For the illicit sources, the goal is complete elimination (100% reduction). However, overall wet weather indicator bacteria load reductions can be estimated using typical stormwater bacteria concentrations. These data indicate that in general two to three orders of

---

[1] This document was created at the initiation of the project in 2005 to be used as a companion guide by communities for addressing bacteria pollution impairments and should be used judiciously since the content does not represent the current status of regulations, permits, and grant programs.

magnitude (i.e., greater than 90%) reductions in stormwater bacteria loading will be necessary, especially in developed areas. This goal is expected to be accomplished through stepwise implementation of illicit discharge detection and elimination programs (IDDE), best management practices, such as those associated with the Phase I and Phase II control program for stormwater.

TMDL goals for each type of bacteria source are provided in Table ES-4. Municipalities are the primary responsible parties for achieving water quality standards through elimination of these sources. TMDL implementation to achieve these goals should be an iterative process with selection and implementation of mitigation measures followed by monitoring to determine the extent of water quality improvement realized. Recommended TMDL implementation measures include identification and elimination of prohibited sources such as leaky or improperly connected sanitary sewer flows and best management practices to mitigate stormwater runoff volume. Certain towns in the watershed are classified as Urban Areas by the United States Census Bureau and are subject to the Stormwater Phase II Final Rule that requires the development and implementation of an IDDE plan. Combined sewer overflows will be addressed through the MWRA Long-Term CSO Control Plan, the associated federal court order, and other actions to require compliance with Massachusetts water quality standards.

In most cases, authority to regulate non-point source pollution and thus successful implementation of this TMDL is limited to local government entities and will require cooperative support from volunteers, watershed associations, and local officials in municipal government. Those activities can take the form of expanded education, obtaining and/or providing funding, and possibly local enforcement. In some cases, such as subsurface disposal of wastewater from homes, the Commonwealth provides the framework, but the administration occurs on the local level. All communities should be encouraged to develop stormwater utilities or other administrative mechanisms to secure a dedicated funding stream to address stormwater issues. Sources of funding for TMDL implementation in NPDES regulated areas are scarce. 319 Nonpoint Source Competitive grant funds, previously a major source of funding for TMDL implementation in urban areas, cannot be used for work that addresses the requirements of NPDES permits; however, this funding can be used to develop stormwater utilities in regulated municipalities. MassDEP's Water Quality Management Planning Grants (Section 604b) and CZM's Coastal Pollution Remediation grants remain available on a competitive basis. State Revolving (Loan) Fund Program (SRF) funds can provide low-interest loans for pollution mitigation.

Table ES 1-4 Sources and Expectations for Limiting Bacterial Contamination in the Boston Harbor Watershed

Surface Water Classification	Pathogen Source	Waste Load Allocation Indicator Bacteria (cfu/100 mL)[1]	Load Allocation Indicator Bacteria (cfu/100 mL)[1]
A, B, SA, SB (prohibited)	Illicit discharges to storm drains	0	Not applicable
	Leaking sanitary sewer lines	0	Not Applicable
	Failing septic systems	Not Applicable	0
A (Includes filtered water supply) & **B**	Any regulated discharge- including stormwater runoff[4] subject to Phase I or II NPDES permits, NPDES wastewater treatment plant discharges [7,9]	Either; a) *E. coli* <=geometric mean[5] 126 colonies per 100 mL; single sample <=235 colonies per 100 mL[11]; or b) Enterococci geometric mean[5] <= 33 colonies per 100 mL and single sample <= 61 colonies per 100 mL[11]	Not Applicable
	Nonpoint source stormwater runoff[4]	Not Applicable	Either a) *E. coli* <=geometric mean[5] 126 colonies per 100 mL; single sample <=235 colonies per 100 mL; or Enterococci geometric mean[5]<= 33 colonies per 100 mL and single sample <= 61 colonies per 100 mL
SA (approved for shellfishing)	Any regulated discharge - including stormwater runoff[4] subject to Phase I or II NPDES permits, NPDES wastewater treatment plant discharges[7,9]	Fecal Coliform <= geometric mean, MPN, of 14 organisms per 100 mL nor shall 10% of the samples be >=28 organisms per 100 mL	Not Applicable
	Nonpoint Source Stormwater Runoff[4]	Not Applicable	Fecal Coliform <= geometric mean, MPN, of 14 organisms per 100 mL nor shall 10% of the samples be >=28 organisms per 100 mL
SA & SB[10] (Beaches[8] and non-designated shellfish areas)	Any regulated discharge - including stormwater runoff[4] subject to Phase I or II NPDES permits, NPDES wastewater treatment plant discharges[7,9]	Enterococci - geometric mean[5] <= 35 colonies per 100 mL and single sample <= 104 colonies per 100 mL[11]	Not Applicable

Surface Water Classification	Pathogen Source	Waste Load Allocation Indicator Bacteria (cfu/100 mL)[1]	Load Allocation Indicator Bacteria (cfu/100 mL)[1]
	Nonpoint Source Stormwater Runoff[4]	Not Applicable	Enterococci -geometric mean[5] <= 35 colonies per 100 mL and single sample <= 104 colonies per 100 mL
SB (approved for shellfishing w/depuration)	Any regulated discharge - including stormwater runoff[4] subject to Phase I or II NPDES permits, NPDES wastewater treatment plant discharges[7,9]	Fecal Coliform <= median or geometric mean, MPN, of 88 organisms per 100 mL nor shall 10% of the samples be >=260 organisms per 100 mL[11]	Not Applicable
	Nonpoint Source Stormwater Runoff[4]	Not Applicable	Fecal Coliform <= median or geometric mean, MPN, of 88 organisms per 100 mL nor shall 10% of the samples be >=260 organisms per 100 mL
SB/CSO (segments Boston Inner Harbor (MA 71-02), Chelsea River (MA 71-06), Mystic River (MA 71-03)[12]	Any regulated discharge - including stormwater runoff[4] subject to Phase I or II NPDES permits, NPDES wastewater treatment plant discharges[7,9], and combined sewer overflows[6].	**For Non-CSO Discharges:** Enterococci - geometric mean[5] <= 35 colonies per 100 mL and single sample <= 104 colonies per 100 mL[11] **For CSO Discharges**: CSO activations and volumes limited to those included and identified in permitted Long-Term CSO Control Plan.[12]	Not Applicable
	Nonpoint Source Stormwater Runoff[4]	Not Applicable	Enterococci -geometric mean[5] <= 35 colonies per 100 mL and single sample <= 104 colonies per 100 mL
B/CSO Variance Alewife Brook (MA 71-04), Upper Mystic (MA71-02)	Combined Sewer Overflows	CSO activations and volumes limited to those included and identified in the permitted Long-Term CSO Control Plan. [12]	Not applicable

[1] Waste Load Allocation (WLA) and Load Allocation (LA) refer to fecal coliform densities unless specified in table.
[2] In all samples taken during any 6 month period
[3] In 90% of the samples taken in any six month period;
[4] The expectation for WLAs and LAs for stormwater discharges is that they will be achieved through the implementation of BMPs and other controls to the maximum extent practical.
[5] Geometric mean of the 5 most recent samples is used at bathing beaches. For all other waters and during the non-bathing season the geometric mean of all samples taken within the most recent six months, typically based on a minimum of five samples.
[6] Or other applicable water quality standards for CSO's
[7] Or shall be consistent with the Waste Water Treatment Plant (WWTP) National Pollutant Discharge Elimination System (NPDES) permit.

[8] Massachusetts Department of Public Health regulations (105 CMR Section 445)
[9] Seasonal disinfection may be allowed by the Department on a case-by-case basis.
[10] Segments identified as CSO have a Long Term Control Plan in place.
[11] Threshold for beach closure. Beaches Environmental Assessment and Coastal Health (BEACH) Act.
[12] See Second Stipulation of the United States and the Massachusetts Water Resources Authority on "Responsibility and Legal Liability for Combined Sewer Overflow Control" filed in US District Court on March 15, 2006. (MWRA 2006).

Note: This table represents waste load and load allocations based on water quality standards current as of the publication date of these TMDLs. If the pathogen criteria change in the future, MassDEP intends to revise the TMDL by addendum to reflect the revised criteria. Waste load allocation (WLA) as a concept in this document refers to pollutants discharged from pipes and channels that require a discharge permit (point sources). Load allocation refers to pollutants entering waterbodies through overland runoff (nonpoint sources). A major difference between the two categories is the greater legal and regulatory control generally available to address point sources while voluntary cooperation added by incentives in some cases is the main vehicle for addressing non-point sources.

Table of Contents

List of Tables

List of Figures

1.0 Introduction

Section 303(d) of the Federal Clean Water Act (CWA) and Environmental Protection Agencies (EPA's) Water Quality Planning and Management Regulations (40 CFR Part 130) require states to place waterbodies that do not meet established water quality standards on a list of impaired waterbodies (commonly referred to as the "303d List") and to develop Total Maximum Daily Loads (TMDLs) for listed waters and the pollutant(s) contributing to the impairment. In Massachusetts, impaired waterbodies are included in Category 5 of the "*Massachusetts Year 2014 Integrated List of Water: Final Listing of the Condition of Massachusetts' Waters Pursuant to Sections 305(b), 314 and 303(d)* of the Clean Water Act" (MassDEP 2015). Figure 1-1 provides a map of the Boston Harbor watershed (excluding the Neponset River sub-basin shown in grey). Figure 1-2 is a map of the subwatersheds with bacteria impaired segments indicated. As shown in Figure 1-2 and Tables ES-1 through 3, much of the Boston Harbor waterbodies are listed as a Category 5 "impaired or threatened for one or more uses and requiring a TMDL" due to excessive indicator bacteria concentrations.

The Final Report has been greatly expanded from the original Draft TMDL. Section 4, Problem Assessment, has been substantially updated with current DEP, MWRA, MyRWA, and CZM data, along with information on all important NPDES dischargers. Sections 5 and 6 have been reworked to give more information on both possible and actual sources of pathogen pollution. Section 7 has been modified to include giving WLA and LA loadings calculations for each segment. Section 8, Implementation, has been rewritten to include detailed up- to- date information on CSO and SSO dischargers, along with progress on CSO and SSO control efforts. Also added to Section 8 is a detailed update on activities and progress of each community in the watershed under the Phase II Stormwater Program. Section 10, Reasonable Assurances has been expanded to give details on various tools and resources that are potentially available to communities and organizations for pathogen pollution controls.

TMDLs are to be developed for water bodies that are not meeting designated uses under technology-based controls only. TMDLs determine the amount of a pollutant that a waterbody can safely assimilate without violating water quality standards. The TMDL process establishes the maximum allowable loading of pollutants or other quantifiable parameters for a water body based on the relationship between pollutant sources and instream conditions. The TMDL process is designed to assist states and watershed stakeholders in the implementation of water quality-based controls specifically targeted to identified sources of pollution in order to restore and maintain the quality of their water resources (USEPA 2001). TMDLs allow watershed stewards to establish measurable water quality goals based on the difference between site-specific instream conditions and state water quality standards.

A major goal of this TMDL is to achieve meaningful environmental results with regard to the designated uses of the Boston Harbor waterbodies. These include: water supply, shellfish harvesting, fishing, boating, and swimming. This TMDL establishes the necessary pollutant load to achieve designated uses and water quality standard and the companion document entitled: "*Mitigation Measures to Address*

Pathogen Pollution in Surface Water: A TMDL Implementation Guidance Manual for Massachusetts" (ENSR 2005)[1] which provides guidance for the implementation of this TMDL. http://www.mass.gov/eea/agencies/massdep/water/watersheds/total-maximum-daily-loads-tmdls.html and on the interactive web site, *Massachusetts Clean Water Toolkit*, http://prj.geosyntec.com/npsmanual/default.aspx.

Historically, water and sediment quality studies have focused on the control of point sources of pollutants (i.e., discharges from pipes and other structural conveyances) that discharge directly into well-defined hydrologic resources, such as estuaries, lakes, ponds, or river segments. While this localized approach may be appropriate under certain situations, it typically fails to characterize the more subtle and chronic sources of pollutants that are widely scattered throughout a broad geographic region such as a watershed (e.g., roadway runoff, failing septic systems in high groundwater, areas of concentrated wildfowl use, fertilizers, pesticides, pet waste, and certain agricultural sources). These so called nonpoint sources of pollution often contribute significantly to the decline of water quality through their cumulative impacts. A watershed-level approach that uses the surface drainage area as the basic study unit enables managers to gain a more complete understanding of the potential pollutant sources impacting a waterbody and increases the precision of identifying local problem areas or "hot spots" which may detrimentally affect water and sediment quality. It is within this watershed-level framework that the Massachusetts Department of Environmental Protection (MassDEP) commissioned the development of watershed based TMDLs.

1.1. Pathogens and Indicator Bacteria

The Boston Harbor pathogen TMDL is designed to support the 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.

Waterborne pathogens include a broad range of bacteria, viruses, and protozoans that are difficult to identify and isolate. Thus, specific nonpathogenic bacteria have been identified that are typically associated with harmful pathogens in fecal contamination. These associated nonpathogenic bacteria are used as indicator bacteria as they are easier to identify and measure in the environment. High densities of indicator bacteria increase the likelihood of the presence of pathogenic organisms.

---

[1] This document was created at the initiation of the project in 2005 to be used as a companion guide by communities for addressing bacteria pollution impairments and should be used judiciously since content of does not represent the current status of regulations, permits, and grant programs.

Selection of indicator bacteria is difficult as new technologies challenge current methods of detection and the strength of correlation of indicator bacteria and human illness. Currently, coliform and fecal streptococci bacteria are commonly used as indicators of potential pathogens (i.e., indicator bacteria). Coliform bacteria include total coliforms, Fecal coliform and *Escherichia coli* (*E. coli*). Fecal coliform (a subset of total coliform) and *E. coli* (a subset of Fecal coliform) bacteria are present in the intestinal tracts of warm blooded animals. Presence of coliform bacteria in water indicates the possible presence of fecal contamination. Fecal streptococci bacteria are also used as indicator bacteria, specifically Enterococci a subgroup of fecal streptococci. These bacteria also live in the intestinal tract of animals, and their presence is a better predictor of human gastrointestinal illness than Fecal coliform since the die-off rate of Enterococci is much lower (i.e., Enterococci bacteria remain in the environment longer) (USEPA 2001). The relationship of indicator organisms is provided in Figure 1-3. The EPA, in the "*Ambient Water Quality Criteria for Bacteria – 1986"* (US EPA 1986) and *"2012 Recreational Water Quality Criteria for Bacteria*" documents, recommends the use of *E. coli* or Enterococci as potential pathogen indicators in fresh water and Enterococci in marine waters (US EPA 2012).

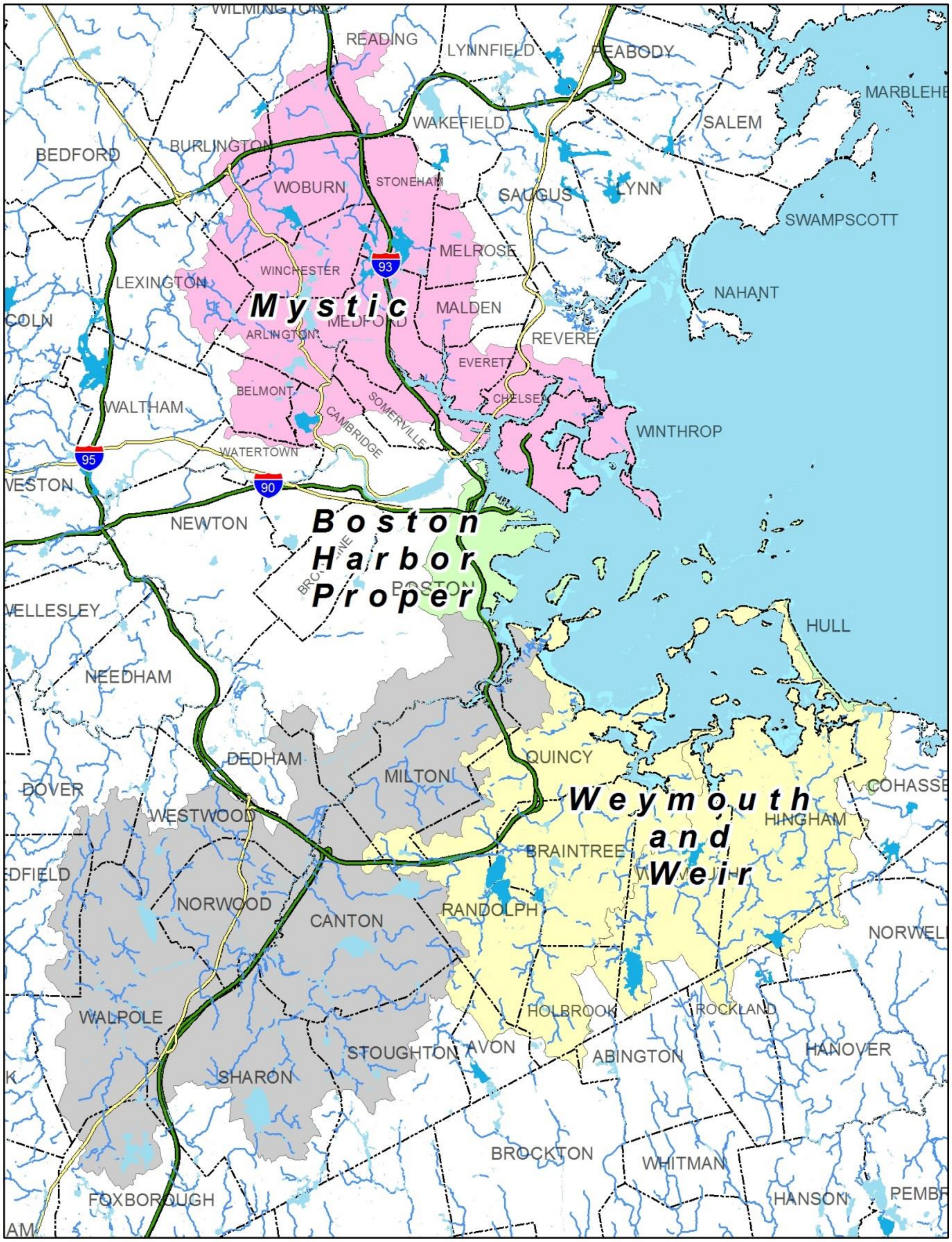


Figure 1-1 Boston Harbor, Weymouth-Weir, and Mystic Subwatersheds

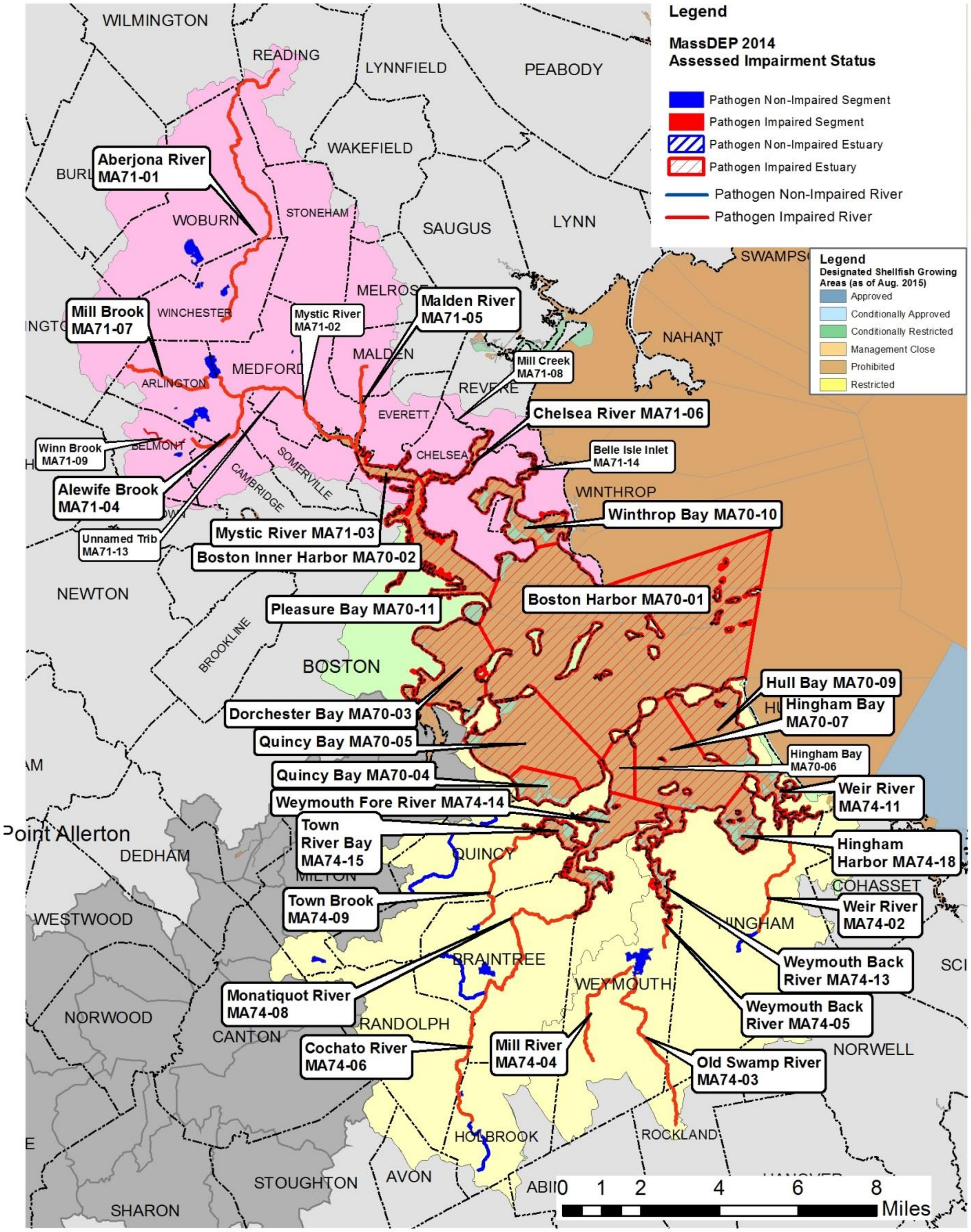


Figure 1-2 Boston Harbor Watershed, Pathogen Impaired Segments (MassDEP 2015) and Shellfish Growing Areas (DMF 2015).

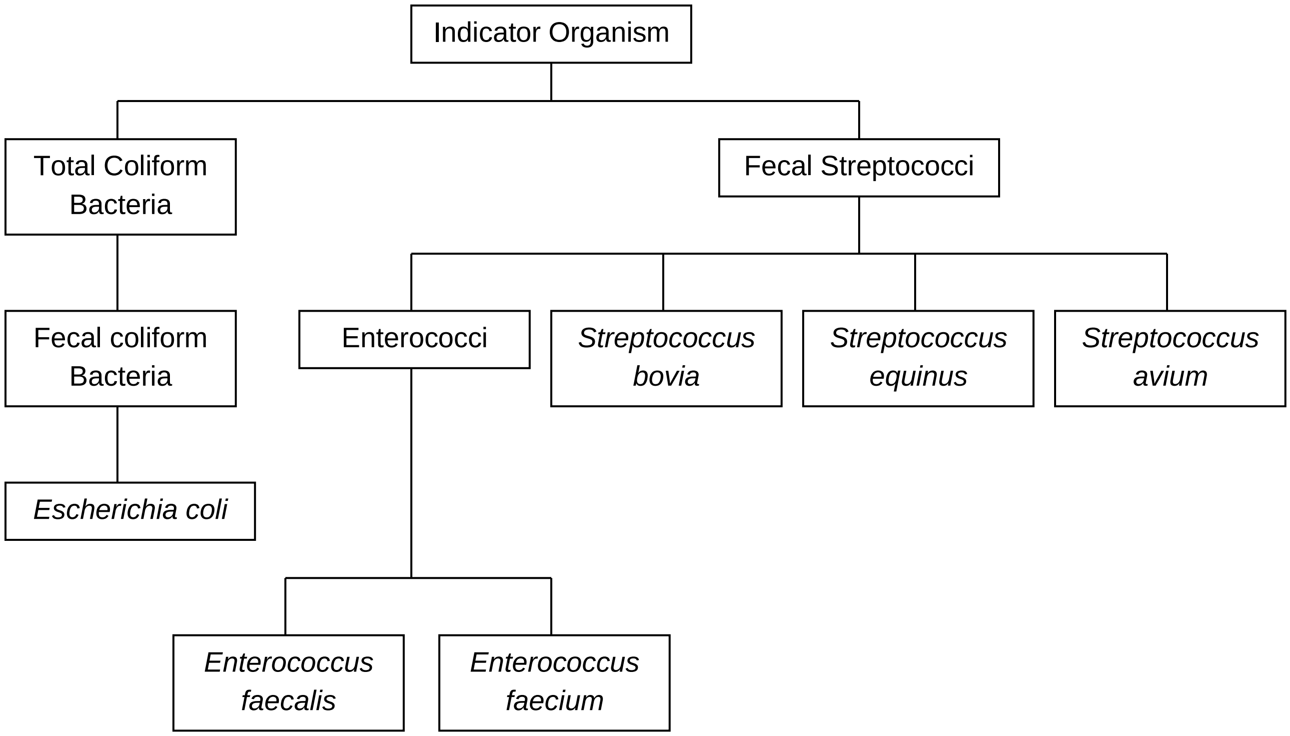


Figure 1-3 Relationships Among Indicator Organisms (US EPA 2001).

The Boston Harbor watershed pathogen TMDLs have been developed using Fecal coliform as an indicator bacterium for shellfish areas and Enterococci for bathing in marine waters and generally *E. coli* for fresh waters (even though some of the data included in the TMDL are Fecal coliform). Any future changes in the Massachusetts pathogen water quality standard will apply to this TMDL at the time of the standard change. Massachusetts believes that the magnitude of indicator bacteria loading reductions outlined in this TMDL will be both necessary and sufficient to attain present WQS and any future modifications to the WQS for pathogens.

Consistent with Section 303(d) of the CWA, the MassDEP has chosen to complete pathogen TMDLs for all waterbodies in the Boston Harbor watershed at this time, regardless of current impairment status (i.e., for all waterbody categories in the *2014 Integrated List*). MassDEP believes a comprehensive management approach carried out by all watershed communities is needed to address the ubiquitous nature of pathogen sources present in the Boston Harbor watershed. Watershed-wide implementation is needed to meet WQS and restore designated uses in impaired segments while providing protection of desirable water quality in waters that are not currently impaired or not assessed.

1.2. Comprehensive Watershed-based Approach to TMDL Development

As discussed below, this TMDL applies to the 33 pathogen impaired segments of the Boston Harbor watershed that are currently listed on the CWA § 303(d) list of impaired waters. MassDEP recommends however, 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).

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. The waste load and/or load allocation for each source and designated use would be the same as specified herein. Therefore, the pollution prevention TMDLs would have identical waste load and load allocations based on the sources present and the designated use of the water body segment (see Table ES-4 or Table 7-1).

This Boston Harbor watershed TMDL may, in appropriate circumstances, also apply to segments that are listed for pathogen impairment in subsequent Massachusetts CWA § 303(d) Integrated List of Waters. For such segments, 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.

There are 61 waterbody segments assessed by the MassDEP in the Boston Harbor, Weymouth-Weir, and Mystic watersheds. Of the 61 segments, 19 are ponds not covered by this TMDL. Thirty-three river or estuarine segments are pathogen impaired, and are listed in Category 5 (i.e. require a TMDL) of the Massachusetts 2014 Integrated List of Waters (MassDEP 2015). Pathogen impairment has been documented by the MassDEP in previous reports, including the *Boston Harbor 2004-2008 Water Quality Assessment Reports* (MassDEP 2010a), resulting in the impairment determination. In this TMDL document, an overview of pathogen impairment is provided in Chapter 4 to illustrate the nature and extent of the pathogen impairment problem. Additional data, not collected by the MassDEP that are used to determine impairment status, are also provided in this TMDL to illustrate the pathogen problem. Since pathogen impairment has been previously established only a summary is provided herein.

The watershed-based approach that was applied to complete the Boston Harbor pathogen TMDL is straightforward. The approach is focused on identification of sources, source reduction, and implementation of appropriate management plans. Once identified, sources are required to meet applicable WQS for indicator bacteria or be eliminated. This approach does not include water quality analysis or other approaches designed to link ambient concentrations with source loadings. For pathogens and indicator bacteria, water quality analyses are generally resource intensive and provide results with large degrees of uncertainty. Rather, this approach focuses on sources and required load reductions, proceeding efficiently toward water quality restoration activities.

The implementation strategy for reducing indicator bacteria is an iterative process where data are gathered on an ongoing basis, sources are identified and eliminated if possible, and control measures including Best Management Practices (BMPs) are implemented, assessed and modified as needed. Measures to abate probable sources of waterborne pathogens include everything from public education, to improved stormwater management, to reducing the influence from inadequate and/or failing sanitary sewer infrastructure.

1.3. TMDL Report Format

This document contains the following sections:

- (Section 2) Watershed Description – provides watershed specific information
- (Section 3) Water Quality Standards – provides a summary of current Massachusetts WQS as they relate to indicator bacteria
- (Section 4) Problem Assessment – provides an overview of indicator bacteria measurements collected in the Boston Harbor watershed
- (Section 5) Identification of Sources – identifies and discusses potential sources of waterborne pathogens within the Boston Harbor watershed.
- (Section 6) Prioritization and Known Sources – identifies and discusses specific sources of waterborne pathogens and assigns pollution priorities to specific segments.
- (Section 7) TMDL Development – specifies required TMDL development components including:
    - Definitions and Equation
    - Loading Capacity
    - Load and Waste Load Allocations
    - Margin of Safety
    - Seasonal Variability
- (Section 8) Implementation Plan– describes specific implementation activities designed to remove pathogen impairment. This section, the companion document "*Mitigation Measures to Address Pathogen Pollution in Surface Water: A TMDL Implementation Guidance Manual for Massachusetts*", ENSR 2005,) and the interactive web site, Massachusetts Clean Water Toolkit, http://prj.geosyntec.com/npsmanual/default.aspx. should be used together to support implementing management actions.
- (Section 9) Monitoring Plan– describes recommended monitoring activities
- (Section 10) Reasonable Assurances– describes reasonable assurances the TMDL will be implemented
- (Section 11) Public Participation– describes the public participation process
- (Section 12) References

2.0 Boston Harbor Watershed Description

The Boston Harbor Watershed, encompassing 293 square miles of land area, including all or part of 45 municipalities, as well as downtown Boston, is located in and around historic Boston Harbor. The watershed includes the Mystic River Watershed to the north and the Neponset, Weymouth and Weir River Watersheds to the south. This report includes information regarding each of these sub-basins with the exception of the Neponset River sub-basin. MassDEP prepared a TMDL for the Neponset River sub-basin in 2002 with an addendum in 2012 (MassDEP 2002c, MassDEP 2012a). The Boston Harbor Watershed, without the Neponset River Watershed, includes approximately 176 square miles.

Land use within the Boston Harbor, Weymouth-Weir, and Mystic watersheds is largely comprised of highly urbanized communities with landuse approximately 65% developed (i.e., residential, commercial/industry, etc.) and approximately 36% undeveloped land (i.e., open space, water, wetlands, etc.), Table 2-1; Figure 2-1 (MassGIS 2015). Surface waters in the watershed are commonly used for primary and secondary contact recreation (swimming and boating) and habitat for aquatic life. As of the date of the report, shellfishing is largely prohibited in the watershed because of management closures or poor water quality.

The Department of Conservation and Recreation (DCR) manages several beaches within these watersheds. Figure 2-2 shows the marine swimming beach locations in this watershed. DCR collects bacteriological water quality data and maintains a "Beaches Water Quality Hotline" for daily updates on water quality at the beaches they manage. The locations of the sampling points may be found at: http://www.mwra.state.ma.us/harbor/html/bhbeaches.htm. Detailed information regarding water quality at swimming beaches (both fresh and marine waters) can be obtained from the beach quality annual reports available for download at the Massachusetts Department of Public Health (DPH) website: mass.digitalhealthdepartment.com/public_21/index.cfm.

MassDEP completed a report on DCR state property beaches for the five year period of 2008 through 2012. This report included 18 marine bathing beaches in the metropolitan Boston-area (MassDEP Undated). Eight of these beaches had precautionary rainfall posting procedures in place in 2012, whereby beaches are posted if specific rainfall thresholds are exceeded. These procedures were introduced by DCR because at certain urban beaches, the previous day's rainfall volume was identified as a better predictor of poor water quality than using only the prior day's enterococci counts. This procedure helps protect the public from potentially elevated bacteria levels due to stormwater runoff. Fifteen of the 18 beaches in metropolitan Boston were reported as receiving >/=90% overall safety scores during the 2008-2012 time frame. The yearly overall safety score was determined based on the percentage of samples that met the single sample maximum numeric water criteria for bacteria.

All offshore areas in this watershed are protected against the disposal of treated or untreated sewage from vessels (i.e., No Discharge Areas; see Figure 2-3).

It should be noted that all waterbodies are influenced by seasonal variations in flow and temperature and the tidal cycles in the estuaries. All these variations will directly impact the extent to which these waterbodies are impaired.

Table 2-1 Boston Harbor, Weymouth-Weir, and Mystic Watersheds Land Use, 2005

Land Use Category	**% of Total Watershed Area**
Pasture, Open Land, Crop Land	2.2
Woody Perennial; Forest	21.4
Wetland; Salt Wetland	7.5
Water, Water Based Recreation	4.4
Total of General Undeveloped	**35.5**
Recreation; Spectator and Participation	3.2
Low, Medium, and High Residential	39.9
Mining, Commercial, Industrial, Urban Public, Waste Disposal	21.4
Total of General Developed	**64.5**

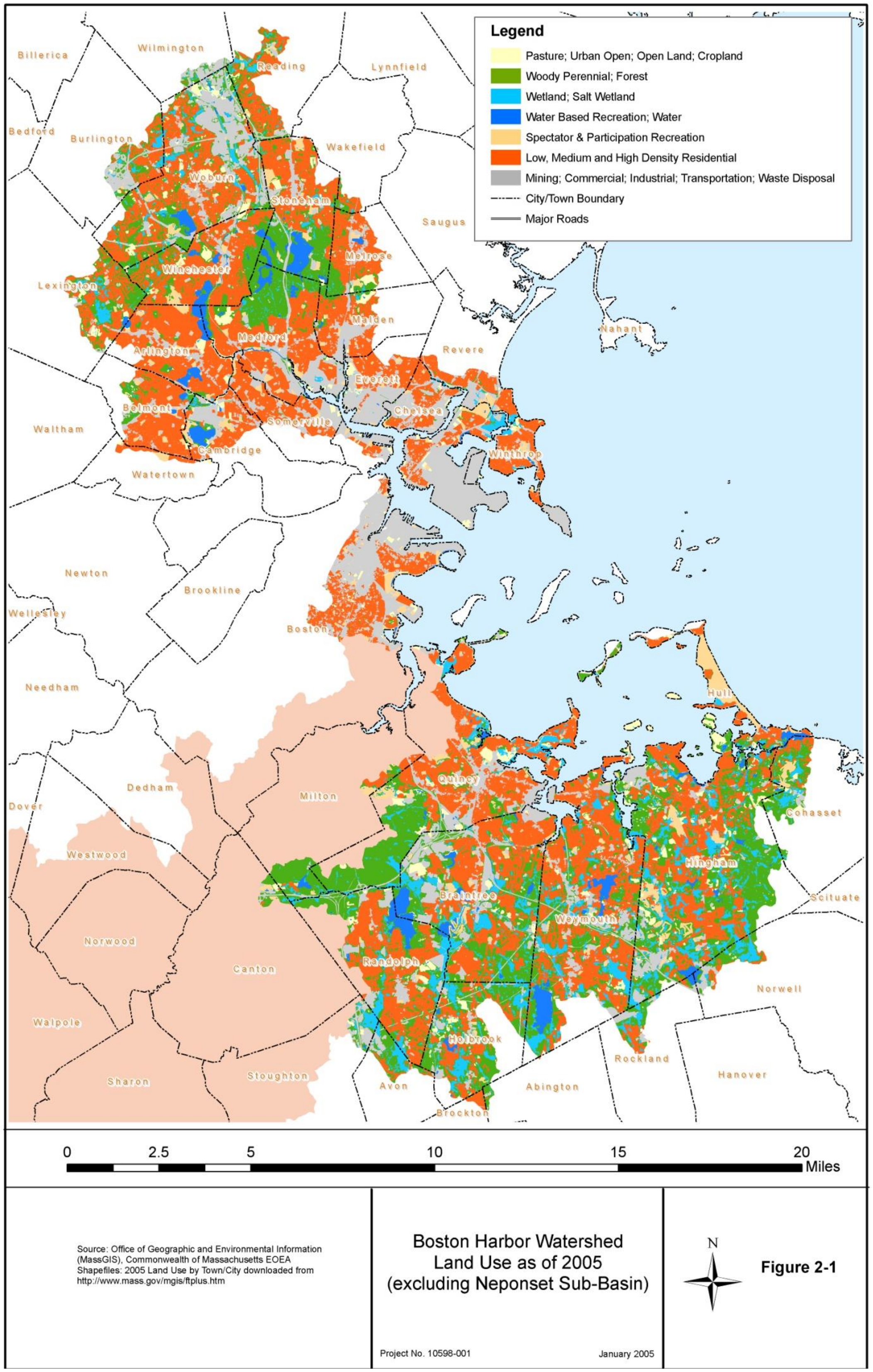


Figure 2-1 Boston Harbor, Weymouth-Weir, Mystic Watersheds Land Use in 2005.

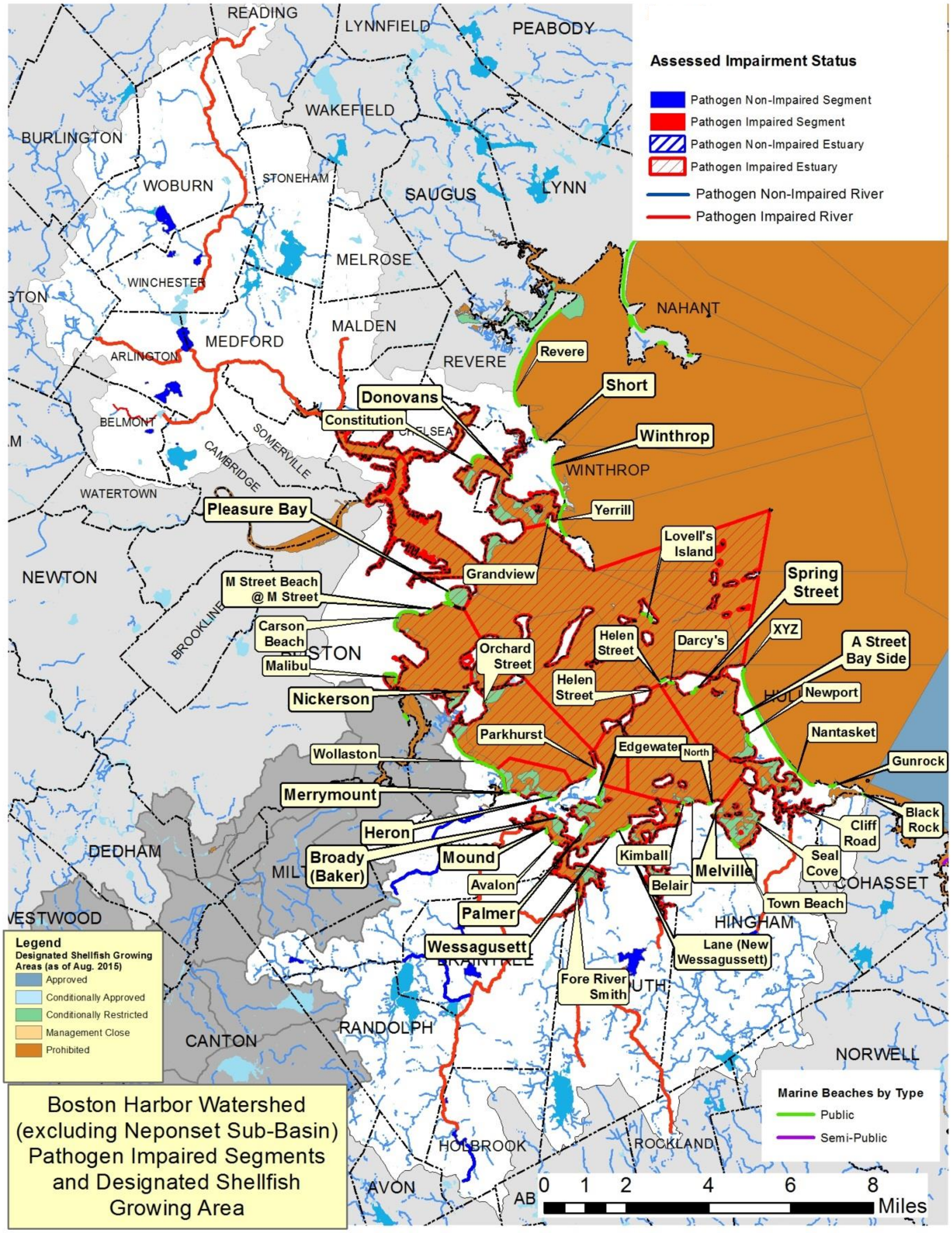


Figure 2-2 Boston Harbor Watershed Marine Beach Locations, Designated Shellfish Growing Areas and Pathogen Impaired Segments (MassDEP 2015).

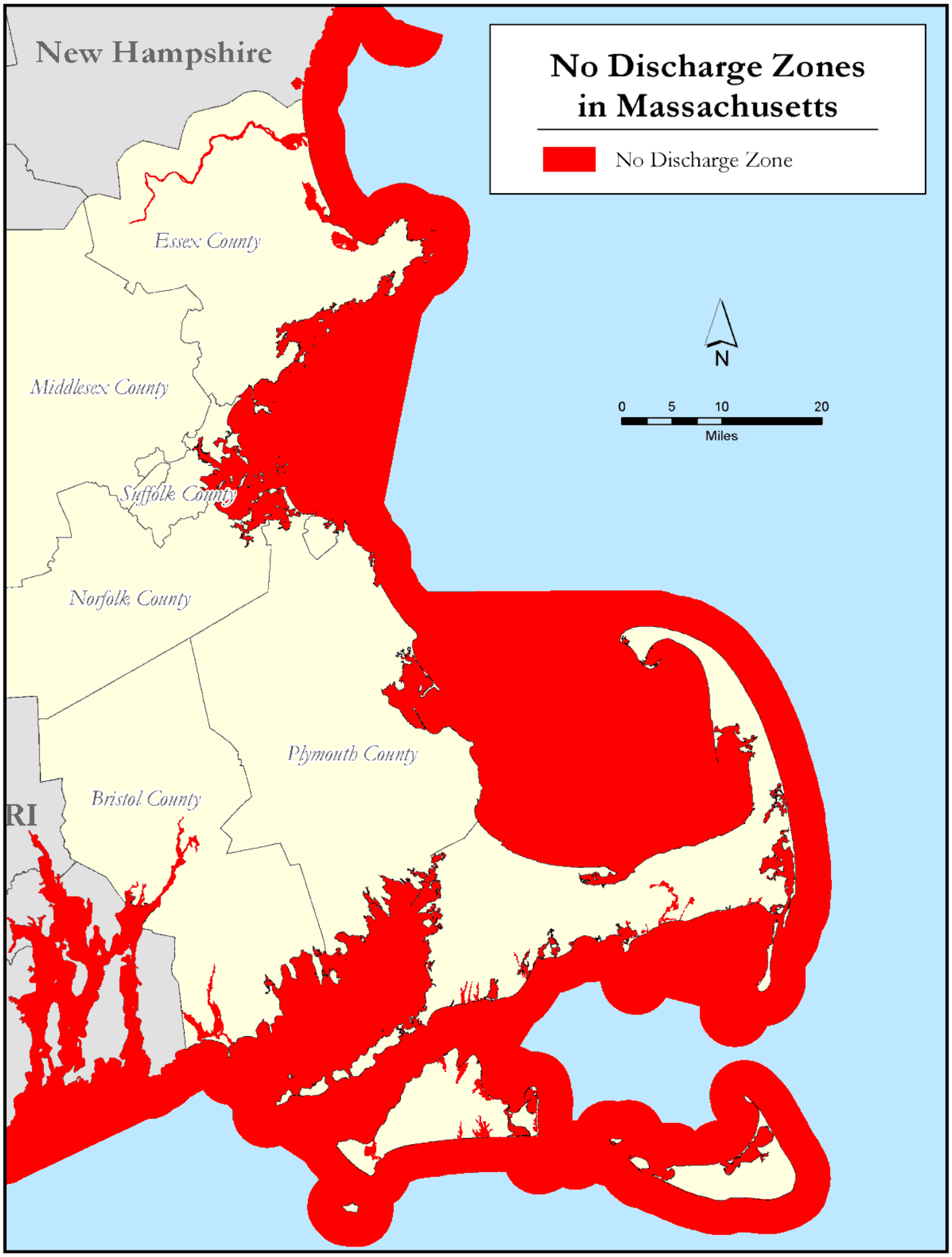


Figure 2-3 No Discharge Zones in Massachusetts (DMF 2015c).

2.1. Boston Harbor Proper Sub-basin and Land Use

The Boston Harbor Proper sub-basin includes the shoreline areas of Boston, Quincy, Hull, and Chelsea and the watershed communities of Winthrop, Hingham, and Weymouth. The Harbor Islands are also included in this sub-basin. The sub-basin extends south from the Chelsea River, east from the Charles River Dam, north from Hingham Bay, and east from the confluence of the Neponset River with Dorchester Bay to a line connecting the Boston Lighthouse to Deer Island in Boston and Point Allerton in Hull. The harbor is often dredged to maintain access to the Inner Harbor for deep draft vessels. More than 2,200 acres of Boston Harbor has been filled to expand Logan Airport. More than one million cubic yards of clays produced from the construction of the Ted Williams Tunnel have been disposed of in the outer harbor. Excavated materials from the Central Artery have been disposed of on Spectacle Island. The Boston Harbor Proper sub-basin is highly urbanized (Table 2-2; Figure 2-1). The Boston Harbor Proper sub-basin waters are commonly used for primary and secondary contact recreation (swimming and boating), habitat for aquatic life, and shellfishing.

2.2. Weir and Weymouth Rivers Sub-basin and Land Use

The Weymouth and Weir Rivers sub-basin lies south of Boston Harbor. The following sixteen communities lie within or partially within the areas drained by the Weymouth and Weir Rivers: Abington, Avon, Braintree, Brockton, Canton, Cohasset, Hingham, Holbrook, Hull, Milton, Norwell, Quincy, Randolph, Rockland, Stoughton, and Weymouth.

Five river systems make up this watershed: Furnace Brook, Town River, Weymouth Fore River, Weymouth Back River, and Weir River. Furnace Brook flows 2.7 miles northeast to Quincy Bay and the other rivers generally flow northeast to Hingham Bay. Town Brook originates in the Blue Hills and flows 3.2 miles from the Old Quincy Reservoir through downtown Quincy to the Town River. Town River flows into Town River Bay, which joins with the Weymouth Fore River before flowing into Hingham Bay. The Weymouth Fore River System originates at Lake Holbrook and flows for 4.0 miles as the Cochato River. When Farm River joins Cochato River, they form the Monatiquot River. The Monatiquot River flows north then east for a total of 4.3 miles before it becomes a tidal estuary and is considered the Weymouth Fore River. The Weymouth Back River originates as the Old Swamp River in Rockland. The river flows to the southern shore of Whitmans Pond in Weymouth. The Weymouth Back River flows from the outlet of Whitmans Pond to the Weymouth Back River estuary. The Weir River is formed at the confluence of Crooked Meadow River and Fulling Mill Brook. The river flows 2.8 miles to its tidal portion. The Weir River System includes the Plymouth, Cooked Meadow, and Weir Rivers. The Weymouth and Weir Rivers sub-basin waters are commonly used for primary and secondary contact recreation (swimming and boating), fishing, habitat for aquatic life, and shellfishing.

2.3. Mystic River Sub-basin and Land Use

The Mystic River watershed includes all or part of the following cities and towns within the northern section of the Greater Boston area: Arlington, Belmont, Boston, Burlington, Cambridge, Charlestown, Chelsea, Everett, Lexington, Malden, Medford, Melrose, Somerville, Reading, Revere, Wakefield, Wilmington, Winchester, Winthrop, and Woburn. The Mystic River is fed by the Aberjona River and Hall's Brook. Horn Pond Brook, Mill Brook, and Alewife Brook are also tributaries to the Mystic River farther along its course. The Amelia Earhart Dam restricts the Mystic's flow just downstream of its confluence with the Malden River. The Chelsea River is the last river to flow into the Mystic River before it discharges into Boston Inner Harbor. The Mystic River and tributaries are commonly used for primary and secondary contact recreation (swimming and boating), fishing, habitat for aquatic life, and shellfishing.

3.0 Water Quality Standards

The Surface Water Quality Standards (WQS) for the Commonwealth of Massachusetts establish chemical, physical, and biological standards for the restoration and maintenance of the most sensitive uses (MassDEP 2007). The WQS limit the discharge of pollutants to surface waters for the protection of existing uses and attainment of designated uses in downstream and adjacent segments.

The Boston Harbor Watershed contains waterbodies classified as Class A (tributaries), B, SA, and SB, SB/CSO and Class B CSO Variance. According to the Massachusetts WQS these waters should be suitable for the following uses: (1) habitat for fish, other aquatic life, wildlife, (2) primary and secondary contact recreation, (3) shellfish harvesting in approved areas, and (4) should have consistently good aesthetic value (A and SA should be excellent). The pathogen impairments (exceedences of Fecal coliform, Enterococci, and *E. coli* bacteria criteria) associated with the waterbodies of interest in this report affect primary contact recreation and shellfishing uses. There are a number of Combined Sewer Overflow (CSO) receiving waters within the Boston Harbor Sub-watershed. Because the WQS were in transition during the development of statewide pathogen TMDLs, and were formally changed after the draft reports were produced, the new bacteria indicator standards are presented in Table ES-4 and 7-1, and can be found at : http://www.mass.gov/eea/agencies/massdep/water/regulations/314-cmr-4-00-mass-surface-water-quality-standards.html

Fecal coliform, Enterococci, and *E. coli* bacteria are found in the intestinal tract of warm-blooded animals, soil, water, and certain food and wood processing wastes. Although they are generally not harmful themselves, they indicate the possible presence of pathogenic (disease-causing) bacteria, viruses, and protozoans that also live in human and animal digestive systems. These bacteria are often used as indicator bacteria since it is expensive and sometimes difficult to test for the presence of individual pathogenic organisms.

Pathogens can significantly impact humans through ingestion of, and contact with recreational waters, ingestion of drinking water, and consumption of filter-feeding shellfish. In addition to contact recreation, excessive pathogen numbers impact potable water supplies. The amount of treatment (i.e., disinfection) required to produce potable water increases with increased pathogen contamination. Such treatment may cause the generation of disinfection by-products that are also harmful to humans. Further detail on pathogen impacts can be accessed at the following EPA websites:

- Water Quality Criteria: Microbial (Pathogen) https://www.epa.gov/wqc/microbial-pathogenrecreational-water-quality-criteria
- Advisories and Technical Resources for Fish and Shellfish Consumption http://www.epa.gov/waterscience/fish/
- Swimming Advisories: http://www.epa.gov/waterscience/beaches/seasons/

Massachusetts revised its freshwater WQS in 2007 by replacing fecal coliform with *E. coli* and *Enterococci* as the regulated indicator bacteria in freshwater systems, as recommended by the EPA in the "Ambient Water Quality Criteria for Bacteria – 1986" and "2012 Recreational Water Quality Criteria" documents (US EPA 1986 and US EPA 2012). The Massachusetts Department of Public Health had previously revised regulations that protect public beaches as discussed below. Up until January of 2007 Massachusetts used fecal coliform as the indicator organism for all waters except for marine bathing beaches, where the Federal BEACH Act requires the use of *Enterococci*. Massachusetts adopted *E. coli* and *Enterococci* for all fresh waters and Enterococci for all marine waters, including non-bathing marine beaches. Fecal coliform remains the indicator organism for shellfishing areas.

Some of the threshold values provided in this TMDL are those established by the MassDEP in the WQS and are:

- **Class A** -Unfiltered water supply intakes – either fecal coliform shall not exceed 20 colony forming units, or cfu per 100 ml in all samples taken in any six month or total coliform shall not exceed 100 cfu/100 ml in 90% of the samples in any six month period.
- **Class SA** -Shellfishing Approved- geometric mean for Fecal coliform shall not exceed 14 cfu/100 mL, and 10% of the samples shall not exceed 28 cfu/100 mL;
- **Class SB** -Shellfishing Approved (but not necessarily open)- geometric mean for Fecal coliform shall not exceed 88 cfu/100 mL, and 10% of samples shall not exceed 260 cfu/100 mL;
- **Class SA** and **SB** Beaches and non- designated shellfish areas- geometric mean for Enterococci shall not exceed 35 cfu/100 mL, and a single sample shall not exceed 104 cfu/ 100 mL for the purposes of beach closure.
- **Class B** –Beaches - geometric average for *E. coli* shall not exceed 126 cfu/100 mL, and a single sample shall not exceed 235 cfu/100 mL.
- **Class SB/CSO** have to goal of meeting the criteria for Class SB but allow for limited CSO discharges as set forth in the approved Long-Term CSO Control Plan reference in the table below.
- **Class B CSO Variance** have the goal of meeting the criteria for Class B but allow for limited CSO discharges as set forth in the Long-Term CSO Control Plan reference in the table below.

Segments where permits and plans are in place to address CSO discharges to Class SB/CSO and Class B CSO Variance receiving water are summarized below.

Name, Class[1]	Segment
Boston Inner Harbor, SB/CSO	MA71-02
Chelsea River, SB/CSO	MA71-06
Mystic River, SB/CSO	MA71-03
Alewife Brook, Class B CSO Variance	MA71-04
Mystic River, Class B CSO Variance	MA71-03

[1] For specific CSO and CSO Variance plan implementation, see MWRA 2006.

Shellfish growing areas are classified by the Massachusetts Division of Marine Fisheries (DMF 2015a). The classification system as provided below is a summary of the DMF classification included in the MassDEP Consolidated Assessment and Listing Methodology, or CALM (MassDEP 2016. Figure 2-2 provides designated shellfish growing areas status as of July 2015.

Approved "...open for harvest of shellfish for direct human consumption subject to local rules and regulations..." An approved area is open all the time and closes only due to hurricanes or other major coastwide events."

Conditionally Approved "...subject to intermittent microbiological pollution..." During the time the area is open, it is "...for harvest of shellfish for direct human consumption subject to local rules and regulations…" A conditionally approved area is closed some of the time due to runoff from rainfall or seasonally poor water quality. When open, shellfish harvested are treated as from an approved area."

Restricted "…area contains a "limited degree of pollution." It is open for "harvest of shellfish with depuration subject to local rules and state regulations" or for the relay of shellfish. A restricted area is used by DMF for the relay of shellfish to a less contaminated area."

Conditionally Restricted "...subject to intermittent microbiological pollution..." During the time area is restricted, it is only open for "the harvest of shellfish with depuration subject to local rules and state regulations." A conditionally restricted area is closed some of the time due to runoff from rainfall or seasonally poor water quality. When open, only soft shell clams may be harvested by specially licensed diggers (Master/Subordinate Diggers) and transported to the DMF Shellfish Purification Plant for depuration (purification)."

Prohibited "Closed for harvest of shellfish."

In general, shellfish harvesting use is supported (i.e., non-impaired) when shellfish harvested from approved open shellfish areas are suitable for consumption without depuration and shellfish harvested from restricted shellfish areas are suitable for consumption with depuration. For an expanded discussion on the relationship between the DMF shellfish growing areas classification and the MassDEP designated use support status, please see any of the completed MassDEP Water Quality Assessment Reports available on-line (for example the "*Boston Harbor Watershed 2004-2008 Water Quality Assessment Report*").

In addition to the WQS, the Massachusetts Department of Public Health (MADPH) has established minimum standards for bathing beaches (105 CMR 445.000) under the State Sanitary Code, Chapter VII http://mass.digitalhealthdepartment.com/public_21/index.cfm. These standards have been adopted by the MassDEP as state surface WQS for fresh water and will apply to this TMDL. The MA DPH bathing beach standards are generally the same as those which were recommended in the US EPA's "Ambient Water Quality Criteria for Bacteria – 1986" (EPA 1986) and the 2012 Recreational Water Quality Criteria (EPA 2012). The EPA recommended the use of Enterococci as the indicator bacterium for marine recreational waters and Enterococci or *E. coli* for fresh waters. As such, the following MADPH standards have been established for bathing beaches in Massachusetts:

Marine Waters - No single Enterococci sample shall exceed 104 colonies per 100 mL and the geometric mean of the most recent five Enterococci levels within the same bathing season shall not exceed 35 colonies per 100 mL.

Freshwaters - No single *E. coli* sample shall exceed 235 colonies per 100 mL and the geometric mean of the most recent five *E. coli* samples within the same bathing season shall not exceed 126 colonies per 100 mL; or (2) No single Enterococci sample shall exceed 61 colonies per 100 mL and the geometric mean of the most recent five Enterococci samples within the same bathing season shall not exceed 33 colonies per 100 mL.

The Federal BEACH Act of 2000 established a Federal standard for marine beaches. These standards are essentially the same as the MADPH marine beach standard. The Federal BEACH Act and MADPH standards can be accessed at:
https://www.epa.gov/beach-tech/beach-act-2000, and
http://www.mass.gov/eohhs/docs/dph/regs/105cmr445.pdf, respectively.

Figure 2-3 provides the location of marine bathing beaches, where the MADPH Marine Waters and the Federal BEACH Act standards would apply. A list of beaches, both fresh and marine, by community with indicator bacteria data can be found in the annual reports on the testing of public and semi-public beaches provided by the MADPH. These reports are available for download from the MADPH website located at: https://www.mass.gov/orgs/department-of-public-health.

4.0 Problem Assessment

Pathogen impairment has been documented at numerous locations throughout the Boston Harbor watershed, as shown in Figure 1-2. Excessive concentrations of indicator bacteria (e.g., Fecal coliform, Enterococci, *E. coli* etc.) can indicate the presence of sewage contamination and possible presence of pathogenic organisms. The amount of indicator bacteria and potential pathogens entering waterbodies is dependent on several factors including watershed characteristics and meteorological conditions. Indicator bacteria levels generally increase with increasing development activities, including increased impervious cover, illicit sewer connections, and failed septic systems.

Indicator bacteria levels also tend to increase with wet weather conditions as storm sewer systems overflow and/or stormwater runoff carries fecal matter that has accumulated to the river via overland flow and stormwater conduits. In some cases, dry weather bacteria concentrations can be higher when there is a constant source that becomes diluted during periods of precipitation, such as with illicit connections. The magnitude of these relationships is variable, however, and can be substantially different temporally and spatially within each watershed.

Tables 4-1 and 4-2 provide ranges of Fecal coliform concentrations in stormwater associated with various land use types. Pristine areas are observed to have low indicator bacteria levels and residential areas are observed to have elevated indicator bacteria levels. Development activity generally leads to decreased water quality (e.g., pathogen impairment) in a watershed. Development-related watershed modification includes increased impervious surface area which can (EPA 1997):

- Increase flow volume,
- Increase peak flow,
- Increase peak flow duration,
- Increase stream temperature,
- Decrease base flow, and
- Change sediment loading rates.

Many of these impacts associated with increased impervious surface area also result in changes in pathogen loading (e.g., increased sediment loading can result in increased pathogen loading). In addition to increased impervious surface impacts, increased human and pet densities in developed areas increase potential fecal contamination. Furthermore, stormwater drainage systems and associated stormwater culverts and outfall pipes often result in the channelization of streams which leads to less attenuation of pathogen pollution.

Table 4-1 Wachusett Reservoir Stormwater Sampling (as reported in MassDEP 2002c) original data provided in MDC Wachusett Stormwater Study (June 1997).

Land Use Category	Fecal Coliform Bacteria[1] (CFU / 100 mL)
Agriculture, Storm 1	110 - 21,200
Agriculture, Storm 2	200 - 56,400
"Pristine" (not developed, forest), Storm 1	0 - 51
"Pristine" (not developed, forest), Storm 2	8 - 766
High Density Residential (not sewered, on septic systems), Storm 1	30 - 29,600
High Density Residential (not sewered, on septic systems), Storm 2	430 - 122,000

[1] Grab sample collected for four storms between September 15, 1999 and June 7, 2000

Table 4-2 Lower Charles River Basin Stormwater Event Mean Bacteria Concentrations (data summarized from USGS 2002)[1].

Land Use Category	Fecal coliform (CFU/100 mL)	Enterococci Bacteria (CFU/100 mL)	Number of Events
Single Family Residential	2,800 – 94,000	5,500 – 87,000	8
Multifamily Residential	2,200 – 31,000	3,200 – 49,000	8
Commercial	680 – 28,000	2,100 – 35,000	8

[1] An Event Mean Concentration (EMC) is the concentration of a flow proportioned sample throughout a storm event. These samples are commonly collected using an automated sampler which can proportion sample aliquots based on flow.

There are 42 river and estuarine segments identified in the Boston Harbor watershed (including Weymouth-Weir, and Mystic) as defined by the MassDEP in the *2014 Integrated List* (MassDEP 2015). Table 4-3 provides summary statistics of assessed and impaired waters within the Boston Harbor watershed. In total, 33 segments contain indicator bacteria concentrations in excess of the Massachusetts WQS for Class A, SA, B, or SB waterbodies (314 CMR 4.05), the MADPH standard for bathing beaches, and/or the BEACH Act. In addition, as described in Section 3 the standards include provisions to address bacteria pollution in CSO receiving waters (Class SB/CSO and Class B CSO variance). Massachusetts has included all waters known not to be meeting water quality standards for bacteria in Boston Harbor on its 2014 Section 303(d) list. Under its current listing approach, Massachusetts keeps a waterbody on its impaired waters list until a new assessment reveals that the waterbody is meeting all applicable waters quality standards or when the original basis for listing is determined to be flawed. The basis for impairment listings is provided in the *2014 Integrated List* (MassDEP 2015). The listings that occurred in prior integrated listing cycles has been documented in water quality assessment reports

(MassDEP 2002a, MassDEP 2010a, Mass2010b, MassDEP 2010c). The methods used to develop listing decisions are described in the Comprehensive Assessment and Listing Methodology (MassDEP 2016) http://www.mass.gov/eea/docs/dep/water/resources/07v5/2012calm.pdf.

A list of pathogen impaired segments requiring TMDLs are provided in Tables 4-4 through 4-6. An overview of the Boston Harbor watershed pathogen impairments is provided in this section to illustrate the nature and extent of the impairment. Since pathogen impairment has been previously established and documented, it is not necessary to provide detailed documentation of pathogen impairment herein. Data were reviewed and are summarized by segment below for illustrative purposes. Segments are listed and discussed in hydrologic order (upstream to downstream) in the following sections. Additional details regarding each impaired segment including water withdrawals, discharges, use assessments and recommendations to meet use criteria are provided in the MassDEP WQA reports.

This TMDL was based on the current WQS using Fecal coliform as an indicator for shellfish areas, and *E. coli* for fresh and Enterococci for either salt or fresh water bathing, respectively. MassDEP has incorporated *E. coli* and Enterococci as indicator organisms for all waters other than shellfishing and potable water intake areas. Not all data presented herein were used to determine impairment listing due to a variety of reasons (including data quality assurance and quality control).

Table 4-3 Assessed and Pathogen Impaired Segment Statistics for the Boston Harbor Watershed (MassDEP 2015).

	Boston Harbor (Proper)	Boston Harbor: Weymouth & Weir	Boston Harbor: Mystic	Total Boston Harbor (excluding Neponset River sub-basin)
ESTUARY (COUNT)	10	5	5	20
total pathogen impaired segments by basin (COUNT)	10	5	4	19
% impaired	100.00	100.00	80.00	95.00
ESTUARY (mi^2)	40.65	5.56	1.018	47.228
total pathogen impaired segments by basin (mi^2)	40.65	5.56	1.01	47.22
% impaired	100.00	100.00	99.21	99.98
RIVER (COUNT)	0	13	9	22
total pathogen impaired segments by basin (COUNT)	0	7	7	14
% impaired	0.00	53.85	77.78	63.64
RIVER (mi)	0	38.2	27.6	65.8
total pathogen impaired segments by basin (mi)	0	23.7	24	47.7
% impaired	0.00	62.04	86.96	72.49

Table 4-4 Boston Harbor Proper Sub-basin Pathogen Impaired Segments Requiring TMDLs (MassDEP 2015).

Segment ID	Segment Name Waterbody Type	Segment Type	Segment Size[1]	Segment Description
MA70-10	Winthrop Bay, Class SB	Estuary	1.65 mi^2	From the tidal flats at Coleridge Street, Boston (East Boston) to a line between Logan International Airport and Point Shirley, East Boston/Winthrop.
MA70-02	Boston Inner Harbor, Class SB/CSO[2]	Estuary	2.56 mi^2	From the Mystic and Chelsea rivers, Chelsea/Boston, to the line between Governors Island and Fort Independence, Boston (East Boston), including Fort Point, Reserved, and Little Mystic Channels).
MA70-11	Pleasure Bay, Class SB	Estuary	0.22 mi^2	A semi-enclosed bay, the flow restricted through two channels between Castle and Head islands, Boston.
MA70-03	Dorchester Bay, Class SB	Estuary	3.46 mi^2	From the mouth of the Neponset River, Boston/Quincy to the line between Head Island and the north side of Thompson Island and the line between the south point of Thompson Island, Boston and Chapel Rocks, Quincy.
MA70-04	Quincy Bay, Class SA	Estuary	1.52 mi^2	From Bromfield Street near the Wollaston Yacht Club, Quincy, northeast to N42 17.3 W71 00.1, then southeast to Houghs Neck near Sea Street and Peterson Road (formerly referred to as the "Willows") Quincy.
MA70-05	Quincy Bay, Class SB	Estuary	4.41 mi^2	Quincy Bay, north of the class SA waters (segment MA70-04), Quincy to the line between Moon Head and Nut Island, Quincy.
MA70-06	Hingham Bay, Class SB	Estuary	0.96 mi^2	The area north of the mouth of the Weymouth Fore River extending on the west along the line from Prince Head just east of Pig Rock to the mouth of the Weymouth Fore River (midway between Lower Neck and Manot Beach), Quincy.
MA70-07	Hingham Bay, Class SB	Estuary	4.8 mi^2	The area defined between Peddocks Island and Windmill Point; from Windmill Point southeast to Bumkin Island; from Bumkin Island southeast to Sunset Point; from Sunset Point across the mouth of the Weir River to Worlds End; from Worlds End across the mouth of Hingham Harbor to Crow Point; from Beach Lane, Hingham across the mouth of the Weymouth Back River to Lower Neck; and from Lower Neck midway across the mouth of the Weymouth Fore River.
MA70-09	Hull Bay, Class SB	Estuary	2.48 mi^2	The area defined east of a line from Windmill Point, Hull to Bumpkin Island, Hingham and from Bumpkin Island to Sunset Point, Hull.
MA70-01	Boston Harbor, Class SB	Estuary	18.59 mi^2	The area defined by a line from the southerly tip of Deer Island to Boston Lighthouse on Little Brewster Island, then south to Point Allerton; across Hull and West guts; across the mouths of Quincy and Dorchester Bays, Boston Inner Harbor and Winthrop Bay (including Presidents Roads and Nantasket Roads).

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

[2] The remaining CSO discharges in this segment are permitted under the SB/CSO designation, subject to the limitations on CSO activations and volumes in the final Long-Term CSO Control Plan.

Table 4-5 Weir & Weymouth Sub-basin Pathogen Impaired Segments (MassDEP 2015).

Segment ID	Segment Name Waterbody Type	Segment Type	Segment Size[1]	Segment Description
MA74-06	Cochato River, Class B	River	4.1 mi	Outlet Lake Holbrook, Holbrook to confluence with Farm and Monatiquot Rivers, Braintree (through former pond segment Ice House Pond MA74028). (SARIS note: the upper portion of this segment is comprised of three surface waters: unnamed tributary from the outlet of Lake Holbrook, portion of Mary Lee Brook, portion of Glovers Brook).
MA74-08	Monatiquot River, Class B	River	4.4 mi	Headwaters at confluence of Cochato and Farm Rivers, Braintree to confluence with Weymouth Fore River at Commercial Street, Braintree.
MA74-09	Town Brook, Class B/SB	River	3.5 mi	Outlet Old Quincy Reservoir, Braintree to confluence with Town River Bay north of Route 3A, Quincy (includes "The Canal"/Town River) (portions culverted underground).
MA74-18	Hingham Harbor, Class SA	Estuary	1.12 mi^2	Hingham Harbor, inside a line from Crows Point to Worlds End, Hingham (formerly reported as MA70-08).
MA74-15	Town River Bay, Class SA	Estuary	0.46 mi^2	From the headwaters at the Route 3A bridge, Quincy to the mouth at the Weymouth Fore River between Shipyard and Germantown Points, Quincy.
MA74-14	Weymouth Fore River, Class B/SB	River	2.29 mi	Commercial Street, Braintree to mouth (eastern point at Lower Neck, Weymouth and western point at Wall Street on Houghs Neck, Quincy.
MA74-03	Old Swamp River, Class A (PWS Trib, ORW)	River	5.2 mi	Headwaters, west of Route 18 and south of Randolph Street, Weymouth to inlet Whitmans Pond, Weymouth (portions culverted underground).
MA74-04	Mill River, Class A (PWS Trib.)	River	3.4 mi	Headwaters, west of Route 18 and south of Randolph Street, Weymouth to inlet Whitmans Pond, Weymouth (portions culverted underground).
MA74-05	Weymouth Back River, Class B (ORW)	River	0.4 mi	Outlet Elias Pond, Weymouth to the base of the fish ladder north of Commercial Street, Weymouth.
MA74-13	Weymouth Back River, Class SA	Estuary	0.86 mi^2	From the base of the fish ladder north of Commercial Street, Weymouth to mouth between Lower Neck to the west and Wompatuck Road, Hingham.
MA74-02	Weir River, Class B/SA	River	2.7 mi	Headwaters at confluence of Crooked Meadow River and Fulling Mill Brook, Hingham to Foundry Pond Outlet, Hingham (through former pond segment Foundry Pond MA74011).
MA74-11	Weir River, Class SA	River	0.83 mi	From Foundry Pond outlet, Hingham to mouth at Worlds End, Hingham and Nantasket Road near Beech Avenue, Hull (including unnamed tributary from outlet Straits Pond, Hingham/Hull).

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

Table 4-6 Mystic River Sub-basin Pathogen Impaired Segments[2] (MassDEP 2015).

Segment ID	Segment Name	Segment Type	Segment [1] Size	Segment Description
MA71-01	Aberjona River, Class B	River	9.1 mi.	Source just south of Birch Meadow Drive, Reading to inlet Upper Mystic Lake at Mystic Valley Parkway, Winchester (portion

Segment ID	Segment Name	Segment Type	Segment [1] Size	Segment Description
				culverted underground). (through former pond segments Judkins Pond MA71021 and Mill Pond MA71031).
MA71-04	Alewife Brook, Class B CSO Variance[2]	River	2.3 mi.	Outlet of Little Pond, Belmont to confluence with Mystic River, Arlington/Somerville (portion in Belmont and Cambridge identified as Little River with name changing to Alewife Brook at Arlington corporate boundary).
MA71-05	Malden River, Class B	River	2.3 mi.	Headwaters south of Exchange Street, Malden to confluence with Mystic River, Everett/Medford.
MA71-02	Mystic River, Class B** CSO Variance[2]	River	4.9 mi.	Outlet Lower Mystic Lake, Arlington/Medford to Amelia Earhart Dam, Somerville/Everett.
MA71-06	Chelsea River, Class SB/CSO[3]	Estuary	0.38 mi^2	From confluence with Mill Creek, Chelsea/Revere to confluence with Boston Inner Harbor, Chelsea/East Boston/Charlestown.
MA71-03	Mystic River, Class SB/CSO[3]	Estuary	0.49 mi^2	Amelia Earhart Dam, Somerville/Everett to confluence with Boston Inner Harbor, Chelsea/Charlestown (Includes Island End River).
MA71-07	Mill Brook, Class B	River	3.9 mi	Headwaters south of Massachusetts Avenue, Lexington to inlet of Lower Mystic Lake, Arlington (portions culverted underground).
MA71-08[4]	Mill Creek, Class SB	Estuary	0.02 mi^2	From Route 1, Chelsea/Revere to confluence with Chelsea River, Chelsea/Revere.
MA71-09[4]	Winn Brook, Class B	River	1.4 mi	Headwaters near Juniper Road and the Belmont Hill School, Belmont to confluence with Little Pond, Belmont (portions culverted underground).
MA71-14[4]	Belle Isle Inlet, Class SA	Estuary	0.12 mi^2	From Tidegate at Bennington Street, Boston/Revere to confluence with Winthrop Bay, Boston/Winthrop.
MA71-13[4]	Unnamed Tributary, Class B**	River	0.1 mi	Unnamed tributary locally known as 'Meetinghouse Brook', from emergence south of Route 16/east of Winthrop Street, Medford to confluence with the Mystic River, Medford. (brook not apparent on 1985 Boston North USGS quad – 2005 orthophotos used to delineate stream).

** may have salt influx

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

[2] Remaining CSO discharges are permitted under a modification of water quality standards, as analyses are conducted and progress is made to improve water quality.

[3] The remaining CSO discharges in this segment are permitted under the SB/CSO designation, subject to the limitations on CSO activations and volumes in the final Long-Term CSO Control Plan.

[4] New Pathogen Impaired Segments that were identified in the Integrated Report (2006 through 2016) after the public comment period for this TMDL, are included in the Boston Harbor Addendum, CN#157.2 that is in the process of being developed.

Data from the Massachusetts Division of Marine Fisheries (DMF) were used, in part, as the basis for pathogen impairment for many of the estuarine areas (Figure 1-2). Numerous samples have been collected throughout the Boston Harbor watershed by the DMF. DMF has a well-established and effective shellfish monitoring program, consistent with the National Shellfish Sanitation Program, that provides quality assured data for each shellfish growing area. Each growing area must have a complete sanitary survey every 12 years, a triennial evaluation every three years, and an annual review in order to maintain a shellfish harvesting classification with the exception of those areas already classified as Prohibited. Annual fecal coliform water quality monitoring includes identification of specific sources and assessment of effectiveness of controls and attainment of standards. DMF reports that "Each year water samples are collected by the DMF at 2,320 stations in 294 growing areas in Massachusetts's coastal waters at a minimum frequency of five times while open to harvesting" (DMF 2016). Designated Shellfish Growing Areas Status as of July 1, 2015 are shown on Figure 1-2 and 2-2.

Available bacteria data are summarized in the following section. The primary sources of data include but are not limited to DMF, CZM, MassDEP, the Massachusetts Water Resources Authority (MWRA), the Mystic River Watershed Association (MyRWA), and the Environmental Monitoring for Public Access and Community Tracking (EMPACT).

Note that while many of the data included here are for Fecal coliform, (the indicator of sanitary quality for shellfish areas) *E. coli* and Enterococci in fresh water and Enterococci in salt water are now the standards for swimming. Nevertheless, Fecal coliform remains a qualitative indicator of water quality.

The MADPH publishes annual reports on the testing of public and semi-public beaches for both marine and fresh waters and note where exceedances of water quality criteria result in beach closures. These reports are available for download from the MADPH website either at http://ma.healthinspections.us/public_21/.

4.1 Boston Harbor Proper Sub-basin

Winthrop Bay Segment MA70-10

This 1.65 square mile Class SB, segment extends from the tidal flats at Coleridge Street in East Boston to a line between Logan International Airport and Point Shirley, East Boston/Winthrop. There are several stormwater discharges in this segment.

- MassPort Authority and the Co-Permittees of Logan International Airport (MA0000787) have an individual stormwater permit for two major stormwater outfalls to this segment and numerous smaller runway outfalls, which discharge to this segment.
- Boston Water and Sewer Commission has a stormwater permit (separate storm drainage system) (MAS01000) for 2 major outfalls and 4 non-major outfalls. Winthrop has coverage under the Phase II National Pollutant Discharge Elimination System (NPDES) stormwater general permits (MAR041084) for their municipal separate storm sewer system (MS4).
- The Atlantis Marina is a vessel pump-out facility located within this segment.

DMF Designated Shellfish Growing Areas Status as of July 1, 2015: Conditionally Restricted for 0.61 square miles; Prohibited for 0.98 square miles (Figure 1-2) (DMF 2015a).

Primary Contact Recreational use is assessed as impaired due to the frequency of closures at Constitution Beach associated with elevated levels of Enterococci bacteria. Secondary Contact Recreation is listed as Support and Aesthetics is not assessed.

The MWRA collected bacteria data at Station #130, as part of their Combined Sewer Overflow (CSO) monitoring program between 2003 and 2014 (MassDEP 2002a). Results of this sampling are provided in Table 4-7. The MWRA also collected daily seasonal bacteria samples between 2008 and 2014 at three stations at Constitution Beach (Table 4-7) (MassDEP 2010a); (MWRA 2014a).

Table 4-7 MA70-10 Winthrop Bay Bacterial Water Quality Summary

Site Description	**Enterococcus (cfu/100 mL)** [1,2] Primary Contact Recreation = 35 cfu/100 ml Secondary Contact Recreation = 175 cfu/100 ml (Geometric mean of a minimum of 5 samples)			**Fecal coliform (cfu/100 mL)** [1] Threshold for restricted shellfishing is 14 cfu/100 ml without depuration and 88 cfu/100mL with.		
	Geometric mean	**Range**	**n**	**Geometric mean**	**Range**	**n**
Winthrop Harbor, green can #1 (MWRA site 130)						
2003 - 2007	1.6	0 - 140	206	1.8	0 - 510	202
2008 - 2009	3.3	0 - 1370	43	2.4	0 - 65	44
2010 - 2014	2.3	1 - 637	108	2.7	1 - 340	108
2008 - 2009	7.9	0 - 9210	477			
2010 - 2014	5.3	1 - 6490	1164			
All locations						
2008 - 2009	7.3	0 - 9210	520	2.4	0 - 65	44
2010 - 2014	4.9	1 - 6490	1272	2.7	1 - 340	108

[1]Values equal to 0 are below the detection limit (usually <10 for *Enterococcus*, and <5 for Fecal coliform or *E. coli*).
Average of a minimum of 5 samples.
[3]Three sampling locations are included in the Constitution Beach sampling – North Site (MWRA site MD16), Bathhouse Site (MWRA site MD17), and Recreation Center (MWRA site MD18).
[4]N/A = no data; Fecal coliform was analyzed at Constitution Beach after 2000.

Boston Inner Harbor Segment MA70-02

This 2.56 square mile Class SB/CSO, Combined Sewer Overflow (CSO) receiving water segment extends from Chelsea/Boston to East Boston/Boston. The segment includes the waters from the Mystic and Chelsea Rivers to a line drawn from Governors Island to Fort Independence. Fort Point, Reserved and Little Mystic Channels are also included in this segment.

The following are permitted NPDES discharges within this segment, which include CSO outfalls as indicated:

- Boston Water and Sewer Commission (BWSC) (MA0101192): including numerous CSO outfalls (MWRA internal outfall MRW215) from the BWSC and MWRA co-permitted Union Park CSO Treatment Facility.
- Exelon New Boston, LLC (MA0004731): Facility closed December 2007, permit terminated June 2009. Exelon now has coverage for stormwater outfalls under the 2008 Multi-Sector General Permit (MSGP) for Stormwater Discharges Associated with Industrial Activities.
- MGH Institute of Health Professionals (MAG250019)
- Boston Ship Repair, LLC (MA0040142)
- P&G Gillette Company (MA0003832)
- MassPort Authority and the Co-Permittees of Logan International Airport (MA0000787) (3 major outfalls to this segment and numerous minor runway stormwater outfalls).
- Massachusetts Water Resources Authority (MA0103284) CSO Outfall 203 Prison Point CSO Treatment Facility
- New England Aquarium Corporation (MA0003123)
- U.S. Coast Guard Integrated Support Command (MA0090671) permit was terminated in December 2006.
- Massachusetts Turnpike Authority Central Artery Tunnel Project (MA0033928) permit was terminated in August 2008.
- Boston Water and Sewer Commission (MAS010001) NPDES Stormwater Permit.
- City of Chelsea MS4 (MAR041077)

There are four vessel sewage pump-out facilities located within this segment: Boston Waterboat Marina, Long Wharf, Constitution Marina, Shipyard Quarters Marina, and Marina at Rowes Wharf.
According to the MassDEP WQA, other state (and related) agencies operating public storm drains, including the Department of Conservation and Recreation (DCR), MA Department of Transportation, Boston Water and Sewer Commission, and the Massachusetts Water Resources Authority (MWRA) are required to obtain NPDES stormwater permits.

DMF Designated Shellfish Growing Areas Status as of July 1, 2015: Conditionally Restricted for 0.00156 square miles; Prohibited for 2.45 square miles (Figure 1-2) (DMF 2015a).

Primary and Secondary Contact Recreational use is assessed as unimpaired with the exception of the Fort Point Channel of Boston Inner Harbor is impaired for Primary Contact Recreational use. Fort Point Channel was impaired due to elevated levels of Enterococci bacteria. Aesthetics use is not assessed.

The MWRA collected bacteria data as part of their CSO monitoring program between 2008 and 2014 (MassDEP 2010a); (MWRA 2014). Summary results of this sampling are provided in Table 4-8.

Table 4-8 MA70-02 Boston Inner Harbor Bacterial Water Quality Summary

Site Description	Enterococcus (cfu/100 mL)[1] Primary Contact Recreation = 35 cfu/100 ml Secondary Contact Recreation = 175 cfu/100 ml (Geometric mean of a minimum of 5 samples)				Fecal coliform (cfu/100 ml)[1] Threshold for restricted shellfishing is 14 cfu/100 ml without depuration and 88 cfu/100mL with.			
	Geometric mean	**Range**	**n**		**Geometric mean**	**Range**	**n**	
Upper Inner Harbor/Chelsea River confluence(MWRA site 015)								
2008 - 2009	2.4	0 - 538	83		21	0 - 1180	83	
2010 - 2014	8.1	1 - 5480	124		35.8	1 - 12000	123	
Upper Inner Harbor/Charles River mouth (MWRA site 014)								
2008 - 2009	2.4	0 - 448	201		6.2	0 - 8400	189	
2010 - 2014	4.7	1 - 631	116		23.2	1 - 1730	115	
Near New England Aquarium (MWRA site 138)								
2008 - 2009	3.9	0 - 201	96		22	0 - 1470	84	
2010 - 2014	3.6	1 - 158	129		23.3	1 - 555	129	
Head of Fort Point Channel (MWRA site 075)								
2008 - 2009	404	0 - 33100	92		4270	9 - 290000	89	
2010 - 2014	494	1 - 73300	200		4651	27 - 360000	200	
Mid Fort Point Channel/Summer St. Bridge (MWRA site 018)								
2008 - 2009	14	0 - 24200	131		158	0 - 382000	128	
2010 - 2014	59	1 - 13000	202		524	1 - 968000	202	
Mouth of Fort Point Channel (MWRA site 019)								
2008 - 2009	3.5	0 - 495	109		27	0 - 16800	109	
2010 - 2014	6.2	1 - 2610	119		36	1 - 5900	118	
Reserved Channel (MWRA site 022)								
2008 - 2009	2.6	0 - 627	83		5.7	0 - 2500	83	
2010 - 2014	6.9	1 - 3650	122		14.5	1 - 16000	121	
Mouth of Inner Harbor (MWRA site 024)								
2008 - 2009	2.4	0 - 448	201		6.2	0 - 8400	189	
2010 - 2014	3.2	1 - 2100	282		7.3	1 - 5900	281	
All locations combined								
2008 - 2009	5.9	0 - 33100	877		33.8	0 - 382000	847	
2010 - 2014	14.4	1 - 73300	1294		69.5	1 - 968000	1289	

[1]Values equal to 0 are below the detection limit (usually <10 for *Enterococcus*, and <5 for Fecal coliform).
(Ave of a minimum of 5 samples)

Pleasure Bay Segment MA70-11

This is a 0.22 square mile Class SB in Boston. The segment is a semi-enclosed bay with two channels between Castle and Head Islands restricting flow. The Massachusetts Water Resources Authority was authorized to discharge under the Remediation General Permit (MAG910128) at the Pleasure Bay Stormwater Relocation project in South Boston (permit issued November 2005 and expired September 2010). The project entailed diverting Pleasure Bay stormwater drainage away from the beach area and into the Reserved Channel requiring the construction of 4,600 feet of new drain piping ranging from 18 to 48 inches. The project was a component of MWRA's Long-Term CSO Control Plan for North Dorchester Bay and Reserved Channel. This has been completed in compliance with the Court-ordered schedule. The new storm drains run along Day Boulevard and Shore Road and ultimately connected to the existing BOS080 outfall at Reserved Channel. Upon completion of the North Dorchester Bay Storage Tunnel in 2008, the discharge from BOS081 was eliminated. (Water quality with respect to pathogen contamination was greatly improved between 2011 and 2015, such that closures at Carson Beach drastically reduced from 18% to 4% of the time, following very heavy rain events. See Section 8.2 for more details).

DMF Designated Shellfish Growing Areas Status as of July 1, 2015: Conditionally Restricted for 0.22 square miles; Prohibited for 0.000043 square miles (Figure 1-2) (DMF 2015a).

Primary and Secondary Contact Recreational are assessed as support for Pleasant Bay based on generally acceptable levels of Enterococci bacteria expressed in terms of beach closures. The Primary Contact Recreational Use is identified with an Alert status because of occasional beach closures although major stormwater related projects that have recently been completed should result in improved conditions. Aesthetics use is not assessed.

The MWRA collected weekly bacteria data at one main sampling station between 2007 and 2014 (MassDEP 2010); (MWRA 2014). Results of this sampling are provided in Table 4-9.

Table 4-9 - MA70-11 Pleasure Bay Bacterial Water Quality Summary

Site Description	**Enterococcus (cfu/100 mL)** [1,2] Primary Contact Recreation = 35 cfu/100 ml Secondary Contact Recreation = 175 cfu/100 ml (Geometric mean of a minimum of 5 samples)		
	Geometric mean	**Range**	**n**
Pleasure Bay Beach[2]			
2008 - 2009	6.0	0 - 4000	46
2010 - 2014	2.3	1 - 2610	445

[1]Values equal to 0 are below the detection limit (usually <10 for *Enterococcus*, and <5 for Fecal coliform). (Ave of a minimum of 5 samples)
[2]One sampling location is included in the Pleasure Bay Beach sampling conducted by DCR – Broadway St (MWRA site MDC20).

Dorchester Bay Segment MA70-03

This 3.5 square mile Class SB, Shellfishing Restricted, segment is located in Boston/Quincy. The segment includes the waters delineated by the mouth of the Neponset River and a line drawn between the south point of Thompson Island and Chapel Rocks. This segment has one vessel sewage pump-out facility located at Marina Bay. The following are NPDES Permits within this segment:

- University of Massachusetts-Boston (MA0040304)
- Boston Water and Sewer Commission (BWSC) (MA0101192) Outfalls BOS081 – BOS087, (7 discharges), no longer discharge to South Boston beaches. There were four major MWRA infrastructure projects completed in 2011 to abate CSO's from these outfalls and all CSO discharges to Dorchester Bay were eliminated for storms up to and including a 25-year storm event (regulator structures will remain open to relieve the system for larger events; secondary benefit is stormwater will also be collected and diverted from the beaches for all storms up to a five-year event).
- North Dorchester Bay Storage Tunnel--completed 12/09
- Pleasure Bay Storm Drain Improvements within the Dorchester Bay segment--completed 3/06
- Morrissey Blvd. Storm Drain--completed 6/09
- Conley Terminal Pump Station and Odor Control Facility--completed 2011
- Massachusetts Water Resources Authority (MA0103284) CSO outfall 209 Fox Point via BOS088/089 was eliminated in 2007 as result of sewer separation work in South Dorchester Bay.
- City of Quincy Phase II Stormwater MS4 Permit (MAR041081).

DMF Designated Shellfish Growing Areas Status as of July 1, 2015: Conditionally Restricted for 0.26 square miles; Prohibited for 3.11 square miles (Figure 1-2) (DMF 2015a).

Primary Contact Recreational use is assessed as impaired based on the frequency of beach closures at four of the six public beaches in this segment that were associated with elevated levels of Enterococci bacteria from storm events. The frequency of Secchi disk depths below the swimming criterion in the southern Dorchester Bay is also a concern. Secondary Contact Recreational is assessed as support based on the acceptable Enterococci bacteria levels and generally good Secchi disk depths. Aesthetics use is not assessed.

The MWRA collected bacteria data as part of their CSO monitoring program between 2003 and 2014 (MassDEP 2010a) (MWRA 2014a). Results of this sampling are provided in Table 4-10. Data in this table are from seven ambient stations in the Bay itself. Additionally, the MWRA and MDC took weekly bacteria samples between 2003 and 2014 at bathing beaches in this segment. Most of the high bacteria counts were associated with wet weather. A summary of the bathing beaches sampling is presented in Table 4-10 below.

Table 4-10 MA70-03 Dorchester Bay Bacterial Water Quality Summary

Site Description	**Enterococcus (cfu/100 mL)** [1] Primary Contact Recreation = 35 cfu/100 ml Secondary Contact Recreation = 175 cfu/100 ml (Geometric mean of a minimum of 5 samples)				**Fecal coliform (cfu/100 ml)**[1] Threshold for restricted shellfishing is 14 cfu/100 ml without depuration and 88 cfu/100mL with.			
	Geometric mean	**Range**	**n**		**Geometric mean**	**Range**	**n**	
North Dorchester Bay, Carson Beach at L St (MWRA site 033)								
2008 - 2009	3.8	0 - 1790	72		9.6	0 - 2100	73	
2010 - 2014	4.5	1 - 768	169		6.8	1 - 2800	169	
North Dorchester Bay, Carson Beach Bathhouse (MWRA site 036)								
2008 - 2009	6.1	0 - 1270	78		19.8	0 - 23400	79	
2010 - 2014	5.4	1 - 2360	171		6.9	1 - 5800	171	
North Dorchester Bay, central (MWRA site 038)								
2008 - 2009	2.1	0 - 171	96		5.2	0 - 160	86	
2010 - 2014	1.6	1 - 52	132		4.7	1 - 170	131	
South Dorchester Bay, Columbia Point at Buoy 12 (MWRA site 084)								
2008 - 2009	4.3	0 - 471	107		17.7	0 - 2400	109	
2010 - 2014	4.6	1 - 464	122		23.7	1 - 2000	122	
South Dorchester Bay at Neponset R. mouth (MWRA site 140)								
2008 - 2009	3.0	0 - 317	94		18.8	0 - 1240	84	
2010 - 2014	4.8	1 - 833	141		27	1 - 540	141	
Malibu Bay (MWRA site 040)								
2008 - 2009	3.5	0 - 121	41		47.2	0 - 730	42	
2010 - 2014	5	1 - 2360	109		36.3	1 - 2900	109	
Savin Hill Cove, at UMASS dock (MWRA site 039)								
2008 - 2009	10.9	0 - 6870	128		67.5	0 - 63000	127	
2010 - 2014	15.6	1 - 6130	171		77.4	1 - 19800	169	
All locations								
2008 - 2009	4.5	0 - 6870	616		20.1	0 - 63000	600	
2010 - 2014	5.1	1 - 6130	1015		16.5	1 - 19800	1012	

[1]Values equal to 0 are below the detection limit (usually <10 for *Enterococcus*, and <5 for Fecal coliform).

Table 4-11 MA70-03 Carson, M Street, and City Point Beach Bacterial Water Quality Summary

Site Description	Enterococcus (cfu/100 mL) [1,2] Primary Contact Recreation = 35 cfu/100 ml Secondary Contact Recreation = 175 cfu/100 ml (Geometric mean of a minimum of 5 samples)		
	Geometric mean	**Range**	**n**
Carson Beach, Bathhouse (MWRA site MDC23)			
2008 - 2009	9.3	0 - 4630	159
2010 - 2014	5	1 - 1420	331
Carson Beach, I Street (MWRA site MDC22)			
2008 - 2009	9.8	0 - 4160	159
2010 - 2014	3.8	1 - 691	332
M Street Beach (MWRA site MDC21)			
2008 - 2009	4.7	0 - 1270	159
2010 - 2014	2.9	1 - 402	330
City Point Beach (MWRA site MDC45)			
2008 - 2009	4.2	0 - 677	159
2010 - 2014	2.7	1 - 420	329
All locations			
2008 - 2009	6.5	0 - 4630	636
2010 - 2014	3.5	1 - 1420	1322

[1]Values equal to 0 are below the detection limit (usually <10 for *Enterococcus*).

Quincy Bay Segment MA70-04

This 1.2 square mile segment is a Class SA Waterbody in Quincy. The segment extends from Bromfield Street near the Wollaston Yacht Club northeast to N42.2781 W70.9941, southeast to N42.2735 W70.9678, and south to Newton Street on the northerly shore of Houghs Neck. Quincy has coverage under the Phase II National Pollutant Discharge Elimination System (NPDES) stormwater general permit (MAR041081) for their municipal separate storm sewer system (MS4).

DMF Designated Shellfish Growing Areas Status as of July 1, 2015: Conditionally Restricted for 0.41 square miles; Prohibited for 1.11 square miles (Figure 1-2) (DMF 2015a).

Primary Contact Recreational use is assessed as impaired based on the frequency of beach closures at a public beach (Wollaston beach) associated with elevated levels of Enterococci bacteria from storm events. Secondary Contact Recreational use is assessed as support in Dorchester Bay. Aesthetics use is unassessed.

The MWRA sampled bacteria samples at one location on this segment between 2008 and 2009 (MassDEP 2010); (MWRA 2014). Results are summarized in Table 4-12 below.

Table 4-12 MA70-04 Quincy Bay Bacterial Water Quality Summary

Site Description	**Enterococcus (cfu/100 mL)** [1] Primary Contact Recreation = 35 cfu/100 ml Secondary Contact Recreation = 175 cfu/100 ml (Geometric mean of a minimum of 5 samples)				**Fecal coliform (cfu/100 ml)** [1] Threshold for restricted shellfishing is 14 cfu/100 ml without depuration and 88 cfu/100mL with.			
	Geometric mean	**Range**	**n**		**Geometric mean**	**Range**	**n**	
Quincy Bay, off Merrymount Park (MWRA site 077) 2008 - 2009	3.3	0 – 10	2		2.0	0 – 0	2	

[1]Values equal to 0 are below the detection limit (usually <10 for *Enterococcus*, and <5 for Fecal coliform). Ave of a minimum of 5 samples. Routine monitoring at Station 077 ended in 2009.

<u>Quincy Bay Segment MA70-05</u>

This 4.8 square mile Class SB, segment is located in Quincy. This segment is north of segment MA70-04 and extends to a line drawn between Moon Island and Nut Island. Quincy has coverage under the Phase II National Pollutant Discharge Elimination System (NPDES) stormwater general permit (MAR041081) for their municipal separate storm sewer system (MS4).

DMF Designated Shellfish Growing Areas Status as of July 1, 2015: Conditionally Restricted for 0.34 square miles; Prohibited for 4.05 square miles (Figure 1-2) (DMF 2015a).

Primary Contact Recreational use is assessed as impaired based on the frequency of beach closures at Wollaston Beach associated with elevated levels of Enterococci bacteria from storm events The Secondary Contact Recreational use is assessed as support based on the acceptable Enterococci bacteria levels and good Secchi Disk depths. Aesthetics use is not assessed.

The MWRA took weekly bacteria samples between 2008 and 2014 at six locations at Wollaston Beach and just offshore within this segment. Most of the high bacteria counts, particularly near or at beaches, have been associated with wet weather (MassDEP 2010a). A summary of the bathing beach and offshore sampling is also presented in Table 4-13 below.

Table 4-13 MA70-05 Quincy Bay and Wollaston Beach Bacterial Water Quality Summary

Site Description	Enterococcus (cfu/100 mL) [1] Primary Contact Recreation = 35 cfu/100 ml Secondary Contact Recreation = 175 cfu/100 ml (Geometric mean of a minimum of 5 samples)				Fecal coliform (cfu/100 ml) [1] Threshold for restricted shellfishing is 14 cfu/100 ml without depuration and 88 cfu/100mL with.			
	Geometric mean	**Range**	**n**		**Geometric mean**	**Range**	**n**	
Quincy Bay, Hangman's Is. (MWRA site 139)								
2008 – 2009	1.4	0 - 10	46		2.5	0 - 60	38	
2010 - 2014	1.3	1 - 20	131		2.4	1 - 150	131	
Quincy Bay, offshore near Sachem St (MWRA site 047)								
2008 – 2009	1.7	0 - 10	18		3.3	0 - 105	18	
2010 - 2014	2.4	1 - 282	113		3.6	1 - 590	113	
Wollaston Beach, Milton Rd (MWRA site MDC29)								
2008 – 2009	16.4	0 - 7270	161		60.9	0 - 2000	34	
2010 - 2014	11.8	1 - 8160	397					
Wollaston Beach, Channing St. (MWRA site MDC31)								
2008 – 2009	13.9	0 - 2930	77		150	5 - 2500	34	
2010 - 2014	16.1	1 - 19900	402					
Wollaston Beach, Sachem St. (MWRA site MDC30)								
2008 – 2009	9.9	0 - 4110	77		64	0 - 3800	34	
2010 - 2014	10.9	1 - 24200	399					
Wollaston Beach, Rice Rd (MWRA site MDC32)								
2008 - 2009	8.9	0 - 2380	77		23.9	0 - 4800	34	
2010 - 2014	6.6	1 - 24200	395					
All locations								
2008 - 2009	7.6	0 - 7270	372		61.1	0 – 4800	136	
2010 - 2014	8.5	1 - 24200	1837		2.9	1 - 590	244	

[1]Values equal to 0 are below the detection limit (usually <10 for *Enterococcus*, and <5 for Fecal coliform).

Hingham Bay Segment MA70-06

This is a 1.0 square mile Class SB segment in Quincy. The segment is enclosed by lines connecting the area north of the mouth of the Weymouth Fore River to Nut Island then to Prince Head and then to Pig Rock. Nut Island was formerly the site of one of MWRA's sewage treatment plants and now serves as a headworks for the south system flows to the Deer Island Treatment Plant. Three former outfalls have been retained (Nut Island Emergency Spillway as part of MA0103284) and only discharge during extreme high flow rain events to prevent sewage backups into homes and businesses. Quincy has coverage under the Phase II National Pollutant Discharge Elimination System (NPDES) stormwater general permit (MAR041081) for their municipal separate storm sewer system (MS4).

DMF Designated Shellfish Growing Areas Status as of July 1, 2015: Conditionally Restricted for 0.01 square miles; Prohibited for 0.93 square miles (Figure 1-2) (DMF 2015a).

The Primary and Secondary Recreational uses are assessed as support for this segment of Hingham Bay based on the Enterococci bacteria data and the generally low frequency of beach closures at Edgewater Beach. Aesthetics use is not assessed.

The MWRA collected limited bacteria samples from the Quincy Yacht Club, Red Buoy #2 (Station # 080) between 2008 and 2014. The results are summarized in Table 4-14 below (MRWA 2014).

Table 4-14 MA70-06 Hingham Bay Bacterial Water Quality Summary

Site Description	**Enterococcus (cfu/100 mL)** [1] Primary Contact Recreation = 35 cfu/100 ml Secondary Contact Recreation = 175 cfu/100 ml (Geometric mean of a minimum of 5 samples)				**Fecal coliform (cfu/100 ml)** [1] Threshold for restricted shellfishing is 14 cfu/100 ml without depuration and 88 cfu/100mL with.			
	Geometric mean	**Range**	**n**		**Geometric mean**	**Range**	**n**	
Quincy Yacht Club, Red Buoy #2 (MWRA site 080)								
2008 - 2009	1.1	0 - 10	39		2.0	0 - 205	40	
2010 - 2014	2	1 - 712	110		2.2	1 - 2480	110	

[1]Values equal to 0 are below the detection limit (usually <10 for *Enterococcus*, and <5 for Fecal coliform).

Hingham Bay Segment MA70-07

This is a 4.8 square mile Class SB segment between Peddocks Island and Windmill Point. The area is defined by lines from Windmill Point southeast to Bumkin Island, from Bumkin Island southeast to Sunset Point, from Sunset Point across the mouth of the Weir River to Worlds End, from Worlds End across the mouth of Hingham Harbor to Crow Point, from Beach Lane, Hingham across the mouth of the Weymouth Back River to Lower Neck, and from Lower Neck midway across the mouth of the Weymouth Fore River. The communities of Hull, Hingham, and Weymouth have coverage under the Phase II National Pollutant Discharge Elimination System (NPDES) stormwater general permit (MAR041040; MAR041038; MAR041070) for their municipal separate storm sewer system (MS4).

DMF Designated Shellfish Growing Areas Status as of July 1, 2015: Conditionally Restricted for 0.11 square miles; Prohibited for 4.61 square miles (Figure 1-2) (DMF 2015a).

The Primary and Secondary Contact Recreational uses are assessed as support for this segment of Hingham Bay based on the Enterococci bacteria data and the lack of any beach closures at Kimball, Belair and North beaches in Hingham. Aesthetics use is not assessed.

The MWRA sampled for bacteria at one to two locations in this segment between 2008 and 2014 (MassDEP 2010a); (MWRA 2014). Results are summarized in Table 4-15 below.

Table 4-15 MA70-07 Hingham Bay Bacterial Water Quality Summary

Site Description	**Enterococcus (cfu/100 mL)** [1] Primary Contact Recreation = 35 cfu/100 ml Secondary Contact Recreation = 175 cfu/100 ml (Geometric mean of a minimum of 5 samples)				**Fecal coliform (cfu/100 ml)** [1] Threshold for restricted shellfishing is 14 cfu/100 ml without depuration and 88 cfu/100mL with.			
	Geometric mean	**Range**	**n**		**Geometric mean**	**Range**	**n**	
Hingham/Hull Bay green can #1 (MWRA site 117)								
2010 - 2014	3.2	1 - 10	2		12.8	9.09 - 18	2	
Hingham Bay, Crow Point flats (MWRA site 124)								
2008 - 2009	1.1	0 - 10	18		2.1	0 - 30	18	
2010 - 2014	1.1	1 - 20	81		1.8	1 - 23.1	81	

[1]Values equal to 0 are below detection limits (generally <10 for *Enterococcus*, and <5 for Fecal coliform).

Boston Harbor Segment MA70-01

This is a 24.2 square mile Class SB segment. This Boston Harbor segment is in Massachusetts Bay and extends from the line between Fort Dawes on Deer Island to The Graves, and from The Graves south to Point Allerton, across Hull and West Guts; across the mouths of Quincy and Dorchester Bays, Boston Inner Harbor and Winthrop Bay (including President Roads and Nantasket Roads).

The following have NPDES wastewater permits to discharge to Boston Harbor:

- MassPort Authority and the Co-Permittees of Logan International Airport (MA0000787) has numerous runway outfalls that discharge to this segment.
- Massachusetts Water Resource Authority has 3 permitted emergency discharge outfalls from the Nut Island Headworks and 4 permitted emergency discharge outfalls from the Deer Island Treatment Plant (MA0103284).
- Town of Hull Water Pollution Control Facility (MA0101231).
- U.S. Department of Homeland Security/U.S. Coast Guard Boston Light (MA0090433).
- Massachusetts Port Authority Logan International Airport Fire Training Facility (MA0032751).
- Boston Water and Sewer Commission (MAS01000).
- Town of Hull MS4 (MAR041040).
- City of Quincy MS4 (MAR041081).

- Town of Winthrop MS4 (MAR041084).

DMF Designated Shellfish Growing Areas Status as of July 1, 2015: Conditionally Restricted for 0.33 square miles; Prohibited for 18.1 square miles (Figure 1-2) (DMF 2015a).

The MWRA sampled for bacteria at seven locations in this segment between 2003 and 2014 (MassDEP 2010a); (MWRA 2014). The samples with the highest numbers were collected during wet weather. Results are summarized in Table 4-16 below.

Table 4-16 MA70-01 Boston Harbor Bacterial Water Quality Summary

Site Description	**Enterococcus (cfu/100 mL)** [1] Primary Contact Recreation = 35 cfu/100 ml Secondary Contact Recreation = 175 cfu/100 ml (Geometric mean of a minimum of 5 samples)				**Fecal coliform (cfu/100 ml)**[1] Threshold for restricted shellfishing is 14 cfu/100 ml without depuration and 88 cfu/100mL with.			
	Geometric mean	**Range**	**n**		**Geometric mean**	**Range**	**n**	
Mouth of Dorchester Bay (MWRA site 044)								
2008 - 2009	2.1	0 - 63	106		4.3	0 - 2200	108	
2010 - 2014	3.2	1 - 1130	124		3.8	1 - 2400	123	
Moon Island (MWRA site 048)								
2008 - 2009	1.4	0 - 41	80		2.4	0 - 45	82	
2010 - 2014	1.8	1 - 350	109		2.3	1 - 510	109	
North of Spectacle Island (MWRA site 065)								
2008 - 2009	2.4	0 - 52	41		4.2	0 - 150	42	
2010 - 2014	1.9	1 - 341	109		3.3	1 - 1280	109	
North of Long Island (MWRA site 106)								
2008 - 2009	1.2	0 - 10	93		1.9	0 - 40	83	
2010 - 2014	1.3	1 - 41	121		2.1	1 - 210	120	
North of Peddocks Island (MWRA site 141)								
2008 - 2009	1.2	0 - 10	94		2.1	0 - 65	84	
2010 - 2014	1.1	1 - 20	126		1.5	1 - 35	125	
President Roads (MWRA site 142)								
2008 - 2009	1.1	0 - 61	89		1.9	0 - 45	79	
2010 - 2014	1.2	1 - 10	116		1.7	1 - 75	116	
All locations								
2008 - 2009	1.4	0 - 63	503		2.6	0 - 2200	478	
2010 - 2014	1.6	1 - 1130	705		2.3	1 - 2400	702	

[1]Values equal to 0 are below the detection limit (usually <10 for *Enterococcus*, and <5 for Fecal coliform or *E. coli*).

Hull Bay Segment MA70-09

This is a 2.5 square mile Class SB, segment located in the Massachusetts Bay in that area defined as: between the west coastline of Hull and a line drawn from Windmill Point to Bumpkin Island to Sunset Point, Hull. Hull has coverage under the Phase II National Pollutant Discharge Elimination System (NPDES) stormwater general permit (MAR041040) for their municipal separate storm sewer system (MS4).

The town of Hull has done Enterococcus bacteria sampling at James Ave Bayside, A Street Bayside, and Newport, which are all along the coastline of Hull Harbor. Sampling results are summarized in Table 4-17 below.

The Primary and Secondary Contact Recreational uses are assessed as support for this segment based on the lack of any frequent or prolonged beach closures. Aesthetics use is not assessed.

DMF Designated Shellfish Growing Areas Status as of July 1, 2000: Conditionally Restricted for 0.22 square miles; Prohibited for 2.22 square miles (Figure 1-2) (DMF 2015a).

Table 4-17 MA70-09 Summary of Enterococcus Data (Town of Hull) 2003- 2015 for Hull Bay

Site Description	Min	Max	Number of Samples >104*	Number Samples
	cfu/100 mL			
At James Avenue Bayside 2003-9	<2	990	3	99
At James Avenue Bayside 2011-15	<10	75	0	41
At A Street Bayside 2003-9	<2	1,800	7	101
At A Street Bayside 2011-15	<10	800	5	56
At Newport 2003-9	<2	380	2	98
At Newport 2011-15	<10	20	0	24

*Indicator Bacteria, Enterococcus: geometric mean <=35 col/100 mL and single sample <=104 col/100 mL

4.2 Weir and Weymouth Sub-basin

Cochato River Segment MA74-06

This is a 4.1 mile long Class B segment extending from Holbrook to Braintree. The segment begins at the outlet of Lake Holbrook and ends at its confluence with Farm and Monatiquot rivers. The Lake Holbrook Dam is located along this segment and is maintained by the Holbrook Conservation Commission.

Holbrook and Braintree have coverage under the Phase II National Pollutant Discharge Elimination System (NPDES) MS4 stormwater general permit (MAR041039; MAR041029) for their municipal separate storm sewer system (MS4).

This segment first appeared on the 303d List of Waters for pathogens in 1992. Primary and Secondary Contact Recreation and Aesthetics uses are not assessed due to insufficient data available (MassDEP 2010a).

The MassDEP collected *E. coli* samples from the Cochato River during 2009. The data are summarized in Table 4-18 below.

Table 4-18 MA74-06 Cochato River *E. coli* Data Summary.

Primary Contact Season			
Site Description	Min cfu/100mL	Max	n
MassDEP 2009			
Downstream of road and 2 stormwater outfalls, Route 37 (Washington St), Braintree	70	1,500	6

Monatiquot River Segment MA74-08

This is a 4.4 mile long Class B segment in Braintree. The segment begins at the confluence of Cochato and Farm Rivers and ends at its confluence with Weymouth Fore River at Route 53. Braintree has coverage under the Phase II National Pollutant Discharge Elimination System (NPDES) stormwater general permits (MAR041029) for their municipal separate storm sewer system (MS4).

This segment first appeared on the 303d List of Waters for pathogens in 1992. Primary and Secondary Contact Recreation and Aesthetics uses were not assessed due to insufficient data available (MassDEP 2010a).

The USGS collected wet and dry weather Fecal coliform bacteria samples from the Monatiquot River for the Massachusetts Watershed Initiative MWI99-02 grant project in 1999 and 2000 (MassDEP 2002a). The MassDEP collected *E. coli* samples from the Monatiquot River during 2009. Data from the USGS, and MassDEP samplings are summarized below in Table 4-19 below.

Table 4-19 MA74-08 Monatiquot River Fecal coliform and *E. coli* Data Summary

Primary Contact Season				
Site Description	Min cfu/100mL	Max	n	n
USGS 1999-2000, Fecal coliform				
Commercial Street, East Braintree	270	4,800	10	7

Primary Contact Season				
Site Description	Min	Max	n	n
MassDEP 2009, *E. coli*				
700' upstream of Commercial Street, Braintree	140	480	6	3
River Street, Braintree	50	460	6	3

Town Brook Segment MA74-09

This 3.5 mile long Class B/SB segment extends from outlet of Old Quincy Reservoir in Braintree to its confluence with Town River, north of Route 3A (includes the "Canal") in Quincy. The Old Quincy Reservoir Dam is located on this segment. The brook is underground for approximately 2.6 miles from the Route 3 interchange in Braintree to Revere Road. The Massachusetts Bay Transit Authority (MBTA) Quincy Pump Station is permitted (MA0033987) to discharge wet weather flow and groundwater to this segment. Quincy and Braintree have coverage under the Phase II National Pollutant Discharge Elimination System (NPDES) stormwater general permits (MAR041081; MAR041029) for their municipal separate storm sewer system (MS4).

This segment first appeared on the 303d List of Waters for pathogens in 2002 based on data collected by the USGS. Primary and Secondary Contact Recreation and Aesthetics uses were not assessed due to insufficient data available (MassDEP 2010a).

The USGS collected wet and dry weather Fecal coliform bacteria samples from Town Brook for the Massachusetts Watershed Initiative MWI99-02 grant project between May 1998 and June 2000 (MassDEP 2002a). The MassDEP collected *E. coli* samples from the Town Brook during 2009. Data from the USGS and MassDEP samplings are summarized below in Table 4-20.

Table 4-20 MA74-09 Town Brook Fecal coliform and *E. coli* Data Summary

	Min	Max	
Site Description	cfu/100mL		n
USGS 1998-2000, Fecal coliform			
Downstream from Miller Stile Road	420	23,000	10
MassDEP 2009, *E. coli*,			
Elm Street, Quincy	250	590	6
Miller Stile Road, Quincy	330	2,200	6

Town River Bay Segment MA74-15

This 0.46 square mile Class SA segment extends from its headwaters in Quincy at the Route 3A bridge to its mouth at the Weymouth Fore River between Shipyard and Germantown Points, also in Quincy. Two vessel sewage pump-out facilities are located on this segment: Bay Pointe Marina and Town River Yacht

Club. Twin Rivers Technologies US Inc. discharge non-contact cooling water and boiler blow down (MA0004073) via one outfall to this segment. Sprague has two permits (Sprague Operating Resources LLC (MA0020869), Sprague Twin Rivers Technology (TRT) Terminal (MA0028037)) to discharge treated stormwater runoff through three outfalls to this segment. Quincy has coverage under the Phase II National Pollutant Discharge Elimination System (NPDES) stormwater general permit (MAR041081) for their municipal separate storm sewer system (MS4).

Primary and Secondary Contact Recreational uses were assessed as support. With the exception of one beach during one season, all marine beaches had closures during less than 10% of the season. Aesthetics use is not assessed due to insufficient data available (MassDEP 2010a).

DMF Designated Shellfish Growing Areas Status as of July 1, 2015: Conditionally Restricted for 0.10 square miles; Prohibited for 0.30 square miles (Figure 1-2) (DMF 2015a).

The City of Quincy has done Enterococci bacteria sampling at Delano Avenue, Broady (Baker), and Mound, which are located along the shoreline of Town River Bay. Sampling results are summarized in Table 4-21 below. Additionally, DMF has sampled at two MA74-15 Town River Bay estuary stations approximately 12 times each year, 2011- 2014. The data are summarized in Table 4-22 below.

Table 4-21 MA74-15 Summary of Enterococci Data (Town of Quincy) 2003- 2014

Site Description	Min	Max	# Samples >104	# Samples	Geomean
	cfu/100 mL				
At Delano Avenue, 2003-2010	<2	330	5	55	-
At Delano Avenue, 2011-2014	5	3,282	10	43	32
At Broady (Baker), 2003-2010	<2	637	15	110	-
At Broady (Baker), 2011-2014	5	6,015	8	57	21
At Mound, 2003-2010	<2	6,015	5	105	-
At Mound, 2011-2014	5	4,160	5	40	16

*Indicator Bacteria, Enterococci: geometric mean <=35 col/100 mL and single sample <=104 col/100 mL

Table 4-22 MA74-15 Town River Bay 2 Monitoring Stations* DMF Fecal coliform Data, 2011-2014

2011 Geometric Average of 2 Stations	2012 Geometric Average of 2 Stations	2013 Geometric Average of 2 Stations	2014 Geometric Average of 2 Stations	2011- 2014 Combined Geometric Average of 2 Stations
18.4 cfu/100mL	7.9 cfu/100mL	6.8 cfu/100mL	8.3 cfu/100mL	10.4 cfu/100mL

*An average of 12 samples taken each year at each station

Weymouth Fore River Segment MA74-14

This 2.29 square mile Class B/SB, segment extends from Route 53 in Braintree to the river's mouth. The eastern point of the mouth is located at Lower Neck in Weymouth, and the western point of the mouth is located at Wall Street on Houghs Neck in Quincy. NPDES Permits in this segment include: MA0004782 (Citgo Petroleum Corp, Braintree), MA0004073 (Twin Rivers Technologies L.P.), MA0005517 (Braintree Electric Light Department), MA0031551 (Clean Harbors Of Braintree, Inc). Quincy, Braintree, and Weymouth have coverage under the Phase II National Pollutant Discharge Elimination System (NPDES) stormwater general permit (MAR041081; MAR041029; MAR041070) for their municipal separate storm sewer system (MS4).

DMF Designated Shellfish Growing Areas Status as of July 1, 2015: Conditionally Restricted for 0.59 square miles; Prohibited for 1.56 square miles. (Figure 1-2) (DMF 2015a).

Primary and Secondary Contact Recreation uses are assessed as support. In the majority of the years, the majority of the beaches had closures less than 10% of the season. Aesthetics use was not assessed (MassDEP 2010a).

DMF has sampled fourteen MA74-14 Weymouth Fore River estuary stations approximately 12 times each year, 2011- 2014. The data are summarized in Table 4-23 below.

Table 4-23 MA74-14 Weymouth Fore River- 14 Monitoring Stations* DMF Fecal coliform Data, 2011-2014

2011 Geometric Average of 14 Stations	2012 Geometric Average of 14 Stations	2013 Geometric Average of 14 Stations	2014 Geometric Average of 14 Stations	2011- 2014 Combined Geometric Average of 14 Stations
17.0 cfu/100mL	9.4 cfu/100mL	11.6 cfu/100mL	12.2 cfu/100mL	12.6 cfu/100mL

*An average of 12 samples taken each year at each station

Old Swamp River Segment MA74-03

This 5.2 mile long Class A (PWS/Trib/ORW) segment extends from its headwaters just west of Pleasant Street and north of Liberty Street in Rockland to the inlet to Whitman's Pond in Weymouth. Rockland and Weymouth have coverage under the Phase II National Pollutant Discharge Elimination System (NPDES) stormwater general permit (MAR041058; MAR041070) for their municipal separate storm sewer system (MS4).

This segment first appeared on the 303d List of Waters for pathogens in 1992 based on Fecal coliform data. The Primary and Secondary Contact Recreation and Aesthetics uses were not assessed due to insufficient data available (MassDEP 2010a).

The USGS collected Fecal coliform bacteria samples from Old Swamp River for the Massachusetts Watershed Initiative grant project between 1999 and 2000 (MassDEP 2002a). The MassDEP collected *E. coli* samples from the Old Swamp River during 2009. Data from the USGS and MassDEP sampling activities are summarized below in Table 4-24.

Table 4-24 MA74-03 Old Swamp River *E. coli* Data Summary.

Site Description	Min	Max	n
USGS 1999-2000, Fecal coliform			
USGS gage (01105600)	10	2,400	9
MassDEP 2009, *E. coli*			
Sharp Street, Hingham	30	440	6
Ralph Talbot Street, Weymouth	180	1,500	6
Elm Street, Weymouth	160	1,200	6
Libbey Industrial Parkway, Weymouth	110	1,000	6

<u>Mill River Segment MA74-04</u>

This 3.4 mile long Class A (PWS/Trib/ORW) segment extends from the headwaters, west of Route 18 and south of Randolph Street, Weymouth to the inlet of Whitmans Pond, also in Weymouth.

Randolph and Weymouth have coverage under the Phase II National Pollutant Discharge Elimination System (NPDES) stormwater general permits (MAR041055; MAR041070) for their municipal separate storm sewer system (MS4).

This segment first appeared on the 303d List of Waters for pathogens in 1992 based on Fecal coliform data. Primary and Secondary Contact Recreation and Aesthetics uses are not assessed due to insufficient data available (MassDEP 2010a).

The MassDEP collected *E. coli* samples from the Mill River during 2009. The data are summarized in Table 4-25 below.

Table 4-25 MA74-04 Mill River *E. coli* Data Summary.

Primary Contact Season			
	Min	Max	
Site Description	cfu/100mL		n
MassDEP 2009			
Front Street, (upstream of the outfall downstream from the bridge), Weymouth	140	3,600	6
West Street, Weymouth	190	2,000	6

Weymouth Back River Segment MA74-05

This 0.4 mile long Class B, Outstanding Resource Water (ORW) segment is located in Weymouth. The river begins at the outlet of Elias Pond and extends to the Old Bay Colony Railroad tracks. Weymouth has coverage under the Phase II National Pollutant Discharge Elimination System (NPDES) stormwater general permits (MAR041070) for their municipal separate storm sewer system (MS4).

This segment first appeared on the 303d List of Waters for pathogens in 1992 based on Fecal coliform data collected by USGS. Primary and Secondary Contact Recreation and Aesthetics uses were not assessed due to insufficient data available (MassDEP 2010a).

USGS collected Fecal coliform bacteria samples during both wet and dry weather from their gage located on this segment for the Massachusetts Watershed Initiative grant project between 1999 and 2000 (MassDEP 2002a). The MassDEP collected *E. coli* samples from the Weymouth Back River during 2009. Data from the USGS and MassDEP samplings are summarized below in Table 4-26.

Table 4-26 MA74-05 Weymouth Back River Fecal coliform and *E. coli* Data Summary.

Site Description	Min	Max	n
	cfu/100mL		
USGS 1999-2000, Fecal coliform			
Downstream from Broad Street, East Weymouth	40	28,000	10
MassDEP 2009, *E. coli*			
Approximately 500' downstream of Commercial Street, Weymouth	310	2,500	6

Weymouth Back River Segment MA74-13

This 0.86 square mile Class SA segment extends from Weymouth to Hingham. The segment begins at the Old Bay Colony Railroad tracks and continues to the river's mouth between Lower Neck to the west and Wompatuck Road. Weymouth has coverage under the Phase II National Pollutant Discharge Elimination System (NPDES) stormwater general permits (MAR041070) for their municipal separate storm sewer system (MS4).

DMF Designated Shellfish Growing Areas Status as of July 1, 2015: Conditionally Restricted for 0.31 square miles; Prohibited for 0.46 square miles. (Figure 1-2) (DMF 2015a).

The Primary and Secondary Recreational uses are assessed as support for Weymouth Back River segment given the general lack of beach closures due to bacterial contamination at the beaches in this segment. Aesthetics use is not assessed (MassDEP 2010a).

As part of their receiving water monitoring program, the MWRA collected Fecal coliform samples at one station downstream from Route 3A bridge between 1998 and 2000 (MassDEP 2002a) (MWRA 2010). Data from their sampling are summarized in Table 4-27 below. It should be noted here that sampling at this site ended after 2000 due to the final closure of the Nut Island Treatment Plant in 1998 (MWRA, 2006). Additionally, DMF has sampled at twelve MA74-134 Weymouth Back River estuary stations approximately 12 times each year, 2011- 2014. The data are summarized in Table 4-28 below.

Table 4-27 MA74-13 Weymouth Back River Bacterial Water Quality Summary, (MWRA 2014a)

Site Description	**Enterococcus (cfu/100 mL)** [1] Primary Contact Recreation = 35 cfu/100 ml Secondary Contact Recreation = 175 cfu/100 ml (Geometric mean of a minimum of 5 samples)			**Fecal coliform (cfu/100 ml)** [1] Threshold for restricted shellfishing is 14 cfu/100 ml without depuration and 88 cfu/100mL with depuration.		
	Geometric mean	**Range**	**n**	**Geometric mean**	**Range**	**n**
Back River, downstream of 3A bridge (MWRA site 086) 1998 - 2000	3.5	0 - 905	70	6.4	0 - 635	70

[1]Values equal to 0 are below the detection limit (usually <10 for *Enterococcus*, and <5 for Fecal coliform). Monitoring at this location ceased in 2000.

Table 4-28 MA74-13 Weymouth Back River 12 Monitoring Stations* DMF Fecal coliform Data, 2011-2014

2011 Geometric Average of 14 Stations	2012 Geometric Average of 14 Stations	2013 Geometric Average of 14 Stations	2014 Geometric Average of 14 Stations	2011- 2014 Combined Geometric Average of 14 Stations
7.6 cfu/100mL	5.2 cfu/100mL	5.2 cfu/100mL	3.9 cfu/100mL	5.5 cfu/100mL

*An average of 12 samples taken each year at each station

Hingham Harbor Segment MA74-18

This 1.12 square mile Class SA segment is located in Hingham. This segment was report as MA70-08 prior to the 2010 Integrated Report. Hingham Harbor is bounded by a line from Crow Point to Worlds End. There are no permitted water withdrawals or wastewater discharges on this segment. There is one vessel sewage pump-out facility located on Hingham Harbor. Hingham has coverage under the Phase II National Pollutant Discharge Elimination System (NPDES) stormwater general permits (MAR041038) for their municipal separate storm sewer system (MS4).

DMF Designated Shellfish Growing Areas Status as of July 1, 2015 Conditionally Restricted for 0.45 square miles; Prohibited for 0.62 square miles (Figure 1-2) (DMF 2015a).

Given the lack of closures due to bacterial contamination at beaches in this segment, Primary and Secondary Contact Recreational uses were assessed as support. Aesthetics use is not assessed due to insufficient data available (MassDEP 2010a).

The town of Hingham has done Enterococci bacteria sampling at Seal Cove, and Town Beach, which is geographically located along the coastline in Hingham Harbor. Sampling results are summarized in Table 4-29 below.

Table 4-29 MA74-18 Hingham Harbor Summary of Enterococcus Data (Town of Hingham) 2003 - 2014

Site Description	Min	Max	# Samples
	cfu/100 mL		
At Seal Cove, 2003-2010	<2	720	92
At Seal Cove, 2010-2014	<10	181	17
At Town Beach, 2003-2010	<2	320	121
At Town Beach, 2010-2014	<10	74	-
At North Beach, 2010-2014	<10	146	1
At Martins Cove, 2010-2014	<10	213	1

<u>Weir River Segment MA74-02</u>

This 2.7 mile long Class B/SA segment extends from its headwaters at the confluence of Crooked Meadow River and Fulling Mill Brook in Hingham to Rockland Street, also in Hingham. Foundry Pond Dam is located on this segment. The Weymouth Great Pond Water Treatment Plant (MAG640031)* and Randolph-Holbrook Water Treatment Plant (MAG640032) have NPDES Permits to discharge to this segment. Hingham and Hull have coverage under the Phase II National Pollutant Discharge Elimination System (NPDES) stormwater general permit (MAR041038; MAR041040) for their municipal separate storm sewer system (MS4).

*With regard to permit MAG640031, EPA is in the process of issuing an individual permit (MA0040410).

This segment first appeared on the 303d List of Waters for pathogens in 1992 based on Fecal coliform data. Primary and Secondary Contact Recreation and Aesthetics uses are not assessed due to insufficient data available (MassDEP 2010a).

The USGS collected Fecal coliform bacteria samples from the Route 3A bridge located on this segment for the Massachusetts Watershed Initiative grant project between 1999 and 2000 (MassDEP 2002a). The MassDEP collected *E. coli* samples from the Monatiquot River during 2009 and 2013. Data from the USGS and MassDEP sampling activities are summarized below in Table 4-30.

Table 4-30 MA74-02 Weir River Fecal coliform and *E. coli* Data Summary.

Primary Contact Season			
Site Description	Min	Max	n
	cfu/100mL		
USGS 1999-2000, Fecal coliform			
Route 3A bridge, Hingham	25	570	10*
MassDEP 2009, *E. coli*			
Route 228 (East Street), Hingham	10	250	6
MassDEP 2013, *E. coli*, Station W2395			
~110' upstream/south of Rte. 228(East St.) Hingham	85	590	5

Weir River Segment MA74-11

This 0.83 mile long Class SA segment extends from Rockland Street and the outlet of Straits Pond in Hingham to the river's mouth at Worlds End in Hingham/Hull. Hingham and Hull have coverage under the Phase II National Pollutant Discharge Elimination System (NPDES) stormwater general permits (MAR041038; MAR041040) for their municipal separate storm sewer system (MS4).

DMF Designated Shellfish Growing Areas Status as of July 1, 2015: Conditionally Restricted for 0.46 square miles; Prohibited for 0.31 square miles (Figure 1-2) (DMF 2015a).

Given the lack of closures due to bacterial contamination at beaches in this segment, Primary and Secondary Contact Recreational uses were assessed as support. Aesthetics uses were not assessed due to insufficient data available (MassDEP 2010a).

DMF conducted Enterococci bacteria sampling at the Rockland Street Bridge between 2007 and 2010 (DMF 2010). MassDEP sampled for *E. coli* bacteria at one station near Rt. 228 (East St.) in Hingham in 2013. Sampling results for DMF and MassDEP are summarized in Table 4-31 below. Additionally, DMF has sampled at 14 MA74-11 Weir River estuary stations approximately 12 times each year, 2011- 2014. The data are summarized in Table 4-32 below.

Table 4-31 MA74-11 Summary of MassDEP *E. coli* (2013) and DMF Enterococci Data, 2007-2010

Site Description	Min	Max	# Number Samples
	cfu/100 mL		
DMF,Rockland Street Bridge, 2010, Enterococci.	10	320	11
DMF,Rockland Street Bridge, 2009, Ent.	10	320	10
DMF,Rockland Street Bridge, 2008, Ent.	10	137	9
DMF,Rockland Street Bridge, 2007, Ent.	10	67	6

Site Description	Min	Max	# Number Samples
	cfu/100 mL		
MassDEP, 2013, Station W2395, ~110' upstream/south of Ret. 228(East St.) Hingham. *E. coli*	85	590	-

Table 4-32 MA74-11 Weir River 14 Monitoring Stations* DMF Fecal coliform Data, 2011-2014

2011 Geometric Average of 14 Stations	2012 Geometric Average of 14 Stations	2013 Geometric Average of 14 Stations	2014 Geometric Average of 14 Stations	2011- 2014 Combined Geometric Average of 14 Stations
8.9 cfu/100mL	6.2 cfu/100mL	6.5 cfu/100mL	6.8 cfu/100mL	7.1 cfu/100mL

*An average of 12 samples taken each year at each station

4.3 Mystic River Sub-basin

Aberjona River Segment MA71-01

This 9.1 mile long Class B, warm water fishery, extends from its source just south of Birch Meadow Drive in Reading to the inlet of the Upper Mystic Lake at Mystic Valley Parkway, Winchester. Parkview Condominium Assoc. (MAG250009), a Non-Contact Cooling Water General Permit (issued 2-12-15), and Olin Corporation (MAG910074), a Remediation General Permit (issued 4-4-12), are permitted to discharge to Halls Brook, a tributary to the Aberjona River, and to the Aberjona River itself. Woburn, Reading and Winchester have coverage under the Phase II National Pollutant Discharge Elimination System (NPDES) stormwater general permits (MAR041056; MAR041072) for their municipal separate storm sewer system (MS4).

Primary and Secondary Contact Recreation and Aesthetics uses are assessed as impaired for exceeding Water Quality Standards for *E. coli* of 126 cfu/100 ml, consistently during the years 2002 through 2008 and for turbidity (MassDEP 2010b).

The Mystic River Watershed Association (MyRWA) Monitoring Network (MMN) monthly bacteria data 2010-2014 for 3 monitoring stations (ABR049, ABR028, ABR006), and one MassDEP monitoring station along this segment are summarized in Table 4-33 below.

Table 4-33 MA71-01 Aberjona River *E. coli* Data Summary (MyRWA 2015, MassDEP 2014b).

Site Description	Min	Max*	n
	cfu/100mL		
	E. coli		
MyRWA, 2010 ABR006, Aberjona R. @USGS Station, Winchester	20	3,870	12
MyRWA, 2011 ABR006	52	2,010	12
MyRWA, 2012 ABR006	63	24,200	12
MyRWA, 2013ABR006	109	1,660	11
MyRWA, 2014 ABR006	97	1,330	11
MyRWA, 2010	***E. coli***		
Station ABR028 @ USGS Gage, Winchester	199	6,870	11
MyRWA, 2011 Station ABR028	63	2,990	12
MyRWA, 2012 Station ABR028	52	14,400	12
MyRWA, 2013 Station ABR028	158	2,280	11
MyRWA, 2014 Station ABR028	41	2,500	11
MyRWA, 2010	***E. coli***		
Station ABR049 @ Salem St. Woburn	52	8,660	12
MyRWA, 2011 Station ABR049	20	8,160	11
MyRWA, 2012 Station ABR049	31	24,200	12
MyRWA, 2013 Station ABR049	10	1,610	9
MyRWA, 2014 Station ABR049	160	1,600	11
	E. coli		
MassDEP, 2013 Station Unnamed Trib. To Aberjona R., 700' downstream of Wildwood Rd, Woburn	98	2,100	4

* highest readings followed wet weather

Additional data for the Aberjona River can be obtained from the MyRWA website: https://mysticriver.org/baseline

Alewife Brook Segment MA71-04

This 2.3 mile long Class B, with a CSO variance, warm water fishery extends from the outlet of Little Pond in Belmont to its confluence with the Mystic River in Arlington/Somerville. NPDES Permits include: City Of Somerville (CSOs) (MA0101982), MWRA (CSOs) (MA0103284), City Of Cambridge (CSOs) (MA0101974). There were initially 15 permitted CSO discharges and through years of work, six remain (with reduced discharges). Collectively, these projects are predicted to reduce annual CSO volume to the Alewife Brook by 85% in a typical year, from 50 million gallons in 1997 to 7.3 million gallons. In 2015, CSO activations in a typical year were reduced from 63 in 1997 to seven. Other NPDES permittees include Shire Human Genetic Therapies, Inc. (MA0040321), and Belmont, Arlington and Somerville have coverage under the Phase II National Pollutant Discharge Elimination System (NPDES) stormwater general permit (MAR041074; MAR041072, MAR041082) for their municipal separate storm sewer system (MS4).

Some progress has been made in addressing CSO discharges and illegal wastewater connections to stormdrains, but more work is needed moving forward. The CSO Variance in the Alewife/Mystic watershed has been extended by EPA through 2019. During the years 2018 – 2020, MWRA is required under a federal court order to assess the level of CSO control for their planning area, which includes the Alewife/Mystic watershed.

Primary and Secondary Contact Recreation and Aesthetics uses are assessed as impaired for exceeding Water Quality Standards for *E. coli* of 126 cfu/100 ml, seven out of seven years (2002-2008) and for poor Secchi disk transparency (MassDEP 2010b).

The Mystic River Watershed Association (MyRWA) Monitoring Network (MMN) monthly bacteria data 2008-2014 for 1 monitoring station (ALB006, at Broadway Bridge) along this segment are summarized in Table 4-34 below. Additionally, the MWRA samples at four stations (174, 074, 172, 070) with the 2003-2014 data summarized in Table 4-35.

Table 4-34 MA71-04 Alewife Brook Indicator Bacteria Data Summary (MyRWA 2015).

	Min	**Max**	
Site Description	**cfu/100mL**		**n**
MyRWA, 2008	***E. coli***		
ALB006, Broadway Bridge, Somerville	52	563	12
MyRWA, 2009, Station ALB006	98	1,220	6
MyRWA, 2010, Station ALB006	121	3,080	12
MyRWA, 2011, Station ALB006	197	12,000	12
MyRWA, 2012, Station ALB006	211	24,200	12
MyRWA, 2013, Station ALB006	213	2,040	11
MyRWA, 2014, Station ALB006	97	1,250	12

Table 4-35 MA71-04 Alewife Brook Bacteria Data Summary (MWRA 2010, MWRA 2014)

Site Description	***Enterococcus* (cfu/100 mL)** [1] Primary Contact Recreation = 35 cfu/100 ml Secondary Contact Recreation = 175 cfu/100 ml (Geometric mean of a minimum of 5 samples)				**Fecal coliform (cfu/100 ml)** [1] Threshold for restricted shellfishing is 14 cfu/100 ml without depuration and 88 cfu/100mL with			
	Geometric mean	**Range**	**n**		**Geometric mean**	**Range**	**n**	
Little River, upstream of Rt 2 (MWRA site 174)								
2003 - 2007	343	0 - 9100	110		652	70 - 14900	111	
2008 - 2009	62	0 - 2280	44		230	41 - 4110	45	
2010 - 2014	266	1 - 45700	148		1048	118 - 63000	49	
Alewife Brook, near Alewife T ramp (MWRA site 074)								

Site Description	***Enterococcus* (cfu/100 mL)** [1] Primary Contact Recreation = 35 cfu/100 ml Secondary Contact Recreation = 175 cfu/100 ml (Geometric mean of a minimum of 5 samples)				**Fecal coliform (cfu/100 ml)** [1] Threshold for restricted shellfishing is 14 cfu/100 ml without depuration and 88 cfu/100mL with			
	Geometric mean	**Range**	**n**		**Geometric mean**	**Range**	**n**	
2003 - 2007	348	0 - 22000	135		716	80 - 33100	136	
2008 - 2009	33	0 - 3650	45		209	10 - 17300	45	
2010 - 2014	191.2	1 - 26900	149		1015.7	164 - 56000	49	
Alewife, Mass. Ave Bridge (MWRA site 172)								
2003 - 2007	426	10 - 13000	119		710	50 - 36000	120	
2008 - 2009	67	0 - 2190	45		200	31 - 15500	45	
2010 - 2014	363.9	1 - 45700	149		1021.1	82 - 48000	49	
Alewife, Mystic Valley Pkwy (MWRA site 070)								
2003 - 2007	465	0 - 20000	135		605	41 - 25000	137	
2008 - 2009	117	0 - 3260	45		278	63 - 2480	45	
2010 - 2014	421.9	1 - 24200	150		1093.9	118 - 38000	49	
All locations								
2003 - 2007	394	0 - 22000	499		668	41 - 36000	504	
2008 - 2009	63	0 - 3650	179		227	10 - 17300	180	
2010 - 2014	298	1 - 45700	596		1044.2	82 - 63000	196	

[1]Values equal to 0 are below the detection limit (usually <10 for *Enterococcus*, and <5 for *E. coli*).

Malden River Segment MA71-05

This 2.5 mile long Class B, warm water fishery extends from its headwaters south of Exchange Street in Malden to its confluence with Mystic River in Everett/Medford. Everett and Medford have coverage under the Phase II National Pollutant Discharge Elimination System (NPDES) stormwater general permits (MAR041131; MAR041078) for their municipal separate storm sewer system (MS4).

The Primary and Secondary Contact Recreation and Aesthetic uses are assessed as impaired for chronic elevated bacteria levels, taste, odor, and turbidity (MassDEP 2010b).

The MyRWA MMN monthly bacteria data 2010-2014 for this segment, station MAR036, is summarized in Table 4-36 and MWRA data at station 176 is summarized in Table 4-37.

Table 4-36 MA71-05 Malden River Indicator Bacteria Data Summary (MyRWA 2015)

Site Description	Min	Max**	n
	cfu/100mL		
MyWRA, 2010	*E. coli*		
Station MAR036, Medford St. Bridge	20	7,270	11
MyWRA, 2011	203	9,210	12
MyWRA, 2012	41	24,200	11
MyWRA, 2013	169	3,650	10
MyWRA, 2014	98	8,160	11

* 10 sites had readings > 5,000 ** Highest readings following wet weather

Table 4-37 MA71-05 Malden River Bacterial Water Quality Summary (MWRA 2014)

Site Description	***Enterococcus* (cfu/100 mL)**[1] Primary Contact Recreation = 35 cfu/100 ml Secondary Contact Recreation = 175 cfu/100 ml (Geometric mean of a minimum of 5 samples				**Fecal coliform (cfu/100 ml)**[1] Threshold for restricted shellfishing is 14 cfu/100 ml without depuration and 88 cfu/100mL with			
	Geometric mean	Range	n		Geometric mean	Range	n	
Malden River at Rt 16 Bridge (MWRA site 176)								
2003 - 2007	23.8	0 - 9000	103		60.7	0 - 24200	102	
2008 - 2009	12.2	0 - 1990	42		111	0 - 4350	42	
2010 - 2014	10.3	1 - 5480	106		0.4	1 - 17300	36	

[1]Values equal to 0 are below the detection limit (usually <10 for *Enterococcus*, and <5 for *E. coli*).

Mystic River Segment MA71-02

This 4.9 mile long Class B CSO variance warm water fishery extends from the outlet of Lower Mystic Lake in Arlington/Medford to the Amelia Earhart Dam in Somerville/Everett. This segment has also been designated as a CSO Variance segment, where limited CSO discharges are allowed consistent with the MWRA Long-Term CSO Control Plan. NPDES Permits in this segment consist of one CSO discharge (SOM007A/MWR205A) co-owned by the City of Somerville (MA0101982) and Massachusetts Water Resources Authority (MA0103284). A description of on-going mitigation measures for these discharges is provided in Section 8.2 of this report. Arlington, Medford, Somerville and Everett have coverage under the Phase II National Pollutant Discharge Elimination System (NPDES) stormwater general permit (MAR041027; MAR041049. MAR041082, MAR041078) for their municipal separate storm sewer system (MS4). Sithe Mystic, LLC (MA0004740) is permitted to discharge through an outfall to this segment. With regard to CSO controls, considerable efforts have resulted in the closing of 2 CSO outfalls and additional controls at the Somerville Marginal Facility and the BOS019 Storage Conduit. More summary details are covered in Section 8.2.

Primary and Secondary Contact Recreation and Aesthetics are assessed as impaired due to chronic elevated bacteria levels and poor Secchi disk transparency (MassDEP 2010b).

The Mystic River Watershed Association (MyRWA) Monitoring Network (MMN) monthly bacteria data 2010- 2014 for 2 monitoring stations (MEB001, and MYR071) along this segment are summarized in Table 4-38 below. Also, MWRA monitoring data 2003 - 2014 for eight stations are summarized in Table 4-39.

Table 4-38 MA71-02 Mystic River Indicator Bacteria Data Summary (MyRWA 2015)

Site Description	Min	Max	n
	cfu/100mL		
MyWRA, 2010	***E. coli***		
Station MEB001, Meetinghouse Brook, outlet into Mystic River	96	4,610	12
MyWRA, 2011 Station MEB001	52	933	12
MyWRA, 2012 Station MEB001	63	9,800	12
MyWRA 2013 Station MEB001	63	14100	11
MyWRA, 2014 Station MEB001	20	11,200	12
	E. coli		
MyWRA, 2010, Station MYR071 at High St. Bridge, Medford	20	10,500	12
MyWRA, 2011 Station MYR071	10	218	12
MyWRA, 2012 Station MYR071	10	419	12
MyWRA, 2013 Station MYR071	10	160	12
MyWRA, 2014 Station MYR071	31	591	11

Table 4-39 MA71-02 Mystic River Indicator Bacteria Water Quality Summary (MWRA 2014)

Site Description	***Enterococcus* (cfu/100 mL)** [1] Primary Contact Recreation = 35 cfu/100 ml Secondary Contact Recreation = 175 cfu/100 ml (Geometric mean of a minimum of 5 samples)				**Fecal coliform (cfu/100 ml)** [1] Threshold for restricted shellfishing is 14 cfu/100 ml without depuration and 88 cfu/100mL with depuration.			
	Geometric mean	**Range**	**n**		**Geometric mean**	**Range**	**n**	
Downstream of Mystic Lakes (MWRA site 083)								
2003 - 2007	40.0	0 - 7300	152		64.9	0 - 5100	153	
2008 - 2009	17.4	0 - 2100	93		67.8	0 - 1020	93	
2010 - 2014	19.9	1 - 24200	239		80.9	1 - 24200	49	

Site Description	***Enterococcus* (cfu/100 mL)** [1] Primary Contact Recreation = 35 cfu/100 ml Secondary Contact Recreation = 175 cfu/100 ml (Geometric mean of a minimum of 5 samples)				**Fecal coliform (cfu/100 ml)**[1] Threshold for restricted shellfishing is 14 cfu/100 ml without depuration and 88 cfu/100mL with depuration.			
Mystic/Alewife confluence (MWRA site 057)								
2003 - 2007	67.9	0 - 9600	111		95.9	0 - 11200	111	
2008 - 2009	38.1	0 - 1550	43		131.9	0 - 2480	43	
2010 - 2014	35.7	1 - 12000	105		166.6	10 - 24200	33	
Upstream of Rt. 93 overpass (MWRA site 056)								
2003 - 2007	73.0	0 - 18500	98		281.6	0 - 27000	98	
2008 - 2009	21.7	0 - 6490	41		333.4	63 - 15500	41	
2010 - 2014	18.7	1 - 4880	106		251.6	20 - 9210	47	
Boston Ave. bridge (MWRA site 066)								
2003 - 2007	89.0	0 - 6600	150		128.2	0 - 15700	151	
2008 - 2009	30.4	0 - 4110	52		109.9	0 - 2360	52	
2010 - 2014	37.8	1 - 6870	171		183.5	1 - 7270	72	
Route 16 bridge (MWRA site 177)								
2000 - 2003	30.1	0 - 16600	130		107.2	0 - 9800	129	
2008 - 2009	24.1	0 - 794	52		257.2	20 - 3260	52	
2010 - 2014	22.3	1 - 3080	137		313.7	20 - 13000	77	
Route 28 bridge (MWRA site 067)								
2003 - 2007	8.4	0 - 4800	99		28.7	0 - 12400	99	
2008 - 2009	6.2	0 - 1330	43		40.9	0 - 5170	42	
2010 - 2014	4	1 - 988	106		47.1	1 - 3260	16	
Mystic/Malden R. confluence (MWRA site 059)								
2003 - 2007	6.5	0 - 2200	99		24.5	0 - 8400	99	
2008 - 2009	4.6	0 - 669	42		38.1	0 - 2760	42	
2010 - 2014	4.8	1 - 884	104		35.9	1 - 6870	10	
Amelia Earhart dam, upstream (MWRA site 167)								
2003 - 2007	10.8	0 - 3800	134		28.9	0 - 9800	133	
2008 - 2009	4.9	0 - 299	50		70.6	0 - 1350	48	
2010 - 2014	6	1 - 683	144		44.8	1 - 1850	22	
All locations								
2003 - 2007	29.1	0 - 18500	973		69.7	0 - 27000	973	
2008 - 2009	14.5	0 - 6490	416		96.3	0 - 15500	413	
2010 - 2014	15.1	1 - 24200	1112		105.5	1 - 24200	326	

[1]Values equal to 0 are below the detection limit (usually <10 for *Enterococcus*, and <5 for *E. coli*).

Chelsea River Segment MA71-06

This 0.39 square mile Class SB/CSO segment extends from the river's confluence with Mill Creek in Chelsea/Revere to its confluence with Mystic River in Chelsea/East Boston/Charlestown. NPDES Permits within this segment include: Sunoco Logistics Terminal (MA0004006), Chelsea, City Of (3 CSOs) (MA0101877), Chelsea Sandwich (MA0003280), Gulf Oil - Chelsea (MA0001091), Irving Oil Terminals, Inc. (MA0001929), Global South Terminal, LLC (MA0000825), Global Petroleum Corp - Revere (MA0003425), Global Revco Terminal, LLC (MA0003298), Boston Water And Sewer Commission, (CSO) (MA0101192). Chelsea, Revere, and Boston (includes Charlestown) have coverage under the Phase II National Pollutant Discharge Elimination System (NPDES) stormwater general permit (MAR041077; MAR041057, MAR041173) for their municipal separate storm sewer system (MS4). More summary details are covered in Section 8.2.

DMF Designated Shellfish Growing Areas Status as of July 1, 2015: Prohibited (Figure 1-2) (DMF 2015a).

Primary and Secondary Contact Recreation and Aesthetics are assessed as impaired due to chronic elevated bacteria levels, poor Secchi disk transparency, and documented petroleum spills/releases to the Chelsea River (MassDEP 2010b).

The MyRWA MMN monthly bacteria data 2010-2014 for this segment for station CHR95S is summarized in Table 4-40. Additionally, MWRA data at station 027 is summarized in Table 4-41.

Table 4-40 MA71-06 Chelsea River Indicator Bacteria Data Summary (MyRWA 2015)

Site Description	Min	Max	n
	Enterococci (cfu/100 mL)		
MyWRA, 2010 Station CHR95S, Chelsea R., E. Boston at Condor St.	2	300	5
MyWRA, 2011 Station CHR95S		57	1
MyWRA, 2012 Station CHR95S	10	2,600	12
MyWRA, 2013 Station CHR95S	10	130	11
MyWRA, 2014 Station CHR95S	1	790	12

Table 4-41 MA71-06 Chelsea River Indicator Bacteria Summary (MWRA 2014a)

Site Description	*Enterococcus* (cfu/100 mL) [1] Primary Contact Recreation = 35 cfu/100 ml Secondary Contact Recreation = 175 cfu/100 ml (Geometric mean of a minimum of 5 samples)				Fecal coliform (cfu/100 ml)[1] Threshold for restricted shellfishing is 14 cfu/100 ml without depuration and 88 cfu/100mL with depuration.			
	Geometric mean	Range	n		Geometric mean	Range	n	
Midchannel, near Condor Street park (MWRA site 027)								
2008 - 2009	2.4	0 - 794	82		10.1	0 - 1070	82	
2010 - 2014	5.4	1 - 3650	124		17	1 - 2800	123	

[1]Values equal to 0 are below the detection limit (usually <10 for *Enterococcus*, and <5 for Fecal coliform and *E. coli*).

Mystic River Segment MA71-03

This 0.49 square mile Class SB/CSO segment extends from the Amelia Earhart Dam in Somerville to confluence with Chelsea River in Chelsea/East Boston, and includes the Island End River. NPDES Permits within this segment include: City Of Somerville (CSOs) (MA0101982), MWRA (CSOs) (MA0103284), City Of Cambridge (CSOs) (MA0101974); Mystic Exelon Station Power Plant, NCCW withdrawal (MA0004740), BWSC (MA0101192). A detailed discussion on the CSOs, their planned elimination, and progress made to date is discussed in detail in Section 8.2 of this report.

DMF Designated Shellfish Growing Areas Status as of July 1, 2015: Prohibited (Figure 1-1) (DMF, 2015).

Primary and Secondary Contact Recreational uses are assessed as supporting. Aesthetic use is not assessed due to lack of data (MassDEP 2010b).

The MyRWA Mystic Monitoring Network (MMN) monthly bacteria data 2010- 2014 for this segment for the two stations MYR275, and MYRMMP are summarized in Table 4-42 below.

Table 4-42 MA71-03 Mystic River Indicator Bacteria Data Summary (MyRWA 2015, MWRA 2014)

Site Description	Min	Max	n
	Enterococci (cfu/100 mL)		
MyWRA, 2010 Station MYR275, Mystic River at Draw 7 Park, Somerville	2	2,400	5
MyWRA, 2011 Station MYR275	-	10	1
MyWRA, 2012 Station MYR275	10	130,000	12
MyWRA, 2013, Station MYR275	10	170	11
MyWRA, 2014, Station MYR275,	10	14,000	11
MyWRA, 2010, Station MYRMMP,	2	760	5

Site Description	Min	Max	n
	Enterococci (cfu/100 mL)		
Mystic R. at O'Malley Park, Chelsea			
MyWRA, 2011, Station MYRMMP	-	66	1
MyWRA, 2012, Station MYRMMP	10	380	12
MyWRA, 2013, Station MYRMMP	10	220	11
MyWRA, 2014, Station MYRMMP	1	790	12

* Geometric mean-- 36

The MWRA periodically sampled at three stations between the years 2003-2014. The data are summarized in Table 4-43 below.

Table 4-43 MA71-03 Mystic River Mouth Indicator Bacteria Summary (MWRA 2014)

Site Description	**Enterococcus (cfu/100 mL)** [1] Primary Contact Recreation = 35 cfu/100 ml Secondary Contact Recreation = 175 cfu/100 ml (Geometric mean of a minimum of 5 samples)				**Fecal coliform (cfu/100 ml)**[1] Threshold for restricted shellfishing is 14 cfu/100 ml without depuration and 88 cfu/100mL with depuration.			
	Geometric mean	Range	n		Geometric mean	Range	n	
Somerville Marginal 205 CSO outfall (MWRA site 052)								
2008 - 2009	11.8	0 - 2910	90		120	0 - 29100	86	
2010 - 2014	16.4	1 - 5170	144		80.6	1 - 52000	143	
Schrafft's Pier at BOS 017 (MWRA site 069)								
2008 - 2009	2.6	0 - 30	32		38.3	0 - 4220	32	
2010 - 2014	12.4	1 - 4880	140		56.9	1 - 22000	139	
Upstream of Tobin Bridge (MWRA site 137)								
2008 - 2009	4.1	0 - 960	93		21.1	0 - 2120	81	
2010 - 2014	4.6	1 - 384	150		20.3	1 - 990	150	
All locations								
2008 - 2009	5.9	0 - 2910	215		49.2	0 - 29100	199	
2010 - 2014	9.7	1 - 5170	434		44.7	1 - 52000	432	

[1]Values equal to 0 are below the detection limit (usually <10 for *Enterococcus*, and <5 for Fecal coliform).

<u>Mill Brook Segment MA71-07</u>

The Mill Brook is a 3.9 mile long, Class B segment, which drains from the outlet of Arlington Reservoir to the inlet of Lower Mystic Lake, Arlington. Portions of this segment are culverted underground. Arlington has coverage under the Phase II National Pollutant Discharge Elimination System (NPDES) stormwater general permit (MAR041027) for their municipal separate storm sewer system (MS4).

Primary and Secondary Contact Recreational uses are assessed as impaired due to chronic elevated bacteria levels exceeding Water Quality Standards. Aesthetic use is assessed as supporting as no odors were reported and color was reported as “clear” or “tea colored” (MassDEP 2010b).

The Mystic River Watershed Association (MyRWA) Monitoring Network (MMN) monthly bacteria data 2010-2014 for monitoring station (MIB001) and MassDEP monitoring station W2401 along the MA71-07 Mill River segment are summarized in Table 4-44 below.

Table 4-44 MA71-07 Mill Brook Indicator Bacteria Data Summary (MyRWA 2015)

Site Description	Min	Max	n
	***E. coli* (cfu/100 mL)**		
MyWRA, 2010, Station MIB001,Mill Bk at Mt.Pleasant Cemetery, Arlington	86	8,160	12
MyWRA, 2011, Station MIB001	31	2,010	12
MyWRA, 2012, Station MIB001	20	24,000	12
MyWRA, 2013, Station MIB001	86	1,720	10
MyWRA, 2014, Station MIB001	228	8,160	12
MassDEP, 2013, Station W2401 (prelim.data), 45’ d’stream/east of BrattleSt., Arlington	990	2,990	5

* dry weather high counts

<u>Mill Creek Segment MA71-08</u>

This 0.02 square mile Class SB segment extends from Route 1, Chelsea/ Revere to the confluence with the Chelsea River, Chelsea/ Revere. Chelsea and Revere have coverage under the Phase II National Pollutant Discharge Elimination System (NPDES) stormwater general permit (MAR041077; MAR041057) for their municipal separate storm sewer system (MS4).

Shellfishing use is Prohibited by DMF as of July 1, 2015 (DMF 2015).

Primary and Secondary Contact Recreational use is assessed as impaired for this segment due to elevated Enterococci sample results. Aesthetic use was not assessed due to insufficient available data (MassDEP 2010b).

The Mystic River Watershed Association (MyRWA) Monitoring Network (MMN) monthly bacteria data 2009-2014 for 1 monitoring station (MIC004 at Broadway Bridge, Chelsea) along this segment are summarized in Table 4-45 below.

Table 4-45 MA71-08 Mill Creek Indicator Bacteria Data Summary (MyRWA 2015)

	Min	**Max**	
Site Description	**cfu/100mL**		**n**
MyRWA, 2009 MIC004,	**Enterococci**		
at Broadway Bridge, Chelsea	43	240	5
MyRWA, 2010 Station MIC004	56	630	5
MyRWA, 2011 Station MIC004	--	870	1
MyRWA, 2012 Station MIC004	74	69,000	12
MyRWA, 2013 Station MIC004	52	6,100	10
MyRWA, 2014 Station MIC004	86	1,800	12

Winn Brook Segment MA71-09

The Winn Brook is a 1.4 mile long, Class B segment which runs from its headwaters near Juniper Road and the Belmont Hill School, Belmont to confluence with Little Pond, Belmont. Belmont has coverage under the Phase II National Pollutant Discharge Elimination System (NPDES) stormwater general permits (MAR041074) for their municipal separate storm sewer system (MS4).

Primary and Secondary Contact Recreational use is assessed as impaired for this segment due to elevated Enterococci sample results. Aesthetic use is not assessed due to insufficient available data (MassDEP 2010b).

The Mystic River Watershed Association (MyRWA) Monitoring Network (MMN) monthly *E. coli* bacteria data 2010-2014 for monitoring station (WIB001) along this segment are summarized in Table 4-47.

Table 4-46 MA71-09 Winn Brook Indicator Bacteria Data Summary (MyRWA 2015)

Site Description	Min	Max	n
	Enterococci (cfu/100mL)		
Station WIB001, 2010, on Winn Brook at the outlet to Little Pond, Belmont,	86	11,200	11
Station WIB001, 2011	109	2,250	11
Station WIB001,2012	10	10,500	12
Station WIB001,2013	272	6,870	10
Station WIB001,2014	74	7,700	11

Belle Island Inlet MA71-14

The Belle Island Inlet is a 0.12 square mile, Class SA, inlet estuary water from the Tidegate at Bennington St., Boston/Revere to confluence with Winthrop Bay, Boston/Winthrop. This inlet is bordered on the northeast side by Revere, on the southeast side by Winthrop, and on the west side by East Boston. All three municipalities, Revere, Winthrop, and East Boston (part of Boston) are covered under the Phase II National Pollutant Discharge Elimination System (NPDES) stormwater general permits for their municipal separate storm sewer system (MS4).

The Mystic River Watershed Association (MyRWA) Monitoring Network (MMN) monthly *E. coli* bacteria data 2010-2014 for 1 monitoring station (BEI093 at Crystal Ave., Revere) along this segment are summarized in Table 4-45 below.

DMF Designated Shellfish Growing Areas Status as of July 1, 2015: Prohibited (DMF 2015a).

Primary and Secondary Contact Recreation and Aesthetic uses are not assessed due to insufficient data (MassDEP 2010b).

Table 4-47 MA71-14 Belle Island Inlet Indicator Bacteria Data Summary (MyRWA 2015)

Site Description	Min	Max	n
	E. coli **(cfu/100mL)**		
MyRWA,2010 BEI093 Belle Island Inlet at Crystal Ave in Revere	8	490	5
MyRWA, 2011 BEI093	-	220	1
MyRWA, 2012 BEI093	31	34,000	12
MyRWA, 2013 BEI093	10	1,600	11
MyRWA, 2014 BEI093	10	240	12

Unnamed Tributary MA71-13

The Unnamed Tributary is a 0.1 mile long Class B segment, locally known as 'Meetinghouse Brook', from emergence south of Route 16/east of Winthrop St., Medford to confluence with the north side of the Mystic R., Medford, (brook is not apparent on 1985 Boston North quad; 2005 orthophotos used to delineate). This area is heavily urbanized with high population concentrations of residential, commercial and industrial land-uses. Medford is covered under the Phase II National Pollutant Discharge Elimination System (NPDES) stormwater general permits for their municipal separate storm sewer system (MS4).

This segment was assessed as Impaired for Primary Contact Recreational use due to *E. coli* concentrations exceeding Water Quality Standards of 126 cfu/100 ml. Secondary Contact Recreational use was assessed as supporting but on alert status. During one out of seven years (2002 through 2008) of sampling, *E. coli* exceeded the secondary standard of 630 cfu/100 ml (MassDEP 2010b).

5.0 Potential Sources

The Boston Harbor watershed, has 33 segments that are listed as pathogen impaired requiring TMDLs. These segments represent 100% of the estuary area, 72.5% of the river miles assessed in the Boston Harbor proper, Weir and Weymouth Rivers and Mystic River subwatersheds. Sources of indicator bacteria in a densely populated urban environment, such as the Boston Harbor watershed, are many and varied. A significant amount of work has been done in the 20 years to improve the water quality in the Boston Harbor watershed. Largely through the efforts of the MWRA, DMF, BWSC, MyRWA and MassDEP, numerous point and non-point sources of pathogens have been identified Table 5.1).

Table 5-1 Some of the Potential Sources of Bacteria in Pathogen Impaired Segments in the Boston Harbor Watershed*.

Segment ID	Segment Name	Potential Sources
Boston Harbor Proper Sub-basin[1]		
MA70-10	Winthrop Bay	CSO, urban runoff/storm sewers, illicit boat discharges
MA70-02	Boston Inner Harbor	CSO, urban runoff/storm sewers, illicit boat discharges
MA70-11	Pleasure Bay	Urban runoff/storm sewers, illicit boat discharges
MA70-03	Dorchester Bay	Urban runoff/storm sewers, illicit boat discharges
MA70-04	Quincy Bay	Urban runoff/storm sewers, illicit boat discharges municipal point source (SSO)
MA70-05	Quincy Bay	urban runoff/storm sewers, municipal point source (SSO)
MA70-06	Hingham Bay	Urban runoff/storm sewers, illicit boat discharges, municipal point source (SSO)
MA70-07	Hingham Bay	Urban runoff/storm sewers, illicit boat discharges
MA70-09	Hull Bay	Urban runoff/storm sewers, illicit boat discharges
MA70-01	Boston Harbor	Urban runoff/storm sewers, illicit boat discharges municipal point source (SSO)
Weymouth and Weir Sub-basin		
MA74-06	Cochato River	Urban runoff/storm sewers
MA74-08	Monatiquot River	Urban runoff/storm sewers, municipal point source (SSO)
MA74-09	Town Brook	Urban runoff/storm sewers
MA74-15	Town River Bay	Urban runoff/storm sewers
MA74-14	Weymouth Fore River	Municipal Point source (SSO), urban runoff/storm sewers
MA74-03	Old Swamp River	Municipal point source (SSO), urban runoff/storm sewers
MA74-04	Mill River	Urban runoff/storm sewers
MA74-05	Weymouth Back River	Municipal point source (SSO), urban runoff/storm sewers
MA74-13	Weymouth Back River	Urban runoff/storm sewers, municipal point source (SSO)
MA74-18	Hingham Harbor	Urban runoff/storm sewers, illicit boat discharges
MA74-02	Weir River	Urban runoff/storm sewers
MA74-11	Weir River	Urban runoff/storm sewers, illicit boat discharges
Mystic River Sub-basin[1]		
MA71-01	Aberjona River	Illicit sewer connections, urban runoff/storm sewers, wildfowl
MA71-04	Alewife Brook	CSO, urban runoff/storm sewers, illicit sewer connections
MA71-05	Malden River	Urban runoff/storm sewers
MA71-02	Mystic River	CSO, urban runoff/storm sewers
MA71-06	Chelsea River	CSO, urban runoff/storm sewers, industrial point sources, spills
MA71-03	Mystic River	CSO, urban runoff/storm sewers
MA71-07	Mill Brook	Urban runoff/storm sewers
MA71-14[2]	Belle Island Inlet	Urban runoff/storm sewers
MA71-13[2]	Unnamed Tributary	Urban runoff/storm sewers

Segment ID	Segment Name	Potential Sources
MA71-08[2]	Mill Creek	Urban runoff/storm sewers
MA71-09[2]	Winn Brook	Urban runoff/storm sewers

*MassDEP 2002a, MWRA 2014a

[1] The remaining CSO discharges in this segment are permitted under the SB/CSO designation, subject to the limitations on CSO activations and volumes in the final Long-Term CSO Control Plan.

[2] New Pathogen Impaired Segments that were identified in the Integrated Report (2006 through 2016) after the public comment period for this TMDL, are included in the Boston Harbor Addendum, CN#157.2 that is in the process of being developed.

Some dry weather sources include:

- leaking sewer pipes,
- stormwater drainage systems (illicit connections of sanitary sewers to storm drains),
- failing septic systems,
- wildlife, including birds,
- recreational activities, and
- illicit boat discharges.

Some wet weather sources include:

- wildlife and domesticated animals (including pets),
- stormwater runoff including municipal separate storm sewer systems (MS4),
- combined sewer overflows (CSOs), and
- sanitary sewer overflows (SSOs).

It is difficult to provide accurate quantitative estimates of indicator bacteria contributions from the various sources in the Boston Harbor watershed because many of the sources are diffuse and intermittent, and extremely difficult to monitor or accurately model. Therefore, a general level of quantification according to source category is provided (e.g., see Table 5-2 and Table 5-3). This approach is suitable for the TMDL analysis because it indicates the magnitude of the sources and illustrates the need for controlling them. Additionally, many of the sources (failing septic systems, leaking sewer pipes, sanitary sewer overflows, and illicit sanitary sewer connections) are prohibited, because they indicate a potential health risk and, therefore, must be eliminated. However, estimating the magnitude of overall indicator bacteria loading (the sum of all contributing sources) is achieved for wet and dry conditions using the extensive ambient data available that define baseline conditions (see segment summary tables and MassDEP 2002a, MassDEP 2010a, MassDEP 2010b, MassDEP 2010c).

Sanitary Waste

Leaking sewer pipes, illicit sewer connections, sanitary sewer overflows (SSOs), combined sewer overflows (CSOs) and failing septic systems represent a direct threat to public health since they result in discharge of partially treated or untreated human wastes to the surrounding environment. Quantifying these sources is extremely speculative without direct monitoring of the source because the magnitude is directly proportional to the volume of the source and its proximity to the surface water. Typical values of Fecal coliform in untreated domestic wastewater range from 10^4 to 10^6 MPN/100mL (Metcalf and Eddy 1991).

The Weymouth Fore River and Back River watersheds have had chronic problems with SSOs in both their municipal sewer systems. Problems with this and the MWRA interceptor system are being alleviated by the relatively new Intermediate Pumping Station (part of the MWRA $231 million Braintree/Weymouth Relief Facilities Project). In the past, hydraulic deficiencies in the systems, excessive amounts of infiltration and inflow in the municipal systems, and poor maintenance and operation have led to overflows into areas of public water supplies, shellfishing beds, and bathing beaches. In Weymouth between 1992 and March 1999, 530 overflow events occurred and flowed into Whitman's Pond, Mill River, Back River, Fore River, Old Swamp River, and other undetermined receiving waters. In Braintree between 1993 and 1999, 120 overflow events occurred and discharged to the Fore and Monatiquot River. The MWRA regional sewer system can discharge overflows into the Fore River, Monatiquot River and Smelt Brook. In the past, the MWRA Smelt Brook Siphon overflowed several times each year for periods up to 11 days because of excessive wet weather flows contributed by Weymouth, Braintree, Randolph, Holbrook, and Hingham. However, MWRA's Intermediate Pumping Station, which went on-line in December, 2004, has alleviated most of these discharges.

The Braintree-Weymouth area, along MWRA's Braintree/Weymouth Extension Sewer from the Smelt Brook Siphon downstream to the Mill Cove Siphon, was at considerable risk for backups and SSOs. The MWRA Braintree/Weymouth Relief Facilities Project increased the sewer capacity and eliminated SSO events, in both Braintree and Weymouth, up to, and including storm events of 6 hour duration, with 1.72" total rainfall (MWRA 2008). The Town has seen a significant decrease in the number of overflow events and in the number of days an event will last (Town of Weymouth 2009).

The MWRA and the CSO communities of Cambridge, Somerville and Chelsea, have eliminated 34 of 84 CSO outfalls and virtually eliminated the five remaining outfalls along the South Boston beaches (MWRA 2016).

Illicit sewer connections into storm drains result in direct discharges of sewage via the storm drainage system outfalls. The existence of illicit sewer connections to storm drains is well documented in many urban drainage systems, particularly older systems that may have once been combined. The EPA, MWRA, the Boston Water and Sewer Commission (BWSC) and many communities throughout the Commonwealth have been active in the identification and mitigation of these sources. It is estimated by EPA Region 1 that over one million gallons per day (gpd) of illicit discharges were removed in the last decade. It is probable that numerous other illicit sewer connections exist in storm drainage systems serving the older developed portions of the Boston Harbor watershed.

Monitoring of storm drain outfalls during dry weather is needed to document the presence or absence of sewage in the drainage systems. Approximately 87% of the Boston Harbor watershed (including the Neponset River sub-basin) is classified as Urban Areas by the United States Census Bureau and is therefore subject to the Stormwater Phase II Final Rule. This requires the development and implementation of an Illicit Discharge Detection and Elimination (IDDE) plan (See Section 8.0 of this TMDL for information regarding IDDE guidance). As a Phase I community, the City of Boston was required to apply for a NPDES stormwater individual permit for their MS4. The BWSC received the permit in 1999. The system has 104 major and 102 lesser outfalls.

Septic systems designed, installed, operated and maintained in accordance with 310 CMR 15.000: Title 5, are not significant sources of Fecal coliform bacteria. Studies demonstrate that wastewater located four feet below properly functioning septic systems contain on average less than one Fecal coliform bacteria organism per 100 mL (Ayres Associates 1993). Failed or non-conforming septic systems, however, can be a contributor of pathogens in the Boston Harbor watershed. Wastes from failing septic systems enter surface waters either as direct overland flow or via groundwater. Wet weather events typically increase the rate of transport of pollutant loadings from failing septic systems to surface waters because of the wash-off effect from runoff and the increased rate of groundwater recharge. Local Boards of Health enforce the Title 5 regulations, which require inspection of systems at the time of property transfer and convey broad authority to ensure that septic systems are in compliance with the regulations.

Recreational use of waterbodies is a source of pathogen contamination. Swimmers themselves may contribute to bacterial impairment at swimming areas. When swimmers enter the water, residual fecal matter may be washed from the body and contaminate the water with pathogens. In addition, small children in diapers may contribute to contamination of the recreational waters. These sources are likely to be particularly important when the number of swimmers is high and the flushing action of waves or tides is low.

Another potential source of pathogens is the discharge of sewage from vessels with onboard toilets. These vessels are required to have a marine sanitation device (MSD) to either store or treat sewage. When MSDs are operated or maintained incorrectly they have the potential to discharge untreated or inadequately treated sewage. For example, some MSDs are simply tanks designed to hold sewage until it can be pumped out at a shore-based pump-out facility or discharged into the water more than 3 miles from shore. Uneducated boaters may discharge untreated sewage from these devices into near-shore waters. In addition, when MSDs designed to treat sewage are improperly maintained or operated they may malfunction and discharge inadequately treated sewage. Finally, even properly operating MSDs may discharge sewage in concentrations higher than allowed in ambient water for fishing or shellfishing, or primary and secondary contact recreational activities. Vessels are most likely to contribute to bacterial impairment in situations where large numbers of vessels congregate in enclosed environments with low tidal flushing. Many marinas and popular anchorages are located in such environments.

In 2014, the US EPA approved Massachusetts designation of all of Massachusetts water as a "No Discharge Zone" (NDZ). An NDZ means that any discharge of boat sewage is prohibited. This was enacted to better protect the waters from receiving nutrient and bacterial wastes from any marine vessel operating within these waters.

Wildlife and Pet Waste

Wildlife can be a potential source of pathogens. Geese, gulls, and ducks are speculated to be a major pathogen source, particularly at lakes and stormwater ponds where large resident populations have become established (Center for Watershed Protection 1999).

Household pets such as cats and dogs can be a substantial source of bacteria – as much as 23,000,000 colonies/gram (Center for Watershed Protection 1999). A rule of thumb estimate for the number of dogs is approximately 1 dog per 10 people producing an estimated 0.5 pound of feces per dog per day. In 2000, the US Census reported that 589,141 people live in Boston. This translates to almost 60,000 dogs producing almost 30,000 pounds of feces per day in the City of Boston alone. Uncollected pet waste is then flushed from the parks, beaches and yards where pets are walked and transported into nearby waterways during wet-weather.

Stormwater

Stormwater runoff is another significant contributor of pathogen pollution. As discussed above, during rain events fecal matter from domestic animals and wildlife are readily transported to surface waters via the stormwater drainage systems and/or overland flow. The natural filtering capacity provided by vegetative cover and soils is dramatically reduced as urbanization occurs because of the increase in impervious areas (i.e., streets, parking lots, etc.) and stream channelization in the watershed.

Extensive stormwater data have been collected and compiled both locally and nationally (e.g., Tables 5-2 and 5-3) in an attempt to characterize the quality of stormwater. Bacteria are easily the most variable of stormwater pollutants, with concentrations often varying by factors of 10 to 100 during a single storm. Considering this variability, stormwater indicator bacteria concentrations are difficult to accurately predict. Caution must be exercised when using values from single wet weather grab samples to estimate the magnitude of bacteria loading because it is often unknown whether the sample is representative of the "true" mean. To gain an understanding of the magnitude of indicator bacterial loading from stormwater and avoid overestimating or underestimating indicator bacteria loading, event mean concentrations (EMC) are often used. An EMC is the concentration of a flow proportioned sample throughout a storm event. These samples are commonly collected using an automated sampler which can proportion sample aliquots based on flow. Typical stormwater event mean densities for indicator bacteria (fecal coliform) in Massachusetts watersheds and nationwide are provided in Tables 5-2 and 5-3. These EMCs illustrate that stormwater indicator bacteria concentrations from certain land uses (i.e., residential) are typically at levels sufficient to cause water quality problems.

Table 5-2 Lower Charles River Basin Stormwater Event Mean Bacteria Concentrations (data summarized from USGS 2002)

Land Use Category	Fecal coliform EMC (CFU/100 mL)	Number of Events	Pre-2007[1] Class B WQS	Reduction to Meet Pre-2007 WQS (%)
Single Family Residential	2,800 – 94,000	8	10% of the samples shall not exceed 400 organisms/ 100 mL	2,400 – 93,600 (85.7 – 99.6)
Multifamily Residential	2,200 – 31,000	8		1,800 – 30,600 (81.8 – 98.8)
Commercial	680 – 28,000	8		280 – 27,600 (41.2 - 98.6)

[1] This table was developed under the previous Class B Standard (revised in 2007): Shall not exceed a geometric mean of 200 organisms in any set of representative samples, nor shall 10% of the samples exceed 400 organisms. Used 400 to illustrate required reductions in the "Reduction to Meet WQS (%)" Column. The current standards are discussed in the Executive Summary and Section 1.

Table 5-3 Stormwater Event Mean Fecal coliform Concentrations (as reported in MassDEP 2002c; original data provided in Metcalf & Eddy, 1992)

Land Use Category	Fecal coliform[1] Organisms / 100 mL	Pre-2007 Class B WQS [2]	Reduction to Meet Pre-2007 WQS(%)
Single Family Residential	37,000	10% of the samples shall not exceed 400 organisms/ 100 mL	36,600 (98.9)
Multifamily Residential	17,000		16,600 (97.6)
Commercial	16,000		15,600 (97.5)
Industrial	14,000		13,600 (97.1)

[1] Derived from NURP study event mean concentrations and nationwide pollutant buildup data (EPA 1983).

[2] This table was developed under the previous Class B Standard (revised in 2007): Shall not exceed a geometric mean of 200 organisms in any set of representative samples, nor shall 10% of the samples exceed 400 organisms. Used 400 to illustrate required reductions in the "Reduction to Meet WQS (%)" Column. The current standards are discussed in the Executive Summary and Section 1.

6.0 Prioritization and Known Sources

Interventions to address water quality issues have been carried out by Towns, organizations, state agencies, and citizens to resolve various water quality problems in the basin. Nutrient identification and source discovery has been the emphasis, however, measures to address nutrients, in an ancillary way, have addressed pathogen pollution and its principal sources. As the introduction states, the principal contributors in general are CSOs, SSOs, and overland stormwater flows as these pick up various pollutants, such as wildlife and pet wastes, and garbage, etc. Particularly strident efforts are necessary in controlling pollutants such as bacteria because the geography of this watershed is shaped as such that most of it is closely oriented (within a few miles) to coastal/estuarine locations that have a high proportion of potential shellfishing usage. The standards for these potential shellfishing waters (<14 cfu/100mL fecal coliform) are far more stringent than the primary contact recreation standard for inland Class B waters (formerly <200 cfu/100mL, now <126 cfu *E. coli*). All the drainage areas, including rivers, streams and smaller tributaries from the inland areas, must have especially clean waters/very low background bacteria levels in order for shellfishing beds to open up in presently closed areas. Tables 6-1, 6-2, and 6-3 provides a listing of the segments covered in this TMDL and prioritization for implementation strategies based on principal bacteria sources.

Boston Harbor Proper Sub-basin

In 1982, the US Environmental Protection Agency (EPA) and the Conservation Law Foundation filed a lawsuit against the Metropolitan District Commission (MDC), the Boston Water and Sewer Commission, and the Commonwealth of Massachusetts, for violating the 1972 Clean Water Act in Boston Harbor. In 1985, a federal court ordered Boston to improve sewage treatment and issued a compliance schedule. To accomplish this, the Massachusetts Water Resources Authority (MWRA) was formed, and the MWRA began the Boston Harbor Project. Wastewater had been treated at the MWRA Deer Island and Nut Island primary treatment facilities until the new Deer Island Sewage Treatment Plant was completed in 2001. The new 9.5 mile outfall discharges treated wastewater further out into the ocean through openings in the last 6,600 feet of pipe, 100 feet below the surface. The Deer Island Wastewater Treatment Plant receives sewage from 43 greater Boston communities and has a higher capacity than the combined capacities of the former Deer Island and Nut Island facilities, greatly reducing back-ups and overflows throughout the system. The sewage passes through primary and secondary treatment, sludge digestion, disinfection, eventually discharging through a 9.5 mile tunnel into Massachusetts Bay (MWRA 2008).

Combined Sewer Overflow (CSO) discharges have decreased due to ongoing implementation of the MWRA Long-Term CSO Control Plan (MWRA 2004a). The MWRA developed a Three-Phase CSO Plan in 1994 and received approvals from EPA, MassDEP and the Federal Court on a final long-term plan in 2006. MWRA has completed all of the 35 projects in the long-term plan, closed 38 of the 84 CSO outlets that were active at plan inception, and reduced system wide CSO discharge volume in a typical rainfall year by 86%, from 3.3 billion gallons in 1988 to 0.49 billion gallons as of 2015. Treatment (screening, disinfection and dechlorination, at a minimum) of 89% of the remaining discharge occurs at MWRA's four CSO facilities, including a new facility brought on-line in 2007 at the Union Park Pumping Station in the South End (MWRA, 2014a).

There have been significant improvements to receiving waters since the wastewater upgrades were completed and the discharge location was moved further offshore. These include: 30-55% reductions in concentrations of phosphorus and nitrogen, 25-30% reductions of chlorophyll, 30% reduction of particulate organic carbon, and 5% increases in bottom water dissolved oxygen levels (Taylor 2006). This translates to other data in Boston Harbor such as improvements in bacteria levels as well (NEERS 2006). Subsequent reports and studies show further improvements in all these parameters, with 2013 nitrogen and phosphorus concentrations the lowest measured since 1995, bottom-water concentrations of dissolved oxygen the highest since wastewater discharges ended in the Harbor, and symptoms of over-enrichment within the Harbor significantly improved (Taylor 2011; Taylor 2013).

In a 2011 paper published in the journal "Estuaries and Coasts", Taylor and colleagues updated the changes observed in the harbor water-column since the completion of the Boston Harbor Project. They report data through 2007, and note that the changes observed shortly after the discharges from Deer Island were diverted offshore have been sustained since. Nitrogen (N) and Phosphorus (P) concentrations in the harbor have been decreased by 30%, ammonium concentrations by 80%, and ratios of dissolved inorganic N:dissolved inorganic P by 30%. Phytoplankton standing stocks (measured as chlorophyll) have decreased by 30-40%, and the minimum bottom-water DO concentrations have increased by 12% (Taylor 2011).

From 2013 data, the water quality improvements observed after the Deer Island and Nut Island wastewater discharges to the harbor were discontinued in 2000, continue to be sustained (see website reference below). Symptoms of over-enrichment of the harbor continue to improve. Calendar year 2013 N and P concentrations in the harbor water were the lowest observed since 1995. Bottom-water DO concentrations in 2013 were the highest observed since the wastewater discharges to the harbor were discontinued. Amounts of algae in the harbor water were slightly higher than many of the years since the discharges to the harbor were discontinued, but remain lower than during years the harbor received the discharges. Enterococci counts in both the Inner Harbor and Outer Harbor were among the lowest since the discharges were discontinued (Taylor 2013). For the latest MWRA detailed summary report on overall parameter data improvements in the harbor: http://www.mwra.state.ma.us/harbor/enquad/pdf/2016-08.pdf
and http://www.mwra.state.ma.us/harbor/enquad/pdf/2016-14.pdf.

Prioritization of Future Activities

In an effort to provide guidance for setting bacterial implementation priorities within the Boston Harbor, Weymouth-Weir, and Mystic Watersheds, summary tables are provided. Tables 6-1 to 6-3 that follow provide a prioritized list of pathogen-impaired segments that will require additional bacterial source tracking work and stepwise implementation of structural and non-structural Best Management Practices (BMPs). Priority should be given to monitoring segments where there is insufficient information to understand the current conditions. Since limited source information and data are available in each impaired segment, a simple scheme was used to prioritize segments based on bacteria concentrations. Data for the 303d listed segments in Boston Harbor Proper, the Weir-Weymouth Sub-basin, and the Mystic Sub-basin are listed in Tables 4-7 to 4-47 in Section 4 of this report.

High priority was assigned to those segments where dry or wet weather concentrations were equal to or greater than 10,000 col/100 ml since such high levels generally indicate a direct sanitary source. Medium priority was assigned to segments where concentrations ranged from 1,000 to 9,999 col/100ml since this range of concentrations generally indicates a direct sewage source that may get diluted in the conveyance system. Low priority was assigned to segments where concentrations were observed less than 1,000 col/100 ml. The highest Fecal coliform or Enterococci counts from Table 4-7 to 4-47 of this report were used. It should be noted that in all cases, waters identified in Table 6-1 to 6-3 exceed the water quality standards for bacteria, and are thereby considered impaired.

Also, prioritization is adjusted upward based on proximity of waters, within the segment, to sensitive areas such as Outstanding Resource Waters (ORW's), or designated uses that require higher water quality standards than Class B or SB, such as public water supply intakes, public swimming areas, or shellfish areas. Best professional judgment was used in determining this upward adjustment. Generally speaking, waters that were determined to be lower priority based on the numeric range identified above were elevated up one level of priority if that segment were adjacent to or immediately upstream of a sensitive use such as an ORW or a public drinking water source. An asterisk * in the priority column of the specific segment would indicate this situation.

MassDEP believes that segments ranked as high priority in Tables ES-1 to ES-3 are indicative of the potential presence of raw sewage and therefore they pose a greater risk to the public. These segments should continue to be subject to aggressive efforts to identify and eliminate illicit wastewater connections to the stormdrain systems. CSOs and Sanitary Sewer Overflows (SSOs) have historically been a significant contributor to bacteria pollution to the Harbor area, and the MWRA CSO Program Assessment being conducted under the federal court order, together with the information being gathered under the terms and conditions of the CSO Variance should be focused on determining the impacts of remaining CSO discharges, and the feasibility of higher levels of CSO control. Eliminating illicit connections, reducing the risk of SSO events, and fixing failing infrastructure is tantamount to improving bacterial water quality. As the bacteria loads from SSOs and CSOs continue to decline it is anticipated that stormwater discharges from Phase I and Phase II regulated communities will remain the predominate source of bacteria pollution along with non-point sources such as failing septic systems.

A top priority activity for finding illicit connection sources should be bacteria source tracking activities during dry weather in those segments where sampling activities show elevated levels of bacteria during dry weather. Identification and remediation of dry weather bacteria sources is usually more straightforward and successful than tracking and eliminating wet weather sources. If illicit bacteria sources are found and eliminated it should result in a dramatic reduction of bacteria concentration in the segment in both dry and wet-weather.

Finding and fixing the bacteria related pollution sources from failed infrastructure poses real challenges for the most part. Overland stormwater runoff greatly exacerbates the pollution from failed infrastructure sources. Segments that remain impaired during wet weather should be evaluated for stormwater BMP implementation opportunities starting with less costly non-structural practices first (such as street sweeping, catch basin cleaning, and/or managerial approaches using local regulatory controls), and lastly, more expensive structural measures. Unfortunately, many failed infrastructure problems require the more expensive structural repair measures to be considered. This would require additional study to identify the most cost efficient and effective technology.

Table 6-1 Pathogen Impaired Segment Priorities- Boston Harbor Proper Sub-Watershed

Segment ID	Segment Name Waterbody Class	Segment Size(m^2)	Segment Description	Priority	Indicators
MA70-10	Winthrop Bay, Class SB	1.65 mi^2	From the tidal flats at Coleridge Street, Boston (East Boston) to a line between Logan International Airport and Point Shirley, East Boston/Winthrop	High*, Shellfishing, Public Swimming	Enterococci, Fecal Coliform
MA70-02	Boston Inner Harbor, Class SB/CSO[1]	2.56 mi^2	From the Mystic and Chelsea rivers, Chelsea/Boston, to the line between Governors Island and Fort Independence, Boston (East Boston), including Fort Point, Reserved, and Little Mystic Channels).	High*, Shellfishing	Enterococci, Fecal Coliform
MA70-11	Pleasure Bay, Class SB	0.22 mi^2	A semi-enclosed bay, the flow restricted through two channels between Castle and Head islands, Boston	High*, Shellfishing, Public Swimming	Enterococci, Fecal Coliform,
MA70-03	Dorchester Bay, Class SB	3.46 mi^2	From the mouth of the Neponset River, Boston/Quincy to the line between Head Island and the north side of Thompson Island and the line between the south point of Thompson Island, Boston and Chapel Rocks, Quincy.	High*, Shell-Fishing, Public Swimming	Enterococci, Fecal Coliform
MA70-04	Quincy Bay, Class SA	1.52 mi^2	From Bromfield Street near the Wollaston Yacht Club, Quincy, northeast to N42 17.3 W71 00.1, then southeast to Houghs Neck near Sea Street and Peterson Road (formerly referred to as the “Willows”) Quincy.	Medium* Shell-fishing	Enterococci, Fecal Coliform
MA70-05	Quincy Bay, Class SB	4.41 mi^2	Quincy Bay, north of the class SA waters (segment MA70-04), Quincy to the line between Moon Head and Nut Island, Quincy	High*, Dry Weather Problems, Shellfish, Public Swimming	Enterococci, Fecal Coliform
MA70-06	Hingham Bay, Class SB	0.96 mi^2	The area north of the mouth of the Weymouth Fore River extending on the west along the line from Prince Head just east of Pig Rock to the mouth of the Weymouth Fore River (midway between Lower Neck and Manot Beach), Quincy	Medium* Shellfish.	Fecal Coliform
MA70-07	Hingham Bay, Class SB	4.8 mi^2	The area defined between Peddocks Island and Windmill Point; from Windmill Point southeast to Bumkin Island; from Bumkin Island southeast to Sunset Point; from Sunset Point across the mouth of the Weir River to Worlds End; from Worlds End across the mouth of Hingham	Medium* Shellfish.	Fecal Coliform

Segment ID	Segment Name Waterbody Class	Segment Size(m^2)	Segment Description	Priority	Indicators
			Harbor to Crow Point; from Beach Lane, Hingham across the mouth of the Weymouth Back River to Lower Neck; and from Lower Neck midway across the mouth of the Weymouth Fore River		
MA70-09	Hull Bay, Class SB	2.48 mi^2	The area defined east of a line from Windmill Point, Hull to Bumpkin Island, Hingham and from Bumpkin Island to Sunset Point, Hull	Medium* Shellfish.	Fecal Coliform
MA70-01	Boston Harbor, Class SB	18.59 mi^2	The area defined by a line from the southerly tip of Deer Island to Boston Lighthouse on Little Brewster Island, then south to Point Allerton; across Hull and West guts; across the mouths of Quincy and Dorchester Bays, Boston Inner Harbor and Winthrop Bay (including Presidents Roads and Nantasket Roads)	High*, Shellfish.	Fecal Coliform

[1] The remaining CSO discharges in this segment are permitted under the SB/CSO designation subject to the limitations on CSO activations and volumes in the final MWRA Long-Term CSO Control Plan.

Table 6-2 Pathogen Impaired Segment Priorities- Weir & Weymouth Sub-Watershed

Segment ID	Segment Name	Segment Size (mi or m^2)	Segment Description	Priority	Indicators
MA74-06	Cochato River, Class B	4.1 mi	Outlet Lake Holbrook, Holbrook to confluence with Farm and Monatiquot Rivers, Braintree (through former pond segment Ice House Pond MA74028). (SARIS note: the upper portion of this segment is comprised of three surface waters: unnamed tributary from the outlet of Lake Holbrook, portion of Mary Lee Brook, portion of Glovers Brook).	Medium	*E. coli*
MA74-08	Monatiquot River, Class B	4.4 mi	Headwaters at confluence of Cochato and Farm Rivers, Braintree to confluence with Weymouth Fore River at Commercial Street, Braintree	Medium, Wet and Dry Weather Problems	*E. coli*
MA74-09	Town Brook, Class B/SB	3.5 mi	Outlet Old Quincy Reservoir, Braintree to confluence with Town River Bay north of Route 3A, Quincy (includes “The Canal”/Town River) (portions culverted underground).	High, Wet and Dry Weather Problems	*E. coli*
MA74-15	Town River Bay, Class SA	0.46 mi^2	From the headwaters at the Route 3A bridge, Quincy to the mouth at the Weymouth Fore River between Shipyard and Germantown Points, Quincy.	High* Shellfishing, Public Swimming	Enterococci, Fecal Coliform
MA74-14	Weymouth Fore River, Class B/SB	2.29 mi^2	Commercial Street, Braintree to mouth (eastern point at Lower Neck, Weymouth and western point at Wall Street on Houghs Neck, Quincy	High* Shellfishing, Public Swimming	Enterococci, Fecal Coliform
MA74-03	Old Swamp	5.2 mi	Headwaters just west of Pleasant Street and	High*, Public	*E. coli*,

Segment ID	Segment Name	Segment Size (mi or m^2)	Segment Description	Priority	Indicators
	River, Class A (PWS Trib)		north of Liberty Street, Rockland to inlet Whitmans Pond, Weymouth	Water Supply	Enterococci
MA74-04	Mill River, Class A (PWS Trib)	3.4 mi	Headwaters, west of Route 18 and south of Randolph Street, Weymouth to inlet Whitmans Pond, Weymouth (portions culverted underground).	High* Public Water Supply	*E. coli*
MA74-05	Weymouth Back River, Class B (ORW)	0.4 mi	Outlet Elias Pond, Weymouth to the base of the fish ladder north of Commercial Street, Weymouth	High* ORW Wet and Dry Weather Problem	*E. coli*
MA74-13	Weymouth Back River, Class SA	0.86 mi^2	From the base of the fish ladder north of Commercial Street, Weymouth to mouth between Lower Neck to the west and Wompatuck Road, Hingham.	Medium* Shellfishing, Public Swimming	Enterococci, Fecal Coliform
MA74-18	Hingham Harbor, Class SA	1.12 mi^2	Hingham Harbor, inside a line from Crows Point to Worlds End, Hingham (formerly reported as MA70-08).	Medium* Shellfishing, Public Swimming	Enterococci, Fecal Coliform
MA74-02	Weir River, Class B/SA	2.7 mi	Headwaters at confluence of Crooked Meadow River and Fulling Mill Brook, Hingham to Foundry Pond Outlet, Hingham (through former pond segment Foundry Pond MA74011).	Medium*	*E. coli*
MA74-11	Weir River, Class SA	0.83 mi	From Foundry Pond outlet, Hingham to mouth at Worlds End, Hingham and Nantasket Road near Beech Avenue, Hull (including unnamed tributary from outlet Straits Pond, Hingham/Hull).	Medium* Shellfishing, Public Swimming	Enterococci, Fecal Coliform

Table 6-3 Pathogen Impaired Segment Priorities- Mystic River[1] Sub-basin

Segment ID	Segment Name	Segment size(mi, or m^2)	Segment Description	Priority	Indicator
MA71-01	Aberjona River, Class B	9.1 mi.	Source just south of Birch Meadow Drive, Reading to inlet Upper Mystic Lake at Mystic Valley Parkway, Winchester (portion culverted underground). (through former pond segments Judkins Pond MA71021 and Mill Pond MA71031).	High, Wet Weather	*E. coli*, Enterococci
MA71-04	Alewife Brook, Class B CSO Variance[1]	2.3 mi.	Outlet of Little Pond, Belmont to confluence with Mystic River, Arlington/Somerville (portion in Belmont and Cambridge identified as Little River with name changing to Alewife Brook at Arlington corporate boundary).	High, Dry and Wet Weather Problems	*E. coli*, Enterococci
MA71-05	Malden River, Class B	2.3 mi.	Headwaters south of Exchange Street, Malden to confluence with Mystic River, Everett/Medford.	High, Wet and Dry Weather	*E. coli*, Enterococci

Segment ID	Segment Name	Segment size(mi, or m^2)	Segment Description	Priority	Indicator
				Problems	
MA71-02	Mystic River, Class B** CSO Variance[1]	4.9 mi.	Outlet Lower Mystic Lake, Arlington/Medford to Amelia Earhart Dam, Somerville/Everett	High, CSO. Wet and Dry Weather Problems	*E. coli*, Enterococci
MA71-06	Chelsea River, Class SB/CSO[2]	0.38 mi^2	From confluence with Mill Creek, Chelsea/Revere to confluence with Boston Inner Harbor, Mystic River, Chelsea/East Boston/Charlestown	High*, Wet and Dry Weather Problems	Fecal Coliform
MA71-03	Mystic River, Class SB/CSO[2]	0.49 mi^2	Amelia Earhart Dam, Somerville/Everett to confluence with Boston Inner Harbor, Chelsea/Charlestown (Includes Island End River).	High*, Shellfishing, CSO. Wet and Dry Weather Problems	Fecal Coliform
MA71-07	Mill Brook Class B	3.9 mi	Headwaters south of Massachusetts Avenue, Lexington to inlet of Lower Mystic Lake, Arlington (portions culverted underground)	High, Wet and Dry Weather Problems	*E. coli*, Enterococci
MA71-08[3]	Mill Creek Class SB	0.02 mi^2	From Route 1, Chelsea/Revere to confluence with Chelsea River, Chelsea/Revere.	High, Wet Weather Problems	Fecal Coliform
MA71-09[3]	Winn Brook Class B	1.4 mi	Headwaters near Juniper Road and the Belmont Hill School, Belmont to confluence with Little Pond, Belmont (portions culverted underground).	High, Wet and Dry Weather Problems	*E. coli*, Enterococci
MA71-14[3]	Belle Isle Inlet Class SA	0.12 mi^2	From the Tidegate at Bennington Street, Boston/Revere to confluence with Winthrop Bay, Boston/Winthrop	High*, ORW, Wet Weather Problems, Shellfishing	Fecal Coliform
MA71-13[3]	Unnamed Tributary Class B**	0.1 mi	Unnamed tributary locally known as 'Meetinghouse Brook', from emergence south of Route 16/east of Winthrop Street, Medford to confluence with the Mystic River, Medford. (brook not apparent on the 1985 Boston North USGS quad – 2005 orthophotos used to delineate stream)	Medium*, Wet Weather Problems	*E. coli*, Enterococci
** may have salt influx					

[1] Remaining CSO discharges are permitted under a modification of water quality standards, as analyses are conducted and progress is made to improve water quality.

[2] The remaining CSO discharges in this segment are permitted under the SB/CSO designation subject to the limitations on CSO activations and volumes in the final MWRA Long-Term CSO Control Plan.

[3] New Pathogen Impaired Segments that were identified in the Integrated Report (2006 through 2014) after the public comment period for this TMDL, are included in the Boston Harbor Addendum, CN#157.2, that is in the process of being developed.

7.0 Pathogen TMDL Development

Section 303 (d) of the Federal Clean Water Act (CWA) requires states to identify waters that do not meet the water quality standards on a list of impaired waterbodies. The *2014 Integrated List of Waters* (MassDEP 2015) identifies 33 segments within the Boston Harbor Watershed, including Mystic and Weymouth-Weir subwatersheds, for use impairment caused by excessive indicator bacteria concentrations. (Four of the 33 segments will be included in the Boston Harbor, Mystic, Weymouth and Weir Addendum, CN#157.2)

The CWA requires each state to establish Total Maximum Daily Loads (TMDLs) for listed waters and the pollutant contributing to the impairment(s). TMDLs determine the amount of a pollutant that a waterbody can safely assimilate without violating the water quality standards. Both point and non-point pollution sources are accounted for in a TMDL analysis. EPA regulations require that point sources of pollution (those discharges from discrete pipes or conveyances) subject to NPDES permits receive a waste load allocation (WLA) specifying the amount of a pollutant they can release to the waterbody. Non-point sources of pollution (all sources of pollution other than point) receive load allocations (LA) specifying the amount of a pollutant that they can release to the waterbody. In the case of stormwater, it is often difficult to identify and distinguish between point source discharges that are subject to NPDES regulation and those that are not. Therefore EPA has stated that it is permissible to include all point source stormwater discharges in the WLA portion of the TMDL. MassDEP has taken this approach. In accordance with the CWA, a TMDL must account for seasonal variations and a margin of safety, which accounts for any lack of knowledge concerning the relationship between effluent limitations and water quality. Thus:

TMDL = WLAs + LAs + Margin of Safety (MOS)

Where:

WLA = Waste Load Allocation which is the portion of the receiving water's loading capacity that is allocated to each existing and future point sources of pollution.

LA = Load Allocation which is the portion of the receiving water's loading capacity that is allocated to each existing and future non-point source of pollution.

MOS = Margin of safety, either explicitly or implicitly.

This TMDL uses an alternative standards-based approach, which is based on indicator bacteria concentrations, but considers the terms of the above equation. This approach is more in line with the way bacteria pollution is regulated (i.e., according to concentrations standards), however, the standard loading approach is provided as well.

7.1 General Approach: Development of TMDL Targets

For this TMDL the MassDEP developed two types of daily TMDL targets. First, MassDEP set daily concentration TMDL targets for all potential pathogen sources by category (i.e., stormwater, NPDES, etc.) and surface water classification. Expressing a loading capacity for bacteria in terms of concentrations set equal to the Commonwealth's adopted criteria, as provided in Table 7-1, provides the clearest and most understandable expression of water quality goals to the public and to groups that conduct water quality monitoring. MassDEP recommends that the concentration targets be used as the primary guide for implementation (see Section 7.2).

Second, MassDEP estimated the total maximum daily load for each river, segment as a function of flow (19 Boston Harbor river segments). 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 varies with flow over the course of the day and season. Also, the loading numbers are very large (i.e. billions or trillions of bacteria per day) and therefore difficult to interpret as they do not relate directly to the State Water Quality Standards or public health criteria.

For embayments, however, total maximum daily pathogen loads were typically calculated based on long-term average runoff volumes. Because of runoff morphology in the Boston Harbor watershed, for the purposes of this report, the loadings calculations for 14 estuary segments were estimated by using 1) the concentration allowed by appropriate criteria from the Massachusetts Water Quality Standards and 2) the estimated volume of runoff entering the embayment from each contributing watershed (See Section 7.3 for detailed methodology).

It is important to note that MassDEP realizes given the vast potential number of bacteria sources and the difficulty of identifying and removing them from sources such as stormwater require an iterative process and that will take some time to accomplish. While the stated goal in the TMDL is to meet the water quality standard at the point of discharge, it is also MassDEP's expectation that for stormwater, an iterative approach is needed that includes prioritization of outfalls and the application of BMPs to achieve water quality standards. MassDEP believes this approach is consistent with current EPA guidance and regulations as stated in a November 22, 2002 EPA memo from Robert Wayland with an addendum from Andrew Sawyers provided November 26, 2014 (see Attachment B).

7.2 Waste Load Allocations (WLAs) and Load Allocations (LAs) As Daily Concentration (CFU/100mL).

To ensure attainment with water quality standards throughout the waterbody, MassDEP emphasizes the simplest and most readily understood way of meeting the TMDL is to have a goal of bacteria sources not exceeding the WQS criteria at the point of discharge. This is also an implicit conservative approach with respect to the MOS.

Sources of indicator bacteria in the Boston Harbor Watershed are varied; however data indicate that most of the bacteria sources are likely stormwater related. (Sections 4, 5 and 6 of this document discuss in more detail the types of sources identified as well as their prioritization for implementation). Point sources within the Boston Harbor Watershed that can potentially affect bacteria pollution levels include permitted wastewater discharges, CSOs and 39 communities regulated under the Stormwater Phase I and Phase II MS4 Program.

NPDES wastewater discharge WLAs for WWTPs are set at the water quality standards. All piped discharges are, by definition, point sources regardless of whether they are currently subject to the requirements of NPDES permits. Therefore, a WLA set equal to the WQS criteria will be assigned to the portion of the stormwater that discharges to surface waters via storm drains. For any illicit sources including illicit discharges to stormwater systems and sewer system overflows (SSO's) the goal is complete elimination (100% reduction). The specific goal for controlling combined sewer overflows (CSO's) is meeting water quality standards through implementation of approved Long-Term Control Plans. It is recommended that these concentration targets be used to guide implementation. The goal to attain WQS at the point of discharge is environmentally protective, and offers a practical means to identify and evaluate the effectiveness of control measures. In addition, this approach establishes clear objectives that can be easily understood by the public and others responsible for monitoring activities. Success of control efforts and subsequent conformance with the TMDL will be determined by documenting that a sufficient number of bacteria samples from receiving water meet the appropriate indicator criteria (WQS) for the water body.

Table 7-1 presents the TMDL indicator bacteria WLAs and LAs for the various source categories as daily concentration targets for the Boston Harbor Watershed. WLAs (to address point sources of pollution) and LAs (to address non-point sources of pollution) are presented below. The full version of the current WQS can be accessed at the MassDEP website: http://www.mass.gov/eea/agencies/massdep/water/regulations/314-cmr-4-00-mass-surface-water-quality-standards.html

Table 7-1 Waste Load Allocations (WLAs) and Load Allocations (LAs) As Daily Concentrations (CFU/100ml).

Surface Water Classification	Pathogen Source	Waste Load Allocation Indicator Bacteria (cfu/100 mL)[1]	Load Allocation Indicator Bacteria (cfu/100 mL)[1]
A, B, SA, SB (prohibited)	Illicit discharges to storm drains	0	Not Applicable

Surface Water Classification	Pathogen Source	Waste Load Allocation Indicator Bacteria (cfu/100 mL)[1]	Load Allocation Indicator Bacteria (cfu/100 mL)[1]
	Leaking sanitary sewer lines	0	Not Applicable
	Failing septic systems	Not Applicable	0
A (Includes filtered water supply) & **B**	Any regulated discharge-including stormwater runoff[4] subject to Phase I or II NPDES permits, NPDES wastewater treatment plant discharges [7,9].	Either; *E. coli* <=geometric mean[5] 126 colonies per 100 mL; single sample <=235 colonies per 100 mL[11]; or b) Enterococci geometric mean[5] <= 33 colonies per 100 mL and single sample <= 61 colonies per 100 mL[11]	Not Applicable
	Nonpoint source stormwater runoff[4]	Not Applicable	Either *E. coli* <=geometric mean[5] 126 colonies per 100 mL; single sample <=235 colonies per 100 mL; or Enterococci geometric mean[5]<= 33 colonies per 100 mL and single sample <= 61 colonies per 100 mL
SA (Approved for shellfishing)	Any regulated discharge - including stormwater runoff[4] subject to Phase I or II NPDES permits, NPDES wastewater treatment plant discharges[7,9].	Fecal Coliform <= geometric mean, MPN, of 14 organisms per 100 mL nor shall 10% of the samples be >=28 organisms per 100 mL	Not Applicable
	Nonpoint Source Stormwater Runoff[4]	Not Applicable	Fecal Coliform <= geometric mean, MPN, of 14 organisms per 100 mL nor shall 10% of the samples be >=28 organisms per 100 mL
SA & SB[10] (Beaches[8] and non-designated shellfish areas)	Any regulated discharge - including stormwater runoff[4] subject to Phase I or II NPDES permits, NPDES wastewater treatment plant discharges[7,9].	Enterococci - geometric mean[5] <= 35 colonies per 100 mL and single sample <= 104 colonies per 100 mL[11]	Not Applicable
	Nonpoint Source Stormwater Runoff[4]	Not Applicable	Enterococci -geometric mean[5] <= 35 colonies per 100 mL and single sample <= 104 colonies per 100 mL
SB (Approved for shellfishing w/depuration)	Any regulated discharge - including stormwater runoff[4] subject to Phase I or II NPDES permits, NPDES wastewater treatment plant discharges[7,9].	Fecal Coliform <= median or geometric mean, MPN, of 88 organisms per 100 mL nor shall 10% of the samples be >=260 organisms per 100 mL[11]	Not Applicable

Surface Water Classification	Pathogen Source	**Waste Load Allocation Indicator Bacteria (cfu/100 mL)[1]**	**Load Allocation Indicator Bacteria (cfu/100 mL)[1]**
	Nonpoint Source Stormwater Runoff[4]	Not Applicable	Fecal Coliform <= median or geometric mean, MPN, of 88 organisms per 100 mL nor shall 10% of the samples be >=260 organisms per 100 mL
SB/CSO (segments Boston Inner Harbor(MA 71-02)[12], Chelsea River (MA 71-06), Mystic River (MA 71-03)[12]	Any regulated discharge - including stormwater runoff[4] subject to Phase I or II NPDES permits, NPDES wastewater treatment plant discharges[7,9], and combined sewer overflows[6].	**For Non-CSO Discharges:** Enterococci - geometric mean[5] <= 35 colonies per 100 mL and single sample <= 104 colonies per 100 mL[11] **For CSO Discharges**: CSO activations and volumes limited to those included and identified in permitted MWRA Long-Term CSO Control Plans.[12]	Not Applicable
	Nonpoint Source Stormwater Runoff[4]	Not Applicable	Enterococci -geometric mean[5] <= 35 colonies per 100 mL and single sample <= 104 colonies per 100 mL
B/CSO Variance Alewife Brook (MA 71-04), Upper Mystic (MA71-02)	Combined Sewer Overflows	CSO activations and volumes limited to those included and identified in the permitted MWRA Long-Term CSO Control Plan.[12]	Not applicable

[1] Waste Load Allocation (WLA) and Load Allocation (LA) refer to fecal coliform densities unless specified in table.
[2] In all samples taken during any 6 month period
[3] In 90% of the samples taken in any six month period;
[4] The expectation for WLAs and LAs for stormwater discharges is that they will be achieved through the implementation of BMPs and other controls.
[5] Geometric mean of the 5 most recent samples is used at bathing beaches. For all other waters and during the non-bathing season the geometric mean of all samples taken within the most recent six months, typically based on a minimum of five samples.
[6] Or other applicable water quality standards for CSO's
[7] Or shall be consistent with the Waste Water Treatment Plant (WWTP) National Pollutant Discharge Elimination System (NPDES) permit.
[8] Massachusetts Department of Public Health regulations (105 CMR Section 445)
[9] Seasonal disinfection may be allowed by the Department on a case-by-case basis.
[10] Segments designated as CSO have a long term control plan in place.
[11] Threshold for beach closure. Beaches Environmental Assessment and Coastal Health (BEACH) Act amended the Clean Water Act in 2000.
[12] See Second Stipulation of the United States and the Massachusetts Water Resources Authority on "Responsibility and Legal Liability for Combined Sewer Overflow Control" filed in US District Court on March 15, 2006. (MWRA 2006).

Note: This table represents waste load and load allocations based on water quality standards current as of the publication date of these TMDLs. If the pathogen criteria change in the future, MassDEP intends to revise the TMDL by addendum to reflect the revised criteria.

It is recommended that these concentration targets be used to guide implementation. The goal to attain WQS at the point of discharge is environmentally protective and offers a practical means to identify and evaluate the effectiveness of control measures. In addition, this approach establishes clear objectives that can be easily understood by the public and others responsible for monitoring activities. Success of the control efforts and subsequent conformance with the TMDL can be determined by documenting that a sufficient number of valid bacteria samples from the receiving water meet the appropriate indicator criteria (WQS) for the water body. Compliance will be measured by concentrations measured in the receiving water.

Potential Sources of Bacterial Contamination

Some insight on potential sources of bacteria is gained using dry or wet weather bacteria concentrations as a benchmark for reductions. Where a segment is identified as having elevated levels during dry weather, sources such as permitted discharges, failing septic tanks, illicit sanitary sewers connected to storm drains, and/or leaking sewers, may be the primary contributors. Where elevated levels are observed during wet weather potential sources may include flooded septic systems, surcharging sewers (combined sewer overflows or sanitary sewer overflows), and/or stormwater runoff. In urban areas sources of elevated bacteria concentrations can include runoff in areas with high populations of domestic animals or pets. Other potential sources include sanitary sewer connected to storm drains that result in flow that is retarded until the storm drain is flushed during wet weather. Sections 4, 5 and 6 of this document discuss in more detail the types of sources identified as well as their prioritization for implementation.

7.3 TMDL Expressed as Daily Load (CFU/Day)

The following section describes the approach for deriving allowable daily bacteria loads for the Boston Harbor Watershed.

7.3.1 Rivers

Flow in rivers and streams are highly variable. Nearly all are familiar with seeing the same river as a raging torrent and at another time as just a trickle. In many areas, seasonal patterns are evident. A common pattern is high flow in the spring when winter snow melts and spring rains swell rivers. Summer time generally is a period of low flows except for the extreme events of heavy rainfall storms up the scale to hurricanes. Across the United States, the US Geological Survey and others maintain a network of stream gages that measure these flows on a continuous basis thus providing quantitative values to the qualitative scenes described above. These flow measurements are reported in terms of a volume of water passing the gage in a given time period. Often the reported values are in cubic feet per second. A cubic foot of water is 7.48 gallons, and flows can range from less than a cubic foot per second to many thousands of cubic feet per second depending on the time of year and the size of the river or stream. The size of the river or stream and the amount of water that it usually carries is determined by the area of land it drains (known as a watershed), the type of land in the watershed, and the amount of precipitation that falls on the watershed. A common way that USGS reports flow is the cubic feet per second (cfs) averaged over a day since flow can vary even over the course of a day.

In addition to quantity, there is of course a quality aspect to water. Most chemical constituents are measured in terms of weight per volume, generally using the metric system with milligrams (mg) per liter (L) as the units. A milligram is one thousandth of a gram, 28 of which weigh one ounce. A liter is slightly more than a quart, so there are 3.76 L in a gallon. The total amount of material is called mass and is the quantity in a given volume of water. For instance, if a liter of water had 16 milligrams of salt and one evaporated all of the water, the 16 milligrams of salt would remain. A volume of two liters with the same 16 mg/L of salt would yield 32 milligrams of salt upon evaporation of the water. So, the total amount of material in a volume of water is the combination of the amount (volume) of water and the concentration of the substance being assessed. These two characteristics, in compatible units, are multiplied to determine the quantity of the material present. In the case of a river or stream, the total amount of material passing a gaging station in a day is the total volume multiplied by the concentration of the chemical being assessed. This quantity often is referred to as "load", and if the time frame is a day, the quantity is called the "daily load". If a year is used as the time frame it is called a "yearly" or "annual" load.

Bacteria also can be discussed in terms of concentrations and loads. However, the common way of expressing concentrations of bacteria is in terms of numbers rather than weight (although one could use weight). Bacteria standards for water are written in terms of concentrations, and while the method of determining the concentrations can be by direct count or estimated through the outcome of some reaction, it is numbers that are judged to be in a given volume of water. Once again, the load is determined by the concentration multiplied by the volume of water. As can be seen, changes in concentration and/or changes in flow result in changes in the loads. Also, maximum loads can increase and if flow increases in proportion, the concentration will remain the same. For instance, if the total number of bacteria entering a section of stream doubles, but the flow also doubles, the concentration remains the same. This means that as flow increases, allowable load can increase so that concentration remains constant (or lower if dilution occurs) while continuing to meet the water quality criterion. In its simplest application, this is the concept of the flow duration curve approach. At each given flow, the maximum load that can enter and still meet the concentration criterion is set. If the numbers of bacteria entering are higher than this allowable number, then a reduction is needed. As a practical matter, determining the flow at each sampling point is resource intensive, expensive and generally is not done.

Given this, however, some estimates of flow can be derived from USGS gages in the watershed or in nearby similar watersheds if there is no gage in the impaired stream.

The pollutant loading that a waterbody can safely assimilate is expressed as either mass-per-time, toxicity or some other appropriate measure (40 CFR § 130.2). Typically, TMDLs are expressed as total maximum daily loads. Expressing stormwater pathogen TMDLs in terms of daily loads is difficult to interpret given the very high numbers of indicator bacteria and the magnitude of the allowable load is dependent on flow conditions and, therefore, will vary as flow rates change. For example, a very high load of indicator bacteria is allowable if the volume of water that transports indicator bacteria is also high. Conversely, a relatively low load of indicator bacteria may exceed the water quality standard if flow rates are low. Given the intermittent nature of stormwater related discharges, MassDEP believes it is appropriate to express stormwater-dominated indicator bacteria TMDLs proportional to flow for flows greater than 7Q10. This approach is appropriate for stormwater TMDLs because of the intermittent nature of stormwater discharges. However, the WLAs for continuous discharges are not set based on the receiving water's proportional flow, but rather, are based on the criteria multiplied by the permitted effluent flow (applying the appropriate conversion factor). Because the water quality standard is also expressed in terms of the concentration of organisms per 100 mL, the acceptable in-stream daily load or TMDL is the product of that flow and the criterion.

In recognition that bacteria loads from stormwater are flow dependent, the total TMDL can be calculated as a function of flow, and allocated to different source categories, as shown in the following equation:

$$\mathbf{TMDL = WQS \times Q_T = WLA + LA + MOS + NB}$$

Where: WLA = allowable load for point source categories (including piped stormwater)

LA = allowable load for nonpoint source categories
Q_T = stream flow on any given day when >7Q10
MOS = margin of safety
NB = natural background conditions
WQS = Massachusetts Water Quality Standard criterion

7.3.2 Embayments

For 19 of the Boston Harbor estuary- embayments, the allowable loading was estimated using the same methodology employed in the North and South Coastal and Buzzards Bay Pathogen TMDL Reports. (Mass DEP 2009, MassDEP 2012b, MassDEP 2014a). Many embayments in the Boston Harbor watershed are fed by a surface water feature such as a river or stream. The land-use, associated with many of the Boston Harbor embayment subwatersheds, is comprised largely of urbanized or heavily populated suburbanized areas, (see Figure 2-1) which represent roughly 63% of the landuse in the Boston Harbor watershed, 50% in the Mystic and 75% in the Weymouth-Weir. Many of these areas make up communities with a fairly high percentage of impervious cover. As a result, the method for estimating allowable loading for the 19 Boston Harbor estuary-embayments was calculated by multiplying the concentration allowed by the Massachusetts Water Quality Standards by the estimated volume of runoff entering 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). DCR precipitation records from 1915-2007 for the entire Eastern Coastal Area of Massachusetts (including the Boston Harbor area) show an average precipitation for the region of 45.7 inches per year (3.8 ft/year) (DCR 2010). USGS maintains a gage network throughout the state of Massachusetts. Runoff records take into account water that is lost to evapotranspiration or infiltration processes. The average runoff for the State of Massachusetts is 2.0 feet per year based on a period of record form 1905-2007 (personal communication David Wilcock, USGS 2008). The estimated volume of runoff entering from each contributing watershed was conservatively estimated by assuming that all precipitation to impervious areas runs directly off into a local waterway (average runoff value of 45.7 inches per year or 3.8 feet). In pervious areas a conservative estimate of 24 inches per year (2.0 feet) was used which represents the 50 percentile of runoff values observed at USGS gages in New England (Hydrologic Unit 1) based on long-term records (1905-2007).

The runoff value above was multiplied by the contributing watershed acreage and the most stringent water quality standard for each segment to calculate the allowable load or total number of bacteria per year (cfu/year). The daily TMDL was then calculated by dividing the allowable annual load by the number of days in a year (365). Finally, the total daily load allocation was then split into wasteload and load allocations based on the ratio of impervious to pervious land within each watershed.

7.3.3 Water Quality Criteria

The water quality criteria used to develop the TMDL was based on the most stringent designated use identified in the Massachusetts Water Quality Standards. In the case of the Boston Harbor Watershed the principal and most sensitive uses include primary contact recreation and shellfishing use. A summary of the relevant water quality criteria that apply to the Boston Harbor Watershed are summarized in Table 7-2.

Table 7-2 Water Quality Targets for Boston Harbor Watershed.

Waterbody Use	Shellfishing Criterion		Primary Contact Recreation Criterion	
	Fecal coliform (cfu/100LmL)		*E. coli* (cfu/100mL)	Enterococci (cfu/100mL)
Waterbody Class	Geometric Mean	10% of samples not to	Geometric Mean	Geometric Mean

Waterbody Use	Shellfishing Criterion		Primary Contact Recreation Criterion	
	Fecal coliform (cfu/100LmL)		*E. coli* (cfu/100mL)	Enterococci (cfu/100mL)
		exceed		
A */B	None	None	126 [a]	33[b]
SA	14 [c]	28 [c]	None	35 [b]
SB	88 [c]	260 [c]	None	35 [b]

[a] e.coli is the indicator, [b] Enterococci is the indicator, [c] Fecal coliform is the indicator. The full version of the standards can be found at: http://www.mass.gov/eea/agencies/massdep/water/regulations/314-cmr-4-00-mass-surface-water-quality-standards.html. *Public Water Supply Tributary

Primary contact recreation criteria apply to all Class A and Class B fresh water systems and will pertain to all river segments in the Boston Harbor watershed. Shellfishing criteria are also applied to segments where shellfishing is prohibited but where there may be an approved area in an abutting or downstream segment.

7.3.4 Calculating the TMDL as Daily Loads (Colonies/Day)

MassDEP believes it is appropriate to express indicator bacteria TMDLs proportional to flow. Because the Water Quality Standard is also expressed in terms of the concentration of organisms per 100 mL, the acceptable in-stream daily load or TMDL is the product of that flow and the water quality standard criterion. This is the same approach used for any pollutant with a numerical criterion. In the case of estuary-embayments, contributing watershed runoff is the flow that is being used to determine the maximum daily load.

The TMDL is calculated based on flow or volume and the concentration of the applicable Massachusetts water quality standard criterion for bacteria in the river. Once the flow or volume is estimated, the total maximum daily load of bacteria in numbers per day is derived by multiplying the estimated flow or runoff volume by the water quality standard criterion for the indicator bacteria. The actual allowable load of bacteria in fresh water systems where the primary contact recreation standard applies, in numbers of bacteria per day, varies with flow at or above 7Q10 in each segment (as presented in Figure 7-1). 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.

Example calculations for determining the TMDL are provided as follows:

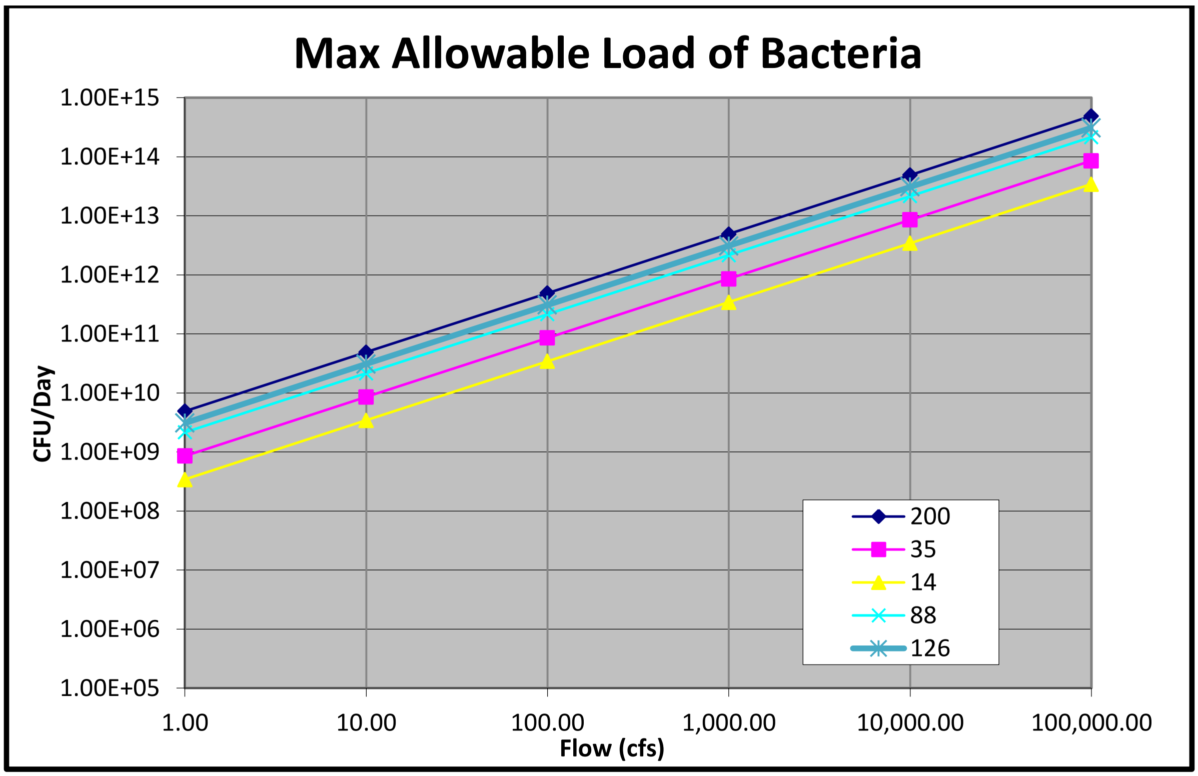
For Rivers: The TMDL associated each **1.0 cubic foot per second of flow** to meet a water quality standard of 126 cfu/100 ml (E.coli, Class A or B) or 33 cfu/100 mL (enterococci Class A or B) is derived as follows:

River Segment (*E. coli*, Class A or B) TMDL = (0.02832 m^3/sec) x (86,400 sec/day) x (1,000 liters/m^3) x (1,000 ml/liter) x (126 cfu/ml) = 3.08 x 10^9 cfu/day.

River Segment (enterococci, Class A or B) TMDL= (0.02832 m^3/sec) x (86,400 sec/day) x (1,000 liters/m^3) x (1,000 ml/liter) x (33 cfu/ml) = 8.07 x 10^8 cfu/day.

For River segments the TMDL is proportioned between the WLA and LA by multiplying the daily load by the percent impervious for the WLA, and by multiplying the daily load by the percent pervious for the contributing watershed for the LA. Table 7-3 summarizes the TMDL for the 14 fresh water segments (rivers) in the Boston Harbor Watershed.

Figure 7-1 River TMDL as a Function of Flow and Bacteria Indicator.



Note: Prior to 2007, the average of all samples shall not exceed 200 cfu/day, Fecal coliform, Class B

From Tables 7-1 and 7-2 Current Bacteria Standards include:

35 cfu/day; Enterococci, Primary Contact Recreation, Class SA

14 cfu/day;,Fecal coliform, Shellfishing, Class SA

88 cfu/day; Fecal coliform, Shellfishing, Class SB

126 cfu/day, *E. coli*, Primary Contact Recreation, Class B

Table 7-3 Stormwater WLA and LA TMDL by River Segment for the Boston Harbor Watershed (*E. coli* Indicator CFU/Day).

	TMDL Allocation[1]	FLOW, cfs					
Segment[2], Waterbody WQS Classification	WLA LA	1	10	100	1,000	10,000	100,000
MA74-06 Chochato River(B)	14.5%	4.48E+08	4.48E+09	4.48E+10	4.48E+11	4.48E+12	4.48E+13
	85.5%	2.64E+09	2.64E+10	2.64E+11	2.64E+12	2.64E+13	2.64E+14
MA74-08 Monatiquot River(B)	18.3%	5.65E+08	5.65E+09	5.65E+10	5.65E+11	5.65E+12	5.65E+13
	81.7%	2.52E+09	2.52E+10	2.52E+11	2.52E+12	2.52E+13	2.52E+14
MA74-09 Town Brook (B/SB)	35.9%	1.11E+09	1.11E+10	1.11E+11	1.11E+12	1.11E+13	1.11E+14
	64.1%	1.98E+09	1.98E+10	1.98E+11	1.98E+12	1.98E+13	1.98E+14
MA74-03 Old Swamp River (A)	21.8%	6.73E+08	6.73E+09	6.73E+10	6.73E+11	6.73E+12	6.73E+13
	78.2%	2.41E+09	2.41E+10	2.41E+11	2.41E+12	2.41E+13	2.41E+14
MA74-05 Weymouth Back River (B)	21.1%	6.51E+08	6.51E+09	6.51E+10	6.51E+11	6.51E+12	6.5E+13
	78.9%	2.44E+09	2.44E+10	2.44E+11	2.44E+12	2.44E+13	2.44E+14
MA74-04 Mill River (A)	20.4%	6.30E+08	6.30E+09	6.30E+10	6.30E+11	6.30E+12	6.30E+13
	79.6%	2.46E+09	2.46E+10	2.46E+11	2.46E+12	2.46E+13	2.46E+14
MA74-02 Weir River (B/SA)	9.1%	2.81E+08	2.81E+09	2.81E+10	2.81E+11	2.81E+12	2.81E+13
	90.9%	2.81E+09	2.81E+10	2.81E+11	2.81E+12	2.81E+13	2.81E+14
MA71-01 Aberjona River (B)	28.2%	8.71E+08	8.71E+09	8.71E+10	8.71E+11	8.71E+12	8.71E+13
	71.8%	2.22E+09	2.22E+10	2.22E+11	2.22E+12	2.22E+13	2.22E+14
MA71-04 Alewife Brook (B/CSO Variance)	34.9%	1.08E+09	1.08E+10	1.08E+11	1.08E+12	1.08E+13	1.08E+14
	65.1%	2.01E+09	2.01E+10	2.01E+11	2.01E+12	2.01E+13	2.01E+14
MA71-05 Malden River (B)	30.7%	9.48E+08	9.48E+09	9.48E+10	9.48E+11	9.48E+12	9.48E+13
	69.3%	2.14E+09	2.14E+10	2.14E+11	2.14E+12	2.14E+13	2.14E+14
MA71-02 Mystic River (B/CSO Variance)	26.9%	8.30E+08	8.30E+09	8.30E+10	8.30E+11	8.30E+12	8.30E+13
	73.1%	2.26E+09	2.26E+10	2.26E+11	2.26E+12	2.26E+13	2.26E+14
MA71-07 Mill Brook (B)	39.0%	1.20E+09	1.20E+10	1.20E+11	1.20E+12	1.20E+13	1.20E+14
	61.0%	1.88E+09	1.88E+10	1.88E+11	1.88E+12	1.88E+13	1.88E+14
MA71-13 Unnamed Tributary (B)	14.9%	4.60E+08	4.60E+09	4.60E+10	4.60E+11	4.60E+12	4.60E+13
	85.1%	2.63E+09	2.63E+10	2.63E+11	2.63E+12	2.63E+13	2.63E+14
MA71-09 Winn Brook (B)	29.0%	8.95E+08	8.95E+09	8.95E+10	8.95E+11	8.95E+12	8.95E+13
	71.0%	2.19E+09	2.19E+10	2.19E+11	2.19E+12	2.19E+13	2.19E+14

[1] TMDL allocation: % surface area of segment watershed for WLA (impervious) and LA (pervious), respectively
[2] All Class A/Class B segments based on 126 *E. coli*/100ml water quality standard for Primary Contact Recreation. Class A segments in these watersheds are tributaries to filtered Public Water Supplies.

For Estuary- Embayments: For 19 of the estuary-embayments, the size of the watershed contributing to the flow must be accounted for. The following equation illustrates the calculation that applies to the estuarine segments.

Embayment TMDL (cfu/year) = (1 acre) x (43,560 ft^2/acre) x ((2.0 ft) x (% pervious area) + (3.8 ft) x(% impervious area)) x (7.48 gallons/ft^3) x (3.78 liters/gallon) x (Applicable WQ Standard cfu/ml) x (1000 ml/l)= cfu/year

Embayment TMDL (cfu/day) = Embayment TMDL (cfu/year) x (year/365 days) = cfu/day

Similar to the River TMDL calculation the Embayment TMDL is proportioned between the WLA and LA by multiplying the daily load by the percent impervious for the WLA, and by multiplying the daily load by the percent pervious for the contributing watershed for the LA. Table 7-4 summarizes the TMDL for the marine segments in the Boston Harbor Watershed.

7.3.5 – Wasteload Allocations (WLAs) and Load Allocations (LAs)

There are several WWTPs and other NPDES-permitted wastewater discharges within the watershed. NPDES wastewater discharge WLAs are set at the WQS. In addition there are numerous stormwater discharges from storm drainage systems throughout the watershed. All piped discharges are, by definition, point sources regardless of whether they are currently subject to the requirements of NPDES permits. Therefore, a WLA set equal to the WQS will be assigned to the portion of the stormwater that discharges to surface waters via storm drains.

WLAs and LAs are identified for all known source categories including both dry and wet weather sources for Class SA, SB, A, and B segments within the Boston Harbor watershed. Establishing WLAs and LAs that only address dry weather indicator bacteria sources would not ensure attainment of standards because of the significant contribution of wet weather indicator bacteria sources to WQS exceedances. Illicit sewer connections and deteriorating sewers leaking to storm drainage systems represent the primary dry weather point sources of indicator bacteria, while failing septic systems and possibly leaking sewer lines represent the non-point sources. Wet weather point sources include discharges from stormwater drainage systems (including MS4s) and sanitary sewer overflows (SSOs). Wet weather non-point sources primarily include diffuse stormwater runoff.

Table 7-4 Stormwater WLA and LA TMDL by Embayment for the Boston Harbor Watershed (CFU/Day).

Segment[1]	Name	WQS Class	Percent Impervious	Percent Pervious	Watershed Area Acres	Shellfishing Indicator Fecal Coliform (cfu/100mL)	Swimming Indicator *Enterococci* (cfu/100mL)	**TMDL Fecal Coliform *WLA* (cfu/day)**	**TMDL Fecal Coliform LA (cfu/day)**	**TMDL Fecal Coliform (cfu/day)**	**TMDL *Enterococci* *WLA* (cfu/day)**	**TMDL *Enterococci* LA (cfu/day)**	**TMDL *Enterococci* (cfu/day)**
MA70-10	Winthrop Bay	SB	45.3%	55.7%	4,032	88	35	2.06E+10	1.33E+10	3.39E+10	8.20E+09	5.30E+09	1.35E+10
MA70-02	Boston Inner Harbor	SB/CSO	31.0%	69.0%	48,094	88	35	1.68E+11	1.97E+11	3.65E+11	6.69E+10	7.84E+10	1.45E+11
MA70-11	Pleasure Bay	SB	19.2%	80.8%	48,094	88	35	4.12E+11	9.12E+11	1.32E+12	1.64E+11	3.63E+11	5.26E+11
MA70-03	Dorchester Bay	SB	19.2%	80.8%	190,031	88	35	4.12E+11	9.12E+11	1.32E+12	1.64E+11	3.63E+11	5.26E+11
MA70-04	Quincy Bay	SA	25.6%	74.4%	5,422	14	35	2.49E+09	3.81E+09	6.30E+09	6.23E+09	9.53E+09	1.58E+10
MA70-05	Quincy Bay	SB	25.6%	74.4%	5,422	88	35	1.57E+10	2.40E+10	3.96E+10	6.23E+09	9.53E+09	1.58E+10
MA70-06	Hingham Bay	SB	17.5%	82.5%	38,763	88	35	7.65E+10	1.90E+11	2.66E+11	3.04E+10	7.55E+10	1.06E+11
MA70-07	Hingham Bay	SB	17.5%	82.5%	38,763	88	35	7.65E+10	1.90E+11	2.66E+11	3.04E+10	7.55E+10	1.06E+11
MA70-09	Hull Bay	SB	12.0%	88.0%	11,189	88	35	1.52E+10	5.85E+10	7.36E+10	6.03E+09	2.33E+10	2.93E+10
MA70-01	Boston Harbor	SB	20.9%	79.1%	277,785	88	35	6.55E+11	1.30E+12	1.96E+12	2.61E+11	5.19E+11	7.80E+11
MA74-15	Town River Bay	SA	36.8%	63.2%	938	14	35	6.20E+08	5.60E+08	1.18E+09	1.55E+09	1.40E+09	2.95E+09
MA74-13	Weymouth Back River	SA	20.0%	80.0%	832	14	35	2.99E+08	6.29E+08	9.28E+08	7.47E+08	1.57E+09	2.32E+09
MA74-14	Weymouth Fore River	B/SB	22.3%	77.7%	15,142	88	35	3.81E+10	6.99E+10	1.08E+11	1.52E+10	2.78E+10	4.29E+10
MA74-18	Hingham Harbor	SA	12.0%	88.0%	11,189	14	35	2.41E+09	9.30E+09	1.17E+10	6.03E+09	2.33E+10	2.93E+10
MA74-11	Weir River	SA	11.4%	88.6%	1,124	14	35	2.30E+08	9.41E+08	1.17E+09	5.75E+08	2.35E+09	2.93E+09
MA71-06	Chelsea River	SB/CSO	49.2%	50.8%	2,425	88	35	1.35E+10	7.32E+09	2.08E+10	5.35E+09	2.91E+09	8.26E+09
MA71-03	Mystic River	SB/CSO	28.7%	61.3%	41,888	88	35	1.36E+11	1.52E+11	2.88E+11	5.40E+10	6.07E+10	1.15E+11
MA71-08	Mill Creek	SB	32.0%	68.0%	1,201	88	35	4.34E+09	4.85E+09	9.19E+09	1.72E+09	1.93E+09	3.65E+09
MA71-14	Belle Isle Inlet	SA	45.0%	55.0%	4,014	14	35	3.24E+09	2.09E+09	5.33E+09	8.11E+09	5.21E+09	1.33E+10

1 -Class SA calculations based on 14 fecal coliform/100 mL, Class SB calculations based on 88 fecal coliform/100 ml, class SA without shellfishing based on 35 enterococcus/100 mL

7.3.6 Stormwater Contribution

Part of the stormwater contribution originates from point sources and is included in the waste load allocation, and part comes from non-point sources and is included in the load allocation of the TMDL. The fraction of the runoff load attributed to the waste load allocation is estimated from the fraction of the watershed that has impervious cover because stormwater from impervious cover is more likely to be diverted, collected and conveyed to the receiving water by stormwater collection systems than non-impervious areas. The fraction of the TMDL associated with the wasteload allocation was estimated, using MassGIS and the algorithm within it to estimate the extent of impervious surface. The wasteload allocation was then defined by multiplying the TMDL for each segment by the percent of imperviousness in each watershed. Likewise the load allocation was estimated using the percent pervious cover in each watershed. MassDEP believes this approach is conservative because it assumes that all runoff from impervious areas actually makes it to the waterbody segment in question, which may or may not always be the case.

For example, based on information from MassGIS and the algorithm within it used to estimate the extent of impervious surface, the Aberjona River, MA71-01 (part of the Mystic River Watershed) at the USGS gage, Winchester MA, on the left bank of the river, 0.5 miles upstream from head of Mystic lakes. The upstream portion of the watershed from the point of this gage is 28.2% impervious and 71.8% pervious. Thus, 28.2% of the acceptable bacteria load at a given flow is assigned as waste load allocation while 71.8% of the total load represents the load allocation. Therefore, in a segment for which the average daily flow on the Aberjona River at the USGS Gage, (Winchester MA) is 29.5 cfs, the allowable *E. coli* bacteria load for that day and location or segment is 9.09 x10^{10} *E. coli*/day (from Figure 7-1). Therefore, for that flow in the Aberjona River at the USGS Gage in Winchester, the waste load allocation is 2.56 x10^{10} bacteria per day (i.e., (0.282) x (8.92x10^{10} bacteria/day) and the load allocation is 6.53 x10^{10} bacteria per day (i.e., (0.718) x (9.09 x10^{10} bacteria/day).
Also as previously indicated, the allowable stormwater load for bacteria varies with receiving water flow. In order to calculate the allowable daily load (TMDL), flow must be taken into account. To estimate the flow for an ungaged location or segment, flows at a gage in the watershed or nearby watershed can be prorated based on drainage area. The USGS also has a web-based application at water.usgs.gov/osw/streamstats/ungaged.html for Massachusetts that incorporates ungaged flow estimations.

7.4 Application of the TMDL to Unimpaired or Currently Unassessed Segments

This TMDL applies to the 33 pathogen impaired segments of the Boston Harbor Watershed that are currently listed on the 2014 CWA § 303(d) list of impaired waters. MassDEP recommends however, 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).

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. The concentration waste load and/or load allocation for each source and designated use would be the same as specified herein. Therefore, the pollution prevention TMDLs would have identical waste load and load allocations based on the sources present and the designated use of the water body segment (see Table 7.1). Any discharge would need to be consistent with the applicable waste load allocations, as well as the antidegradation provision of the Massachusetts Water Quality Standards. Any new construction that complies with state stormwater standards and permits is presumed to comply with antidegradation requirements of the state water quality standards.

This Boston Harbor Watershed TMDL may, in appropriate circumstances, also apply to segments that are listed for pathogen impairment in subsequent Massachusetts CWA § 303(d) Integrated List of Waters. For such segments, 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, the Commonwealth determines with EPA approval of the CWA § 303(d) list that this TMDL should apply to future pathogen impaired segments.

7.5 Margin of Safety

This section addresses the incorporation of a Margin of Safety (MOS) in the TMDL analysis. The MOS accounts for any uncertainty or lack of knowledge concerning the relationship between pollutant loading and water quality. The MOS can either be implicit (i.e., incorporated into the TMDL analysis through conservative assumptions) or explicit (i.e., expressed in the TMDL as a portion of the loadings). This TMDL uses an implicit MOS, through inclusion of two conservative assumptions. First, the TMDL does not account for mixing in the receiving waters and assumes that zero dilution is available. Realistically, influent water will mix with the receiving water and become diluted below the water quality standard, provided that the receiving water concentration does not exceed the TMDL concentration. Second, the goal of attaining standards at the point of discharge does not account for losses due to die-off and settling of indicator bacteria that are known to occur. Third, the TMDL assumes that all the runoff from impervious areas throughout the contributing watershed actually makes it to the impaired segment, which is generally not the case especially in large watersheds where impervious surfaces are not continually connected.

7.6 Seasonal Variability

In addition to a Margin of Safety, TMDLs must also account for seasonal variability. Pathogen sources to Boston Harbor Watershed waters arise from a mixture of continuous and wet-weather driven sources, and there may be no single critical condition that is protective for all other conditions. This TMDL has set WLAs and LAs for all known and suspected source categories equal to the Massachusetts WQS independent of seasonal and climatic conditions. This will ensure the attainment of water quality standards regardless of seasonal and climatic conditions. Controls that are necessary will be in place throughout the year, protecting water quality at all times.

8.0 Implementation Plan

Setting and achieving TMDLs should be an iterative process, with realistic goals over a reasonable timeframe and adjusted as warranted based upon on-going monitoring. The concentrations set out in the TMDL represent reductions that will require substantial time and financial commitment to be attained.

CSOs and Sanitary Sewer Overflows (SSOs) have historically been a significant contributor to bacteria pollution to the Harbor area, and the MWRA CSO Program Assessment being conducted under the Federal Court Order, together with the information being gathered under the terms and conditions of the CSO Variance should be focused on determining the impacts of remaining CSO discharges, and the feasibility of higher levels of CSO control. Eliminating illicit connections, reducing the risk of SSO events, and fixing failing infrastructure is tantamount to improving bacterial water quality. As the bacteria loads from SSOs and CSOs continue to decline it is anticipated that stormwater discharges from Phase I and Phase II regulated communities will remain the predominate source of bacteria pollution along with non-point sources such fertilizer runoff.

Finding illicit connection sources through bacteria source tracking activities in those segments where sampling activities show elevated levels of bacteria during dry weather is a top priority. Identification and remediation of dry weather bacteria sources is usually more straightforward and successful than tracking and eliminating wet weather sources. If illicit bacteria sources are found and eliminated it should result in a dramatic reduction of bacteria concentration in the segment in both dry and wet-weather. Each regulated community will need to implement a comprehensive program to ensure illicit sources are identified and that appropriate actions will be taken to eliminate them.

Finding the bacteria related pollution sources from failed infrastructure and fixing these poses real challenges. Overland stormwater runoff greatly exacerbates the pollution from failed infrastructure sources. Segments that remain impaired during wet weather should be evaluated for stormwater BMP implementation opportunities starting with less costly non-structural practices first (such as street sweeping, catch basin cleaning, and/or managerial approaches using local regulatory controls), and lastly, more expensive structural measures. Unfortunately, many failed infrastructure problems require the more expensive structural repair measures to be considered. This would require additional study to identify the most cost efficient and effective technology.

Controls on several types of pathogen sources will be required as part of the comprehensive control strategy. Many of the sources in the Boston Harbor watershed including sewer connections to drainage systems, leaking sewer pipes, sanitary sewer overflows, and failing septic systems, are prohibited and must be eliminated. Individual sources must first be identified in the field before they can be abated. Pinpointing sources typically requires extensive monitoring of the receiving waters and tributary stormwater drainage systems during both dry and wet weather conditions. The MassDEP, USEPA, MWRA, MyRWA, BWSC, and DCR have been successful in carrying out such monitoring, identifying sources, and, in some cases, mobilizing the responsible municipality and other entities to begin to take corrective actions.

Stormwater runoff represents another major source of pathogens in the Boston Harbor watershed, and the current level of control is inadequate for standards to be attained. Improving stormwater runoff quality is essential for restoring water quality and recreational uses. At a minimum, intensive application of non-structural BMPs is needed throughout the watershed to reduce pathogen loadings as well as loadings of other stormwater pollutants (e.g., nutrients and sediments) contributing to use impairment in the Boston Harbor watershed. Depending on the degree of success of the non-structural stormwater BMP program, structural controls may become necessary.

For these reasons, a basin-wide implementation strategy is recommended. The strategy includes a mandatory program for implementing stormwater BMPs and eliminating illicit sources. TMDL implementation-related tasks are shown in Table 8-1. MassDEP working with EPA and other team partners shall make every reasonable effort to assure implementation of this TMDL. These stakeholders can provide valuable assistance in defining hot spots and sources of pathogen contamination as well as the implementation of mitigation or preventative measures.

Table 8-1 TMDL Implementation Related Tasks

Task	Organization
Writing TMDL	MassDEP
TMDL public meeting	MassDEP
Response to public comment	MassDEP
Organization, contacts with volunteer groups	MassDEP, MyRWA, Massachusetts Community Water Watch (MCWW) Tufts Chapter
Development of comprehensive stormwater management programs particularly in close proximity to each embayment including identification and implementation of BMPs	Boston Harbor Communities
Illicit discharge detection and elimination (where applicable)	Boston Harbor Communities with MyRWA, MCWW Tufts Chapter, where applicable

Task	Organization
Leaking sewer pipes and sanitary sewer overflows	Boston Harbor Communities
CSO management	Boston Harbor Communities, BWSC, MWRA, where applicable
Inspection and upgrade of on-site sewage disposal systems as needed	Homeowners and Boston Harbor Communities (Boards of Health)
Organize implementation; work with stakeholders and local officials to identify remedial measures and potential funding sources	MassDEP, DCR, DPH, MyRWA, BWSC, MWRA and Boston Harbor Communities
Organize and implement education and outreach program	MassDEP, DCR, DPH, Boston Harbor Communities, Save the Harbor/Save the Bay, and MyRWA
Write grant and loan funding proposals	MassDEP, MyRWA and Boston Harbor Communities and Planning Agencies with guidance from MassDEP
Inclusion of TMDL recommendations in Executive Office of Energy and Environmental Affairs (EEA) Watershed Action Plan	EEA
Surface Water Monitoring	MassDEP, Boston Harbor Communities, DCR, and MWRA
Provide periodic status reports on implementation of remedial activities	Boston Harbor Communities, MyRWA

8.1 Summary of Organizations and Activities within the Boston Harbor Watershed

Data supporting this TMDL show that indicator bacteria enter the Boston Harbor watershed from a number of contributing sources under a variety of conditions. Activities that are ongoing and/or planned to ensure that the TMDL can be implemented are summarized in the following subsections. There are several watershed organizations focused on improving water quality within the Boston Harbor watershed, including the Mystic River Watershed Association (MyRWA), Tufts University, the Massachusetts Bays Estuary Program (MassBays), Save the Harbor/Save the Bay, The Boston Harbor Association (TBHA), the Weir River Watershed Association (WRWA), and the Fore River Watershed Association (FRWA).

Through the MassBays Program, a Massachusetts Bays Comprehensive Conservation & Management Plan (MassBays 2004) has been developed. This plan lists the following initiatives intended to protect and enhance shellfishing and the progress of these initiatives:

- Conduct three Sanitary Survey Training Sessions annually-one each on the North Shore, Metro Boston/South Shore, and Cape Cod - to educate local shellfish constables and health officers on the proper technique for identifying and evaluating pathogen inputs into shellfish harvesting areas (progress: full). Local partner: Division of Marine Fisheries.

- Develop and administer a local Shellfish Management Grants Program to help communities finance the development and implementation of affective local shellfish management plans (progress: substantial). Local partner: Division of Marine Fisheries.

- Continue and expand the Shellfish Bed Restoration Program to restore and protect shellfish beds impacted by non-point source pollution (progress: moderate). Local partner: Shellfish Bed Restoration Program.

- Through the Shellfish Clean Water Initiative, complete an Interagency Agreement defining agency roles and contributions to protect shellfish resources from pollution sources (progress: new). Local partner: Office of Coastal Zone Management.

- 2015 State of the Bays Report.

In 1990, Congress added the Coastal Nonpoint Source Pollution Control Program to the Reauthorization of the Coastal Zone Management Act. "This legislation gives states the opportunity to work with federal agencies and already existing programs to develop and implement enforceable measures to restore and protect coastal waters from NPS [nonpoint source] pollution. The legislation also gives states the flexibility to design measures that are both environmentally and economically sound. The Massachusetts Coastal Zone Management Office (CZM) and the Department of Environmental Protection (MassDEP), in cooperation with a variety of other state agencies, are responsible for developing the Coastal Nonpoint Source Pollution Control Program for the Commonwealth." (CZM 2005b)

Through the Coastal Nonpoint Pollution Control Program, CZM is working with federal and state agencies, local officials, industry representatives, environmentalists, and the public to develop enforceable measures to restore and protect coastal waters from nonpoint source (NPS) pollution, which is currently the number one pollution problem in U.S. coastal waters. NPS pollution occurs when contaminants are picked up by rain water and snow melt and carried over land, in groundwater, or through drainage systems to the nearest waterbody.

Two grant programs administered by CZM support the implementation of the Coastal Nonpoint Pollution Control Program.

- The Coastal Pollutant Remediation (CPR) Grant Program provides funding to municipalities in Massachusetts coastal watersheds to reduce stormwater impacts from roads, highways, or parking areas and to install municipal boat pumpout facilities.

- The Coastal Nonpoint Source Pollution (Coastal NPS) Grant Program complements CPR and addresses more general areas of nonpoint source control. These grants to municipalities, as well as other public and non-profit groups, can be used for the following types of projects: assessment, identification, and characterization of nonpoint sources; targeted assessment of the municipal stormwater drainage system (runoff from municipal roadways, parking lots and bridges); the development of transferable tools (nonstructural best management practices), such as guidance documents, model by-laws, and land use planning strategies to improve nonpoint source control and management; and the implementation of innovative and unique demonstration projects.

Both the CPR and Coastal NPS grant programs have been developed to provide resources to municipalities for assessing and managing nonpoint sources of pollution. Projects funded through these grants can stand-alone or they can be discrete components of multi-year projects. For example, a municipality might use Coastal NPS funds to identify pollution sources in a subwatershed during year one of a project, and then apply for CPR funds to develop best management practices to remediate the identified roadway related pollutants during year two. CZM encourages the incorporation of long-term, progressive pollution mitigation planning components into proposals for both programs.

Also as part of the Coastal Nonpoint Pollution Control Program, CZM developed the *Massachusetts Clean Marina Guide*. This reference for owners and operators of marine boating facilities provides information on cost-effective strategies and practices aimed at reducing marina and boating impacts on the coastal environment (CZM 2005c).

For more information regarding CZM programs and grants, please visit their website at http://www.mass.gov/czm/czm.htm

The MyRWA is a not-for-profit active steward of the Mystic River watershed. The MyRWA is a citizens group primarily focused on education, outreach, and water quality monitoring. The association has its own monitoring network (Mystic Monitoring Network (MMN)) supported by volunteers, which contributed much of the data in the Mystic River sub-basin section of this report. The association has also encouraged the development of individual stream and river groups such as the Alewife/Mystic River Advocates, the Friends of the Mystic River, and the Alewife Brook/Little River Stream Team. These groups have been involved in shoreline surveys and water quality sampling. The Alewife Stream Team has also developed an Action Plan for the sub- watershed based on their shoreline survey that included noting land use, pipes, and odors potentially caused by sewage.

The MyRWA has formed a partnership with Tufts University to conduct research on the river and promote involvement from students at the University. Tufts has been able to secure grants for research on the Mystic River and has also planned classes incorporating issues surrounding the Mystic. The MyRWA, Tufts University, and the City of Somerville have also partnered to conduct real-time water quality monitoring in the Mystic River watershed. This project was started under an EPA program known as Environmental Monitoring for Public Access and Community Tracking (EMPACT).

The Massachusetts Bays Program (MassBays) was established in 1988 with a scientific research focus to determine pollution problems in the Bays. A “Conference” of individuals from federal, state, and local government agencies, regional planning agencies, user groups, public and private institutions, and the public gathered to evaluate the research and worked together to create the Comprehensive

Conservation Management Plan (CCMP). MassBays works closely with municipalities and often assists them in seeking funds and passing by-laws. MassBays is also focused on educating the local officials through technical workshops. MassBays has provided training for volunteers to monitor stormwater outfalls, and swimming beaches (EEA 2003).

Save the Harbor/Save the Bay is a nonprofit advocacy group focused on restoring and protecting Boston Harbor and Massachusetts Bay. Save the Harbor/Save the Bay aims to inform the public on the state of the harbor's water quality, beaches, and waterfront. The organization publishes a newsletter, Splash, and strives to educate and encourage the next generation of Stewards. Recent projects include educating the public on beach closings and the reasons behind them, and keeping the public informed about water quality issues related to outfall pipe in Massachusetts and Cape Cod Bays (Save the Harbor/Save the Bay 2016).

The Boston Harbor Association (TBHA) is focused on monitoring water quality in the harbor and restoring the harbor's beaches. The TBHA publishes a quarterly newsletter called "Harbor News", which gives members updates on water quality improvements and the association's programs. Promoting education and involvement in the community is of high importance to TBHA. TBHA offers several free educational programs for youths teaching students about water quality and pollution. Each year, over 1,200 high school students are taught about the Boston Harbor Project and career opportunities in the environmental and maritime fields through TBHA programs. TBHA has:

- published a Boston Harbor Curriculum Guide for middle school science teachers,
- hosted lecture series open to the public focusing on water quality and beaches,
- offered free Boston Harbor boat cruises open to the public providing speakers discussing water quality issues while cruising,
- written columns for Banker & Tradesman on issues affecting the harbor, and
- been involved in preparing a report on water quality improvements on Wollaston Beach and educating the public on beach water quality (TBHA 2016).

The Weir River Watershed Association (WRWA) promotes awareness and stewardship in the watershed. The WRWA is focused on gathering data through monitoring programs, conducting local projects to improve water quality, reporting findings on the state of the watershed to the public, governmental agencies, and others, and building partnerships with schools, businesses, community groups, and government agencies (WRWA 2016).

The Fore River Watershed Association's (FRWA) mission is to "promote, protect, restore, enhance and improve the water quality, natural resources, cultural sites, and recreational opportunities of the Fore River watershed" (FRWA 2016). The FRWA conducts shoreline and land use surveys of the river corridor, conducts a long-term water quality monitoring program, implements water quality improvement programs, educates the public, conducts river cleanups, offers educational and recreational programs for community outreach, monitors government activities, advocates the protection of open space, and works with government agencies and the public to promote more involvement.

The Neponset River Watershed Association, University of Massachusetts, Urban Harbors Institute, Boston Harbor Association, Fore River Watershed Association, and Weir River Watershed Association have prepared a "*Boston Harbor South Watersheds 2004-2009 Action Plan"* (NRWA et al. 2004). The Action Plan focuses on:

1. Sewer system improvements
2. Stormwater management and groundwater recharge
3. Septic management
4. Management of landscaped areas
5. Water supply and streamflows
6. Riverine habitat
7. Public access to waterways
8. Watershed assessment
9. Boating initiatives
10. Financing, regional collaboration, and adapting to local conditions

Items relating to water quality improvements such as sewer system improvements, stormwater management, and septic management make up a large portion of the action items in the "Common Action Plan for all Boston Harbor South Watersheds" section. The implementation of this TMDL is consistent with the goals and objectives of the Action Plan.

Within the Boston Harbor watershed grant projects are conducted by communities under the: (1) Federal 319 Grant program; (2) Federal 604b Grant program. There have already been seven (7) 319 projects conducted, with total monies expended of $2,321,350 for all the projects, and three (3) 604b projects conducted, with a total of $139,704. Each project potentially impacts, in a positive sense, the bacteria levels in 303(d) listed segments in this report. Although the emphasis of the projects overall centers on nutrients, phosphorus, and sediment BMP controls, these types of controls no doubt have a positive effect in removing bacteria contamination as well. The projects are summarized here and the affected 303(d) listed impaired waters in this report are identified:

1. "Reducing Stormwater Pollution in an Ultra Urban Environment" (98-07/319), a $118,700, 1998-2002 project to improve the water quality of Alewife Brook (MA71-04) by treating and reducing stormwater discharges by implementing an innovative retrofit technology to one stormdrain outlet, to conduct a public survey to assess detrimental behavior contributing to nonpoint source pollution, to help identify sites where pervious cover can be increased, and to conduct a watershed-wide workshop for municipalities on how to control non- point source pollution.
2. "Telecom City: Malden, Medford, Everett" (99-05/319), a $250,000, 1999-2002 project, part of a larger effort to redevelop a 200+ acre site along the Malden River (MA71-05). This 319 project developed a model to quantify the predicted mitigation of NPS runoff impacts through

implementation of specific BMPs to restore specific parcels of wetlands on site, prior to commencement of the larger industrial redevelopment on the larger brownfields site. With the BMPs selected to be installed, there will be pre and post monitoring, final calibration of the model based on monitoring results, and a public outreach effort to explain the BMPs, the model, and their effectiveness.

3. "Stormwater System Maintenance and Residuals Waste Handling" (01-24/319), a $143,389, 2001-04 project to look at the (MA70-05, Quincy Bay) negative water quality impacts from eight stormwater outfalls discharging directly to Wollaston Beach. The project developed a specific O & M plan for the collection system, particularly the storm drains, and protocols for processing catch basin residuals and making these conform to Beneficial Use Determination (BUD). Processed residuals were made available and transferable to other cities and towns in the Commonwealth.
4. "Spy Pond Stormwater Management Program" (03-10/319), a $298,100, 2003-5 project (Mystic Watershed) to design and put in place BMP's to control Category 5 impairments: sediment, phosphorus, weeds, and turbidity. Although the segment is not listed for pathogens, the installation of the BMPs (six baffled sediment tanks and sixteen deep sump/leaching catch basins) to control Route 2 stormwater discharge runoff will certainly help to remove whatever existing pathogens are in this runoff.
5. "Children's Wharf Project: Growing the Next Generation of Environmental Stewards" (05-08/319), a $833,334 2005-08 project whereby the Boston Children's Museum mitigated pollutants going into Fort Point Channel from stormwater runoff by incorporating Best Management Practices into the design and construction of a facility expansion and renovation project. Project tasks included construction of a green roof, stormwater reclamation system, rainwater harvesting, and other low-impact development practices to encourage infiltration and reuse of stormwater. An extensive public outreach and education task included hands-on interactive displays, interpretive signage, and special programs to educate children, educators, and other adult caregivers about the new onsite stormwater management practices and the importance of individual actions and activities to improve water quality.
6. Sunset Lake Watershed Stormwater BMPs (11-10/319), a $145,510, 2010-12 project to improve the water quality of Sunset Lake by reducing NPS pollution into the lake (particularly bacterial pollution). Sunset Lake, a 57-acre lake in the center of Braintree with a town-owned swimming beach, a park and a parking lot on its eastern shore, suffers from bacterial contamination issues, eutrophication and nuisance aquatic weed growth. Two untreated stormwater discharges at the beach were retrofitted with infiltration BMPs which are known for their effectiveness at treating bacteria. Deep sump catch basins were constructed on the high school access road to replace drop inlet basins which drop directly into the culvert connecting the marsh and the lake, which currently allow sediment and pollutants to discharge directly into the lake. In addition, a kiosk was installed in the beach parking lot to provide information on the stormwater BMPs and strategies/rationales for protecting the lake environment: (1) restrictions against feeding waterfowl; (2) dogs not being permitted on the beach. Watershed property owners were mailed

a brochure on discouraging Canada Geese from their lawns, the importance of picking up pet waste and reducing or eliminating fertilizer use for lawns

7. City of Boston Porous Pavement Green Alley NPS Demonstration 2007-09 Project (13-07/319), a $532,320 project resulted in the design, construction, and monitoring of a permeable pavement retrofit in the City of Boston. The project goals were to: (1) Reduce nonpoint source pollutant (NPS) contributions to water bodies by decreasing the stormwater runoff volumes and treatment via permeable pavement and sub-grade materials; (2) Increase the recharge of water in the City's Groundwater Conservation Overlay District; (3) Evaluate the potential for using permeable pavements in alleys as a standard practice for improving stormwater management in the City of Boston; (4) Quantify the benefits of the project with a monitoring program; (5) Develop design recommendations for the use of permeable pavements for retro-fitting alleys in the City of Boston; and (6) Identify areas for suggested additional research and investigation. Project tasks included: (1) Design and construct BMPs; (2) Develop a BMP Operation and Maintenance Plan; (3) Education and Outreach.
8. Green Street Demonstration Project (Section 604b, 2007-05 Project), a $44,986 project to assess the potential stormwater management and recharge benefits of Green Streets by implementing a pilot Green Street project in the City of Boston. Specific tasks completed include: (1) Assess existing conditions at an urban location; (2) Develop Source Loading and Management Model estimates of surface water runoff and nutrient loading for the selected site; (3) Evaluate Low Impact Development (LID) Best Management Practices (BMP) Opportunities; (4) Conduct scenario modeling for various BMP's; (5) Select BMP options Streetscape Concept; (6) Conduct a Public Outreach program; (7) Prepare a final project report.
9. Mystic River Headwaters: Alewife & Mill Brook Sub-watersheds (Section 604b, 2013 project), a $48,380 project The Town of Arlington partnered with the Town of Belmont to collectively address the problem of non-point source pollution in the Alewife and Mill Brook sub-watersheds. The two municipalities identified pollution sources to reduce pollutant loading through an examination of solutions with a focus on "green" structural BMPs. The project goals included developing conceptual designs for five BMPs – three within Arlington and two in Belmont– that will reduce pollutant loading from respective sites to water bodies in the Alewife and Mill Brook sub-watersheds. This project provided the towns with the information, experience, and tools necessary to move forward with more widespread BMP implementation in the future.
10. Westwood - Green Infrastructure Planning (Section 604b, 2013 project), a $25,974 project that identified voluntary retrofitting opportunities on private property not the subject of active redevelopment as a strategy for reducing water quality, hydrologic, and habitat impacts. The goal of the project was to retrofit existing impervious surfaces on private property, using green infrastructure techniques. Once potential sites were identified and landowner interest established, the town of Westwood will work with private landowners to encourage them to implement recommended measures through a program of general education, technical

assistance workshops, and other incentives. A variety of mechanisms such as water banks, tradable mitigation credits or stormwater utilities may be considered.

8.2 Illicit Sewer Connections, Failing Infrastructure, SSOs and CSOs.

Eliminating illicit sewer connections, repairing failing infrastructure, and controlling impacts associated with CSOs and SSOs are of extreme importance in eliminating and preventing bacterial pollution. Many organizations, along with at least several major programs, have been trying to address these problems, with considerable progress to date. The Massachusetts Department of Environmental Protection (MassDEP), U.S. Environmental Protection Agency (EPA), U.S. Geological Survey (USGS), Metropolitan District Commission (MDC), Massachusetts Water Resources Authority (MWRA), Boston Water and Sewer Commission (BWSC), and Mystic River Watershed Association (MyRWA), have all been active in the identification, and mitigation of bacterial related pollution problems for many years. For instance, in the Mystic River and Alewife Brook watersheds, the Mystic River Watershed Association has for years conducted dry weather sampling of storm drains and outfalls, and has identified a number of illicit sanitary flows going into these drains, which go directly to receiving waters from the outfalls. The MassDEP has issued Notices of Noncompliance to the responsible communities within these watersheds, requiring them to create programs to identify the location of the illicit connections and to eliminate them.

Previously, wastewater was treated at the MWRA Deer Island and Nut Island primary treatment facilities until the new Deer Island Sewage Treatment Plant was completed in 2001. The Deer Island Wastewater Treatment Plant now receives sewage from 43 greater Boston communities and has a higher capacity than the combined capacities of the former Deer Island and Nut Island facilities, greatly reducing back-ups and overflows throughout the system. The sewage passes through primary and secondary treatment, sludge digestion, disinfection, eventually discharging through a 9.5 mile long tunnel into Massachusetts Bay at 100 feet below the water surface (MWRA 2004a). The switch of the Nut Island Outfall to the Deer Island Wastewater Treatment facility in 1998, and the Deer Island facility discharge to the Massachusetts Bay outfall in 2000, has greatly improved bacteria related water quality in the previous Nut island and Deer Island outfall areas of Boston Harbor (see Figure 8-1) (MWRA 2004b). MWRA is responsible for monitoring the outfall and the Outfall Monitoring Science Advisory Panel (OMSAP), an independent panel of scientists provides advice on scientific issues related to the monitoring and discharge permit (http://www.mwra.state.ma.us/harbor/enquad/pdf/2016-11.pdf).

With regard to CSO controls, in a stipulation entered in 1987 through the Boston Harbor Court Case No. 85-0489, MWRA accepted responsibility for developing a Long- Term (CSO) Control Plan (LTCP) to address discharges from all CSOs connected to the MWRA sewer system, including outfalls owned by its member communities. The Court also required the development of an implementation schedule. In 1994, MWRA submitted its Final CSO Conceptual Plan and System Master Plan, which included a long-term control plan for CSOs that recommended 25 site-specific CSO projects located in Boston, Cambridge, Chelsea, and Somerville. This recommended plan was later refined in a 1997 Facilities Plan/ EIR, and again in an agreement MRWA reached with EPA and DEP with a Second Stipulation and LTCP in March 2006 which outlined the responsibility and liability for CSOs (MWRA 2010). This Second Stipulation was subsequently amended in May, 2008. The final long- term CSO control plan includes 35 projects for which design and construction milestones have been added to the Federal Court schedule (Schedule Seven). Under the order, MWRA has until 2020 to complete all CSO work and subsequent system monitoring, which will determine whether or not the LTCP goals have been achieved (MWRA 2010). MWRA has completed all 35 projects at a cost of $891 million, which is 98% of it's CSO budget in MWRA's Proposed FY 17 Capital Improvement Program (CIP) (MWRA 2016). This Capital Improvement Program (CIP) budget figure includes all the CSO LTCP work manifested under the Original Court Order, Second Stipulation, and Amendment in 2008. Updated details on CSO progress for MWRA, BWSC and other communities: http://www.mwra.state.ma.us/annual/csoar/2015/2015csoar-r4.pdf

Since the beginning of MWRA's CSO control planning efforts in the late 1980's, MWRA and the CSO Communities have eliminated or virtually eliminated, with a 25-year storm level of control, CSO discharges at 34 of the 84 outfalls addressed in the Long-Term CSO Control Plan (LTCP), five more than the number of outfalls recommended for closure in the LTCP. On December 4, 2014, the City of Chelsea permanently closed off Outfall CHE002 to CSO discharges following the City's completion of a sewer separation project that was outside the scope of the Long-Term CSO Control Plan. The outfall now serves as a city stormwater discharge. Four outfalls were previously closed by BWSC and the City of Cambridge – East Boston outfalls BOS006 and BOS007 to Boston Inner Harbor, and Cambridge outfalls CAM009 and CAM011 to the Charles River Basin – also through efforts outside the scope of the Long-Term Control Plan. The last outfall recommended for closure in the Long-Term Control Plan, Outfall CAM004 to Alewife Brook, was closed in December 2015 (MWRA 2016).

As shown in Figure 8-2, estimated average annual volume of CSO discharge has dropped from 3.3 billion gallons in 1988 to 0.45 billion gallons today, an 86% reduction, with 89% of the current average annual discharge volume receiving treatment at MWRA's four long-term CSO facilities at Cottage Farm, Prison Point, Somerville Marginal and Union Park (MWRA 2016). Figure 8-3 shows the decreasing volume of CSO discharge to receiving waters over time.

Major bacteria water quality improvement has occurred in the Charles River basin, where average annual CSO discharge has been drastically cut from 1.7 billion gallons in 1988, to 23 million gallons today, a greater than 98% reduction. Approximately 80% of this remaining CSO flow is treated at MWRA's Cottage Farm CSO Treatment Facility in Cambridge. Additionally, communities along the Charles have implemented programs to reduce pollution in separate stormwater discharges, and remove illicit sewer connections or cross connections to storm drain systems. All of these programs have resulted in significant water quality improvements to this particular basin[1].

In the Mystic River, Figure 8-4, "Change in Mystic River Water Quality Over Time", shows improvement in all areas of the Mystic after 2008, with the Lower Mystic and Mystic River mouth having the best water quality. These areas meet water quality limits most of the time, with more than 90% of bacteria samples meeting the *Enterococci* swimming standards of 104 cfu/100mL in all weather conditions for 2008 through 2014. Bacterial water quality in the Upper Mystic is also good, with bacteria meeting limits more than 90% of the time, except in heavy rain. While conditions worsen in heavy rain events, these rainfall conditions are relatively infrequent. Bacteria counts in Alewife Brook, where major CSO control work was undertaken in 2015, frequently fail to meet swimming limits in wet weather, with water quality being particularly poor after heavy rain. However, Alewife Brook's influence on downstream water quality conditions in the Mystic main stem is limited, with bacterial conditions downstream showing little influence from Alewife Brook.

Improvement in the quality of Boston Inner Harbor waters is also seen in (1) Figure 8-5, "Change in Inner Harbor Water Quality Over Time" and (2) Figure 8-6, "Changes in Boston Harbor *Enterococci* Bacteria in Wet Weather". Improvement was greatest in the Upper Inner Harbor and in Chelsea Creek, which have had in the past more serious wet weather pollution problems. Bacteria data indicate that water quality conditions improved greatly with the significant increase in wastewater transport and treatment capacity (delivery to the Deer Island Treatment Plant) since the late 1990s. This increase in delivery capacity greatly reduced CSO discharges at most outfalls. Also, the movement of the Deer Island Outfall 9.5 miles offshore in Massachusetts Bay has greatly added to pathogen level improvements. Since then, dry-weather water quality has greatly improved, and wet-weather water quality continues to improve in Boston Harbor and its tributary rivers, but at a slower pace due in part to diminishing returns on wastewater pollution investments and the dominance of other sources of pollution, including urban stormwater.

South Boston Beaches

Water quality along the beaches was excellent during the 2014 swimming season, with 100% of the Department of Conservation and Recreation's (DCR) sampling results meeting bacteria limits for swimming. The improvements in Pathogen water quality throughout the entire North-South Dorchester Bays Area are due in large part to two huge MWRA/BWSC projects which have been completed: (1) $253.9 Million North Dorchester Bay CSO/Stormwater Storage Tunnel/Facilities, and Pleasure Bay/Morrissey Blvd. Stormdrain Improvements; (2) $126.5 Million South Dorchester Bay Fox Pt./Commercial Pt. CSO closure; and in an ancillary way, (3) the Dorchester Area Sewer Separations. This

[1] More detail on specific projects and improvements in the Charles River are available in a separate Final Bacteria TMDL Report document for the Charles River Watershed. www.mass.gov/dep/water/resources/tmdls.htm

Dorchester Area Sewer Separation project involved a 306 acre, $72.6 Million Sewer Separation Effort in the Reserved Channel Area, immediately adjacent to Dorchester Bays. This project, has significantly improved water quality in the beach areas.

The fraction of days failing to meet the bacteria limit at one or more beaches in South Boston dropped from an average of 18% in the five years (2005-2010) prior to opening of the storage tunnel, to an average of 4% in the years following its opening (Figure 8-7). The few remaining water quality violations and related beach closings are not CSO related, (as there have been no CSO discharges in the beaches area since May 2011), and may be caused by environmental factors such as near-field overland stormwater runoff contaminated with garbage, pet waste or bird droppings. During 2014, the storage tunnel captured approximately 203 million gallons of CSO and separate stormwater and prevented any CSO or stormwater discharge to the beaches over approximately 97 rainfall events. Since start-up in May 2011, the storage tunnel has captured 753 million gallons of CSO and stormwater, and there has been no discharge of CSO to the beaches, two discharges of stormwater to the beaches (during Hurricane Irene in August 2011 and a portion of the storm of December 9, 2014), and two transfers of stormwater to Savin Hill Cove.

Alewife Brook CSO Control Plan

The Alewife Brook CSO Control Plan minimizes CSO discharges to the Alewife Brook primarily by separating combined sewer systems in parts of Cambridge and through upgrades of the hydraulic capacities at local sewer connections to the MWRA interceptors. The plan also includes a stormwater outfall and constructed wetland to accommodate the separated stormwater flows, prevent any increase in flooding along Alewife Brook, and provide a level of stormwater treatment. Refer to the MWRA CSO web page for most current status on projects and water quality improvement: http://www.mwra.state.ma.us/03sewer/html/sewcso.htm#located

CAM004 Sewer Separation

The CAM004 Sewer Separation Project, completed in 2015, represents the largest example of the Alewife Brook CSO Control Plan effort, totaling $73.4 Million, which includes 211 acres of sewer separation, and construction of an outfall and wetlands basin. Cambridge has completed the Sewer Separation Project which involves the separation of combined sewers upstream of Outfall CAM004 in the Huron Avenue and Concord Avenue neighborhoods east of Fresh Pond Parkway.

The project included the installation of approximately 20,700 linear feet of sanitary sewers and storm drains up to 54-inch diameter along Huron Avenue and several intersecting streets in a 68-acre area immediately east of Fresh Pond Parkway. Also in the project was installation of three large storm drain vaults on Vassal Lane, 45 new or replacement catch basins with hoods and 6-foot sumps, work on the private property of 58 buildings within the project area to remove roof runoff and sump pump discharges from the sewer system, and 6,700 linear feet of replacement water main ranging from 6-inch to 12-inch diameter. Surface restoration work and environmental improvements included porous pavements, stormwater biobasins, and trees and other plantings. Finally, 21,000 linear feet of new sanitary sewers and storm drains from 8-inch to 30-inch diameter, 1,700 linear feet of trenchless pipe rehabilitation, and approximately 13,230 linear feet of ductile iron water main pipe from 4-inch to 24-inch diameter along Huron Avenue and several intersecting streets in an 83-acre area east of Contract 8A.

Weymouth-Weir Wastewater-SSO Improvements

To abate the SSO problems in the Weymouth and Weir sub-basin, the MassDEP began an initiative in 1998 to reduce the frequency, duration, and volumes of overflows from the MWRA Braintree-Weymouth Interceptor and the Braintree and Weymouth municipal sewer systems. MWRA worked to identify hydraulic deficiencies in their sewer system in 1993. MassDEP signed an Administrative Consent Order (ACO) with MWRA requiring the MWRA to construct the Braintree-Weymouth Relief Facilities on a specified schedule. This total $231 million project has increased the system's capacity and streamline the route the wastewater takes from the communities to the Deer Island Treatment Plant. As a result of the completed project, Sanitary Sewer Overflow (SSO) incidents have been reduced by well over 90%. Braintree and Weymouth both signed ACOs with MassDEP to improve their sewer systems. Weymouth will be undertaking a $15 million capital improvement project and will perform work on extensive infiltration and inflow removal. Braintree has also begun infiltration reduction projects. The towns of Braintree and Weymouth have identified and removed hundreds of illegal sump pumps. In 2002, the Clean Water State Revolving Fund (SRF) gave the Town of Randolph $210,000 to perform a sewer investigation in the Amelia Road area where severe sewer overflows had occurred in March 2001. As part of the ACO with MassDEP, Braintree and Weymouth were required to perform dry weather sampling of storm drains to identify illegal connections to the storm drain system (MWRA, 2008).

CSO Progress Highlights and Accomplishments

MWRA and its CSO communities continued to implement the Long-Term CSO Control Plan and comply with the Federal Court-ordered obligations defined in Schedule Seven and in the March 15, 2006, Second Stipulation of the United States and the Massachusetts Water Resources Authority on Responsibility and Legal Liability for Combined Sewer Overflows, as amended by the Federal District Court on May 7, 2008 (the "Second CSO Stipulation"). The MWRA and the CSO communities have eliminated CSO discharges at 34 or the 84 CSO outfalls and virtually eliminated (25 year storm level of control, CSO discharges, along with 5-year storm level of control of separate stormwater discharges) at the five remaining outfalls along the South Boston beaches. The 34 closed outfalls include five outfalls (two in Cambridge, two BWSC, and one in Chelsea) that the LTCP had assumed would remain active.

For more details on the work that has been completed and water quality improvement statistics refer to the MWRA website for the most recent annual report: http://www.mwra.state.ma.us/annual/csoar/2015/2015csoar-r4.pdf.

Figure 8-1 Approved Long-Term CSO Control Plan and Benefits (MWRA 2015)

BENEFITS

- 84 CSO Outfalls: 34 Closed
  - 46 Reduced to a Minimal Number of CSO Discharges per year
  - 4 Treated
- Eliminates or Reduces CSO Activations to Achieve a Level of CSO Control Consistent with Water Quality Standards
- Treats More Frequent Discharges
- Controls Floatable Materials at remaining active CSO Outfalls

CSO CONTROL PROJECTS

Sewer Separation
Existing CSO Treatment Facility Upgrades
New CSO Treatment Facility
CSO Consolidation /Storage Conduits
Relief Sewers
Localized Hydraulic Relief
Outfall Repairs
Region Wide Floatables Controls
System Optimization

PROGRAM SCHEDULE

Final CSO Conceptual Plan	Dec 1994
Final Facilities Plan and EIR	Jul 1997
Final Approved Plan	Apr 2006
Design and Construction	1995 - 2015
Assessment Phase	2018 - 2020

COSTS
Planning, Design & Construction
$898.3 Million
Net Annual O&M
$1.5 Million

Figure 8-2 CSO Volume Reduction by Receiving Water (MWRA 2016)

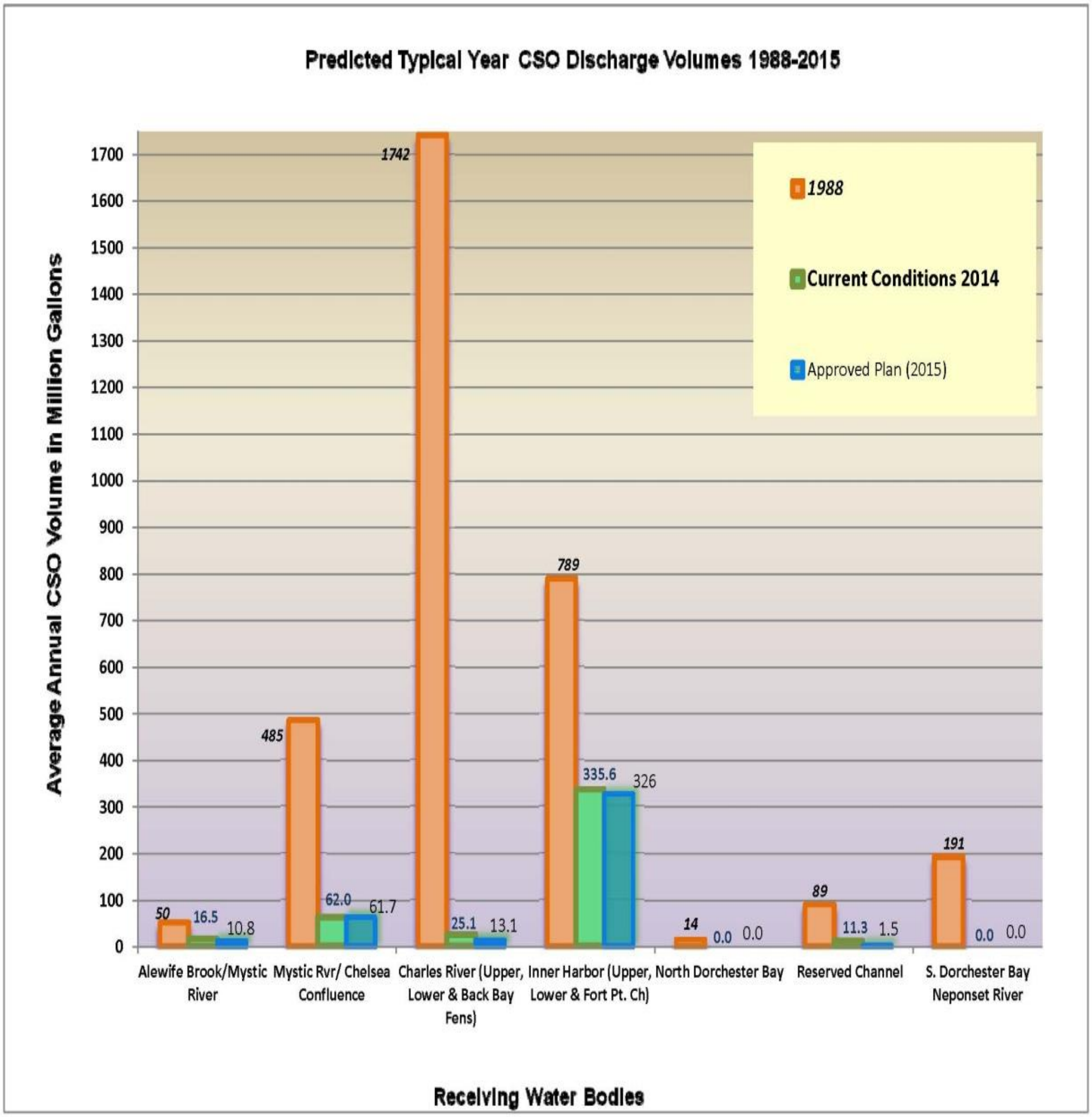


Figure 8-3 Region-wide CSO Reduction and Goal (MWRA 2015)

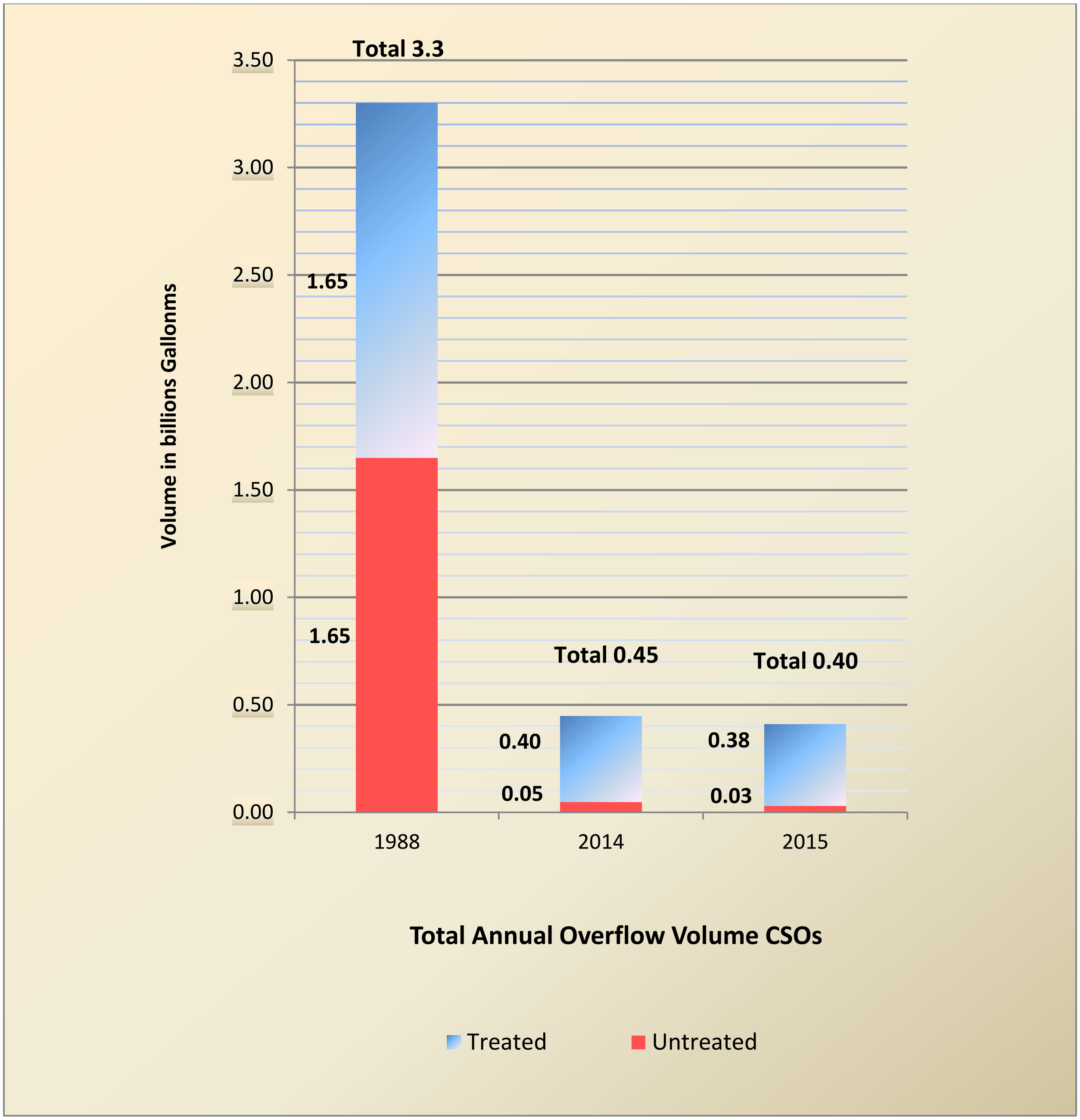
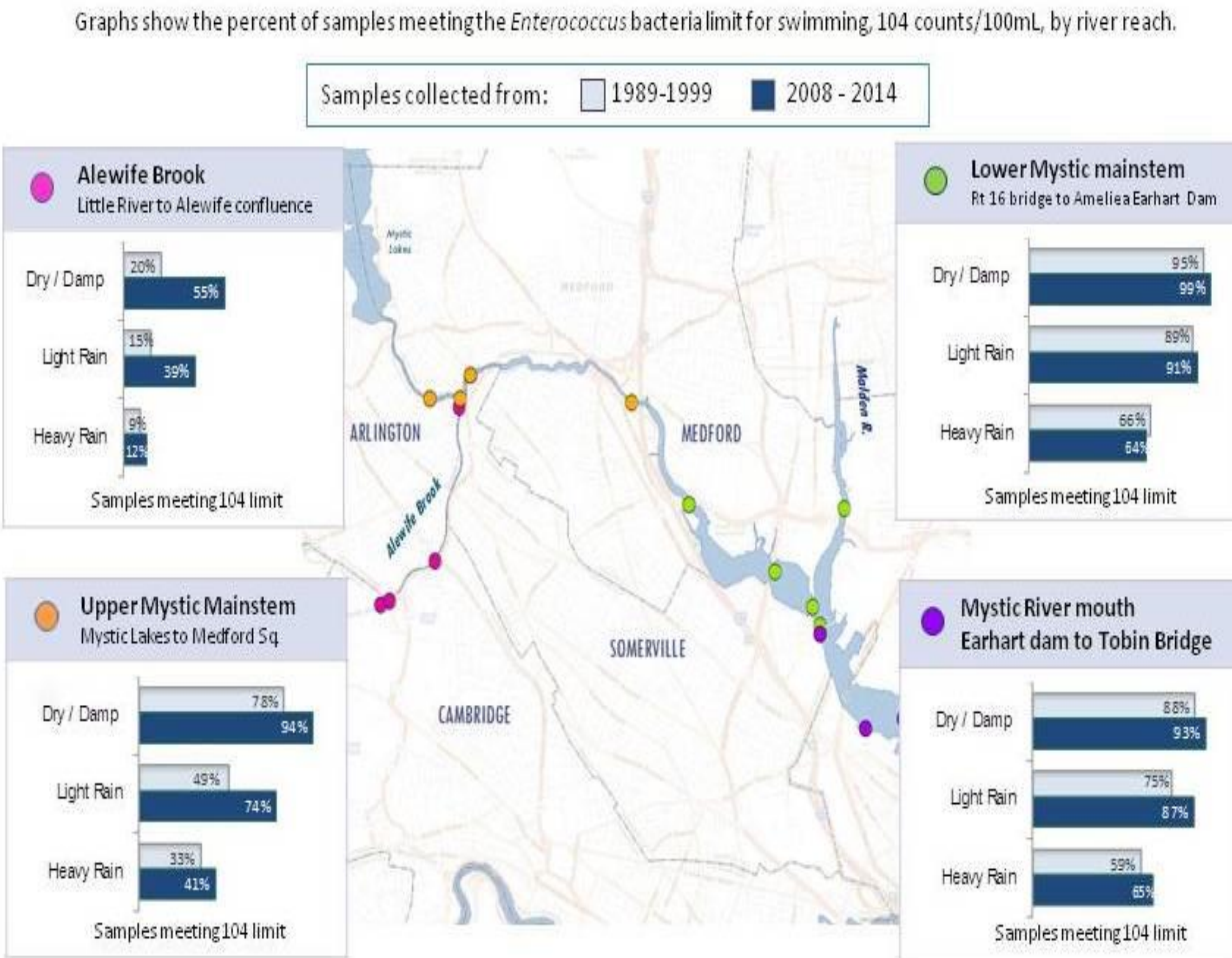


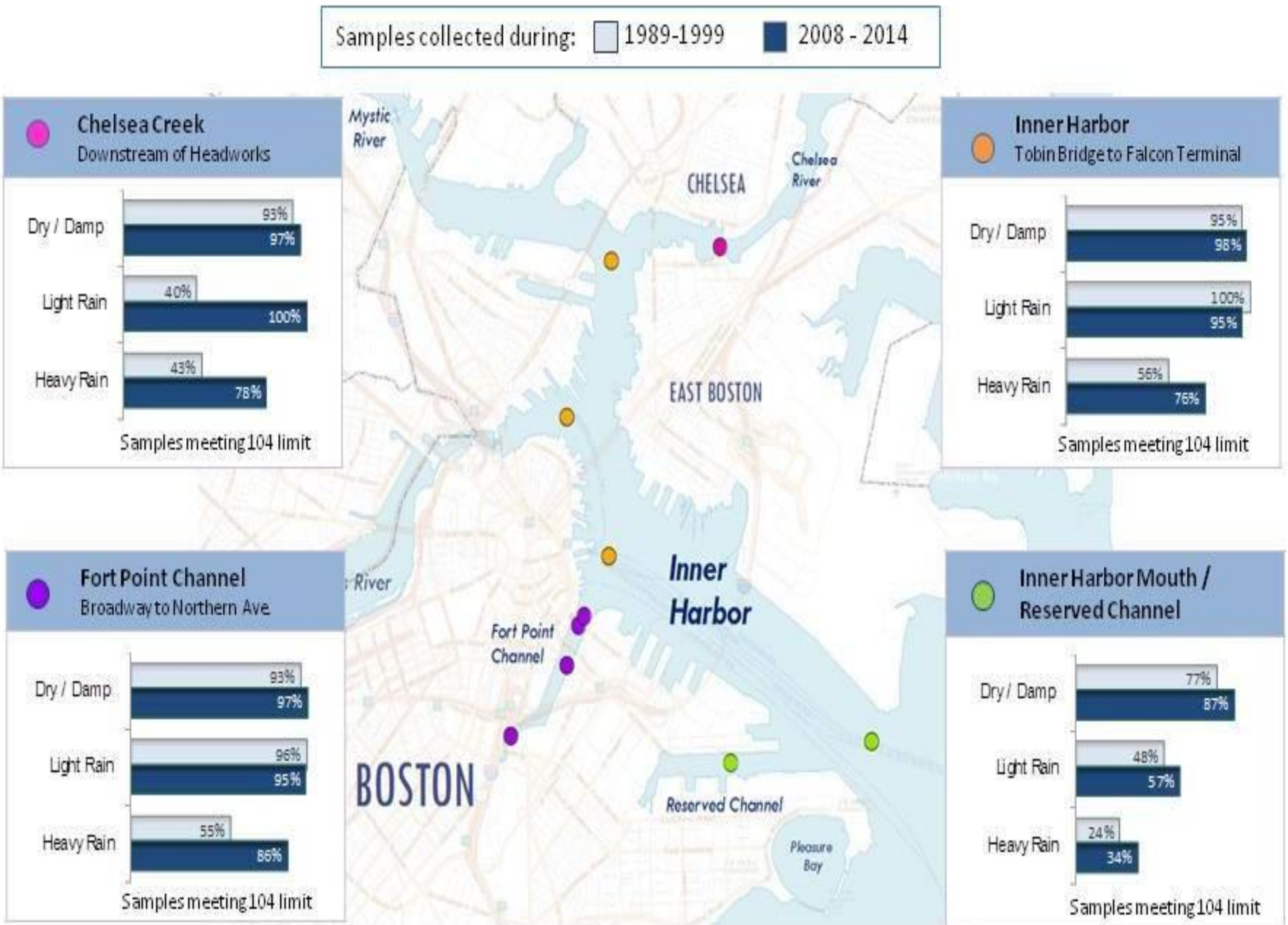
Figure 8-4 Change in Mystic River Water Quality over Time (MWRA 2015)



Dots are MWRA sampling locations. State swimming standards for *Enterococcus* single sample limit is 104 cfu/100 mL. Rainfall: Heavy Rain is at least 0.5 inches of rain in previous 48 hours; Light Rain is between 0.1 and 0.5 inches of rainfall in previous 48 hours. 2008 – 2014 period is considered current conditions, following substantial completion of infrastructure improvements. Data from intervening years (2000 – 2007) are excluded.

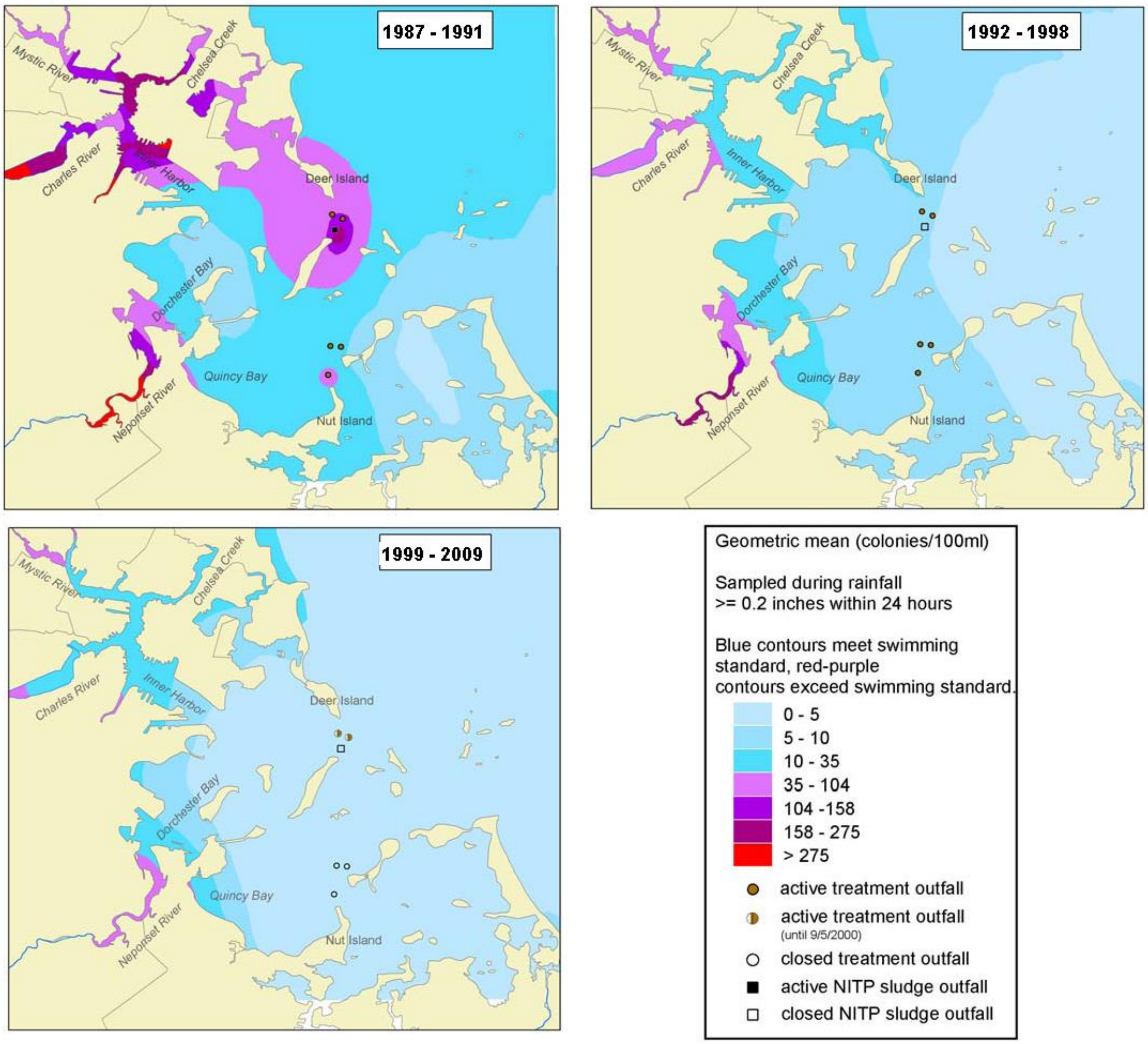
Figure 8-5 Change in Inner Harbor Water Quality over Time (MWRA 2015)

Graphs show the percent of samples meeting the *Enterococcus* bacteria limit for swimming, 104 counts/100mL.



Dots are MWRA sampling locations. State swimming standards for *Enterococcus* single sample limit is 104 cfu/100 mL. Rainfall: Heavy Rain is at least 0.5 inches of rain in previous 48 hours; Light Rain is between 0.1 and 0.5 inches of rainfall in previous 48 hours. 2008 – 2014 period is considered current conditions, following substantial completion of infrastructure improvements. Data from intervening years (2000 – 2007) are excluded.

Figure 8-6 Changes in Boston Harbor Enterococcus Counts in wet weather (MWRA 2010)



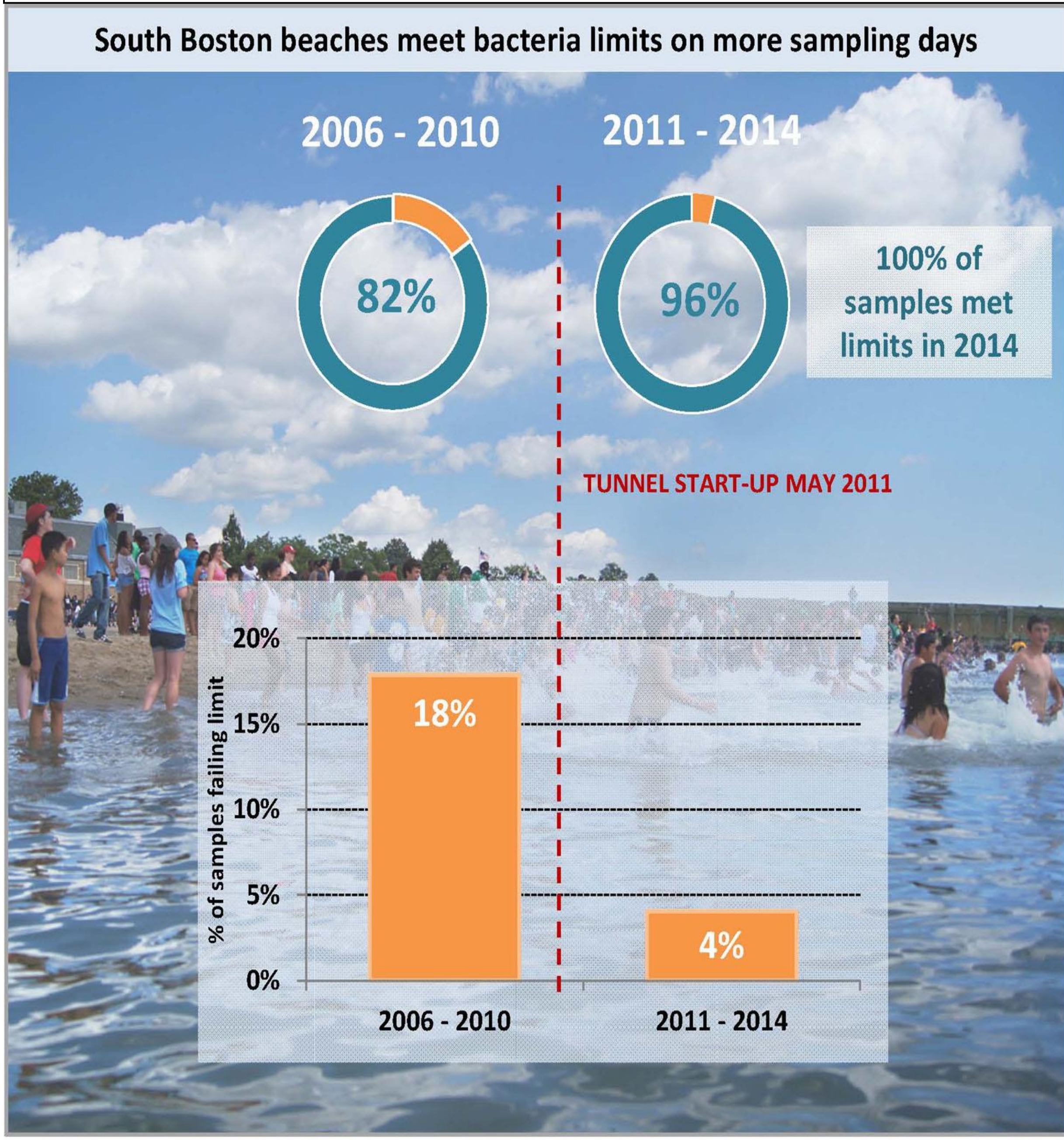
Contours show the geometric means of *Enterococcus* data collected when more than 0.2 inches of rain fell in the previous 24 hours. Blue areas meet the EPA geometric mean standard and red-purple areas exceed the standard.

1987 - 1991 This period shows data collected prior to when the Boston Harbor project and CSO plans began, through the last year that sludge was discharged (1991). In wet weather, areas affected by the discharge of sewage and sludge from the Deer Island Treatment Plant and Nut Island Treatment plant, and most of the Inner Harbor and tributary rivers, failed to meet the standard.

1992 - 1998 Data from these years reflect the effects of CSO upgrades, the ending of sludge discharge, full pumping at DITP, improved primary and beginning secondary treatment at DITP. Most of the harbor meets standards except for the tributary rivers, Fort Point Channel and along Wollaston Beach.

1999 - 2009 The current period shows continued improvement due to the closure of 22 CSO outfalls, upgrades of CSO facilities, ending of harbor treatment plant effluent discharges as the new outfall began operating in 2000, and local efforts to abate stormwater pollution.

Figure 8-7 Water Quality improvements at South Boston Beaches (MWRA 2015)



8.3 Illicit Discharge Detection and Elimination (IDDE) in the Boston Harbor Watershed

Elimination of illicit sewer connections and repairing failing infrastructure are of extreme importance. EPA's Phase II rule specifies an MS4 community must develop, implement, and enforce a stormwater management program that is designed to reduce the discharge of pollutants to the maximum extent practicable, protect water quality, and satisfy the applicable water quality requirements of the Clean Water Act. Illicit discharge detection and elimination (IDDE) is one of the six minimum control measures that must be included in the stormwater management program. The other control measures are:

- Public education and outreach on stormwater impacts
- Public involvement and participation
- Construction site stormwater runoff control
- Post-construction stormwater management in new development and redevelopment
- Pollution prevention and good housekeeping for municipal operations

As part of their applications for Phase II permit coverage, MS4 communities must identify the best management practices they will use to comply with each of these six minimum control measures and the measurable goals they have set for each measure.

In general, a comprehensive IDDE Program must contain the following four elements:

1) Develop (if not already completed) a storm sewer system map showing the location of all outfalls, and the names and location of all waters of the United States that receive discharges from those outfalls.

2) Develop and promulgate municipal regulations that require the municipality to comply with Phase II regulations including prohibition of illicit discharges and appropriate enforcement mechanisms.

3) Develop and implement a plan to detect and address illicit discharges, including illegal dumping, to the system. EPA recommends that the plan include the following four components: locating priority areas; tracing the source of an illicit discharge; removing the source of an illicit discharge; and program evaluation and assessment.

4) Inform public employees, businesses, and the general public of hazards associated with illegal discharges and improper disposal of waste. IDDE outreach can be integrated into the broader stormwater outreach program for the community. Fulfilling the outreach requirement for IDDE helps the MS4 community to comply with this mandatory element of the stormwater program.

Communities that are not covered under the Phase II rule (i.e., not designated as MS4 communities) are encouraged to implement a program for detecting and eliminating sewage discharges to storm sewer systems including illicit sewer connections. Implementation of the Phase II rule, whether voluntarily or mandated will help communities achieve bacteria TMDLs.

Guidance for implementing an illicit discharge detection and elimination program is available from several documents. EPA New England developed a specific plan for the Lower Charles River (US EPA 2004c) to identify and eliminate illicit discharges (both dry and wet weather) to their separate storm sewer systems. Although originally prepared for the Charles River Watershed it may be applicable to other watersheds throughout the Commonwealth, however, it represents just one of the approved methodologies available. More generic guidance is provided in a document prepared for EPA by the Center for Watershed Protection and the University of Alabama entitled Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments (US EPA 2004). In addition, practical guidance for municipalities is provided in a New England Interstate Water Pollution Control Commission publication entitled Illicit Discharge Detection and Elimination Manual, A Handbook for Municipalities (NEIWPCC 2003). Implementation of the protocol outlined in these guidance documents satisfies the Illicit Discharge Detection and Elimination requirement of the NPDES program.

8.4 Stormwater Runoff

Stormwater runoff can be categorized in two forms 1) point source discharges and 2) non-point source discharges (includes sheet flow or direct runoff). The term "nonpoint source" is defined to mean any source of water pollution that does not meet the legal definition of "point source" in section 502(14) of the Clean Water Act. Many point source stormwater discharges are regulated under the NPDES Phase I and Phase II permitting programs when discharged to a Waters of the United States. Municipalities that operate regulated municipal separate storm sewer systems (MS4s) must develop and implement a stormwater management plan (SWMP) which must employ, and set measurable goals for the following six minimum control measures:

1. public education and outreach,
2. public participation/involvement,
3. illicit discharge detection and elimination,
4. construction site runoff control,
5. post construction runoff control, and
6. pollution prevention/good housekeeping.

The NPDES permit does not, however, establish numeric effluent limitations for stormwater discharges. Maximum extent practicable (MEP) is the statutory standard that establishes the level of pollutant reductions that regulated municipalities must achieve. The MEP standard is a narrative effluent limitation that is satisfied through implementation of SWMPs and achievement of measurable goals. Non-point source discharges are generally characterized as sheet flow runoff and are not categorically regulated under the NPDES program and can be difficult to manage. However, some of the same principles for mitigating point source impacts may be applicable. Individual municipalities not regulated under the Phase I or II should implement the exact same six minimum control measures minimizing stormwater contamination.

Stormwater Phase II Annual Reports from the various communities were last received in May 2015 (EPA 2015). Indications are that substantial progress is being made, particularly with certain communities, on those aspects of the six point plan requirements that would address bacteria pollution. A brief review is made herein on each community covered under the Program in the watershed and their progress:

Arlington- Public education has included stormwater information on the town website, brochures on pet waste management and waterfowl management, and programs offered on Arlington Cable TV. During 2008-9, the town intensified efforts with its existing pet waste and waterfowl management program. By 2014, the town was actively maintaining dog waste receptacles in all public park areas. The Stormwater Management Plan draft has been made available on the website and Cable TV station. The town applied and got a 319 grant for a project on Spy Pond for fertilizer and waste control. This included storm drain stenciling. The town has extended these efforts to Arlington Reservoir. IIllicit connection detection efforts have included mapping the overall stormwater drainage system including outfalls, reviewing and redrafting town stormwater by-laws, and developing a pollution control plan. During 2007, a number of stormwater control projects commenced, including: sewer rehabilitation efforts at Cross, Hemlock Street, and Highland Avenue, dry weather sampling and smoke dye testing at these locations plus others, and television inspection of sewer laterals to find bacteria contamination sources. During 2008, MWRA sewer and drain rehabilitation work continued in the Mystic Bank area, Ryder Street, and on Landsdown Road. In 2009, the town conducted dye water testing of sewers serving the Ottoson Middle School as a follow up to optical brightener sampling that had been done by MassDEP during late 2008. Follow up sampling occurred in 2010-11, including 136,000 linear feet of smoke testing, and 45,000 linear feet of TV inspections. The town has developed a 15 year plan to rehab the entire town's sanitary sewer system. Housekeeping has included the effort of stormwater training for DPW personnel, annual street sweeping and catch basin cleaning, and sewer cleaning/ rehabilitation on Summer Street in the Reeds Brook area, and in the Spy Pond area. This includes a 319 Grant award to the town to install a stormceptor system in the Spy Pond area.

Belmont- Public Education efforts have included developing a webpage on the town's website for stormwater issues, developing flyers and sending them out to citizens, and sending a copy of the Stormwater Management Plan (SWMP) to all town boards, including posting it on the town website. As of 2013-14, a stormwater education brochure is distributed annually by inclusion in municipal light bills. In August 2013, a day-long public education stormwater conference was facilitated by the DPW and the Office of Community Development. A warrant article on stormwater by-laws was approved at town meeting in 2013, and was posted on the town's website. With illicit connection detection, an overall outfall map was created on GIS. This outfall map was formally revised in 2013 utilizing special sewer and stormdrain models. A city- wide sewer rehabilitation program has been underway, including TV camera investigations to help discover illicit connections. As of 2007, a number of these had been found in the

Wellington Brook area. By 2009, 'Phase III' of a stormdrain rehabilitation and CCTV inspection project was underway to fix illicit connection problems in this same area. As of 2009, over 17,000 linear feet of sewer lines and stormwater drainage systems had been dye tested &/or inspected with TV cameras for rehabilitation needs, as well as for locating illicit connections. Also by 2009, the town had an Inflow/Infiltration reduction project well underway, to identify I/I sources, and remove them. A $2.3 million SRF loan award was received in 2011-12 to rehabilitate 30,000 linear feet of stormdrain lines, plus reline 90 sewer laterals. Also, MWRA monies were utilized for I/I rehab work, which resulted in removal of 200,000 GPD. Housekeeping includes an annual DPW staff training program, street sweeping at least 2 times per year, and catch basin cleaning at least once per year. In 2006, the town received a 319 grant to install deep sump pump and baffle tanks in various catch basins around Spy Pond.

Boston- Boston is served by combined sewers, and separate sanitary and storm drain systems. The municipal sewer and storm drain systems within Boston are managed by the Boston Water and Sewer Commission (the Commission). The combined sewer system is permitted by EPA under NPDES Permit No. MA0101192, issued in March 2003. The stormwater system is permitted by EPA under NPDES Permit number MAS010001, issued in September 1999. Both permits have expired and the Commission applied for renewals as required. Their terms continue administratively as allowed by EPA regulation.

Approximately 75 percent of the sewered portion of the City, roughly 36.5 square miles, is served by separate sewers and 25 percent, approximately 12.1 square miles, is served by combined sewers. Since 1999, the Commission has spent more than $286 million to separate its combined sewers. As a result, CSO discharges from the combined system have been reduced by 124.3 million gallons per year, and water quality in Boston Harbor, and the Charles, Neponset and Mystic Rivers has substantially improved.

On August 23, 2012, the Commission entered in a Consent Decree with EPA and others in settlement of a CWA suit in the U.S. District Court. As a result, the Commission is implementing remedial measures designed to further improve the quality of discharges. These measures include implementing a Capacity, Maintenance, Operations and Management (CMOM) program; mitigating sanitary sewer overflows (SSO's); prioritizing sub-catchment areas for investigation and elimination of illicit discharges to the drainage system; improving mapping capabilities; tracking industrial facility and construction site discharges; developing a comprehensive stormwater model; implementing structural Best Management Practices (BMPs) which include green infrastructure and low impact development; and other activities.

The Commission owns 200 stormwater outfalls, consisting of 101 major outfalls (36" or more pipe diameter), and 99 non- major outfalls. The Commission's stormwater outfalls are screened annually for bacteria, ammonia, surfactants and other parameters. The Commission has a very aggressive illicit discharge identification and elimination (IDDE) program. Since 1988 the Commission has eliminated more than 1,471 illicit discharges and removed over 681,000 gallons per day of sewage from the separated storm drainage system. Illicit discharge investigation of the Commission's entire separated storm drainage system is scheduled for completion in 2019.

Under the Commission's Capital Improvement Program, since 1978, 82.8 miles of deteriorated or collapsed sanitary sewer and drains have been replaced, 54.7 miles of sewer and drain have been rehabilitated, 585 miles of sewer/drain pipe has been television inspected, 45.6 miles of large sewer and drain pipe has been cleaned and approximately 93.3 miles of new storm drain has been installed for separation purposes to reduce the volume and frequency of CSO discharges.

The Commission's 2015-2017 Capital Improvement Budget included $76.5 million for sewer and drain related projects, of which $36.3 million was earmarked for 2015.

Braintree- Public education includes partnering with the Pond Meadow Park Organization to carry out stormwater public education efforts. This has included producing 2 flyers on illicit sump pumps associated with sanitary sewer overflow problems. A SWMP was developed, and posted on the town website, with programs broadcast on the local cable TV. An educational webpage on stormwater is available on the town website. The topic of stormwater management is covered in the weekly DPW Department meetings. The town's stormwater drainage system has been mapped in autocad format, including the GPS field location of 247 outfalls. Illicit connections identification efforts have included dry weather flow monitoring and water quality sampling of 31 outfalls. Two major illicit discharges have been corrected (at Common St., and Commercial St.). In 2008, the Fore River Watershed Association discovered a raw sewage discharge, which the Water and Sewer Department corrected. A by-law final draft on illicit connections (set up as an IDDE Program) has been developed by the Engineering, Highway, and Planning/Community Development Departments, but as of 2014, had not been submitted yet to the Mayor for final approval. The plan will be submitted in 2015, with anticipation of approval during that year. Additionally, the town has set up a priority schedule where sewer service cleanouts are necessary. The town is actively involved with bacteria testing at town beaches, with data results posted on the town website.

Chelsea- Public education efforts have included city- wide distribution of stormwater material via mail twice per year (through 2013), plus instituting a stormwater webpage on the town website. Starting in 2007, the town began holding coordination meetings twice per year on stormwater related issues with Chelsea Greenspace, and the Mystic River Watershed Association. Starting in 2012, the town joined as a participating member of the MyRWA Steering Committee. Also, the town participated in storm drain stenciling and providing support for MyRWA monitoring efforts. As of January, 2012, the existing stormdrain map was updated, with additional information included on all tributary areas. The town has produced stormdrain map updates on GIS. The town has reviewed, together with DEP, Oil Terminal permits in relation to bacteria pollution. For instance in 2006, a major illicit sanitary sewer connection-outfall was found and the connection removed at the Gulf Oil Terminal. A non-stormwater ordinance for Chelsea was formally adopted in October, 2009. Also, starting in 2009, a recently adopted five- year capital plan allocated $125,000 annually to be spent on stormwater related work. Housekeeping includes street sweeping every street twice per month, and the cleaning of 500 catch basins per year up through 2014. Also, deep sump pumps have been installed in all catch basins that have been rehabilitated.

Everett- This municipality has had an excellent overall Phase II control effort ever since this program began in 2003. Stormwater information has been available on the town website, and a series of talks and news articles on the subject are regularly telecast on the local TV cable station. In addition, the city has recently been working with 'New Friends of the Malden River Group' to place stormwater related educational materials on Facebook and the Internet. Educational programs have been focused on small businesses and individuals. There has been considerable contact and cooperation with MyRWA and Mass. Riverways on various education and sampling efforts. There has been an effort to put up dog waste disposal signs, and provide pooper scooper stations in public parks in town. There has also been an education effort with businesses, particularly with illicit connection concerns. Watershed education curriculums have been infused in the K –12 public schools, and at the high school, a special science unit is taught on water quality testing in the Malden River. A stormwater task force has been formed, plus a stormwater telephone hotline set up for illicit connections.

During 2006, the town conducted a hydraulic- mapping GIS study (including modeling) involving the entire stormwater system. This included determining size of pipes, flow potential, material structure of pipes, conditions, age, manhole and catch basin locations. Also, illicit connection detection efforts have included a schedule to screen and monitor for Fecal coliform at 25 dry weather outfalls twice per year starting in 2008. There is an aggressive effort to prioritize troublesome outfalls, and to obtain funding to fix these. Also, the city wants to create electronic records of everything related to illicit connections, including field investigations, data and findings, and resultant remediation actions. A stormwater ordinance was passed in 2008-9 which was particularly aimed at dealing with illicit connections. In 2012, Beth Consultants was hired to facilitate an ongoing citywide IDDE program, update the GIS mapping of stormdrains, and to establish priority outfalls for future monitoring for illicit discharges. A monitoring program was supposedly put in place during 2013. Housekeeping has a pollution prevention program in place to address all aspects, including street sweeping and catch basin cleaning.

Hingham- Public education efforts on stormwater have included: (1) the distribution of 1,500 stormwater related door hangers during catch basin cleaning operations; (2) stormwater press releases, and a stormwater webpage on the town website; (3) the EPA stormwater program broadcast on cable TV, 'After the Storm'; (4) a telephone hotline for citizens to report illicit discharges to stormwater. By the end of 2014, 97% of the drainage system had been mapped on GIS, including all outfalls. As of 2014, illicit connection detection efforts had included the inspection of a total of 329 outfalls (141 of these were dry weather outfalls), with 3 illicit connections found and removed. Illicit discharge information has been put in at least three flyers and press releases per year, and an illicit connection reporting hotline set up through the Fire Department. In 2013, a boat waste pumping station was installed in the town pier area. Catch basins are cleaned bi-annually, with many tons of detritus collected.

Holbrook- Public education efforts have included the mailing to all residents of a professionally produced flyer on stormwater. Also, a fact sheet on dog waste disposal was mailed to residents, with signs posted in all public parks. Stormwater education modules are currently being taught in the Middle School. A stormwater management plan has been prepared, with annual updates on its progress given at a televised selectman's meeting by the Stormwater Advisory Committee. The town has mapped on GIS (with aerial photography) the stormwater collection system including all outfalls, catch basins and manholes. Dry weather outfall sampling occurred during 2007- 2008. A number of illicit connections have been found and fixed. Since 2006, housekeeping efforts have included: an illegal dumping prevention effort, annual street sweeping (includes 55 miles of streets), and annual cleaning of 50% of all catch basins.

Malden- The City continues to make significant progress towards meeting the requirements of proposed revisions to the MS4 General Permit. In support of this compliance program, the City has invested significant resources and funding to support the objectives of the Stormwater Compliance Team (SCT). As an example of the City's commitment to the MS4 Stormwater program, staffing support has been increased for Malden Department of Public Works (MDPW), who represent the major component of the Compliance Team. The systematic cleaning of catch basins, mapping of infrastructure system components, logging of component attributes, identification of infrastructure needs, and removal of illicit discharges serves to demonstrate the effectiveness of the City's stormwater management program. Through the efforts of City personnel and outside technical support, paper records have been converted into a working GIS resource. This management tool has increased the efficiency and timing of responses, while providing an in depth working knowledge of the infrastructure, major components of which date back to the late 1800s.

Of primary note is that working with representatives of the USEPA and the City's IDDE Implementation Plan, it has been quantified through flow isolation studies that Malden receives substantial dry weather flows from neighboring communities. As a "flow through community" the City has provided this information for public distribution. The City of Malden currently maintains a dedicated team of in-house staff and supporting technical services to meet the challenges of stormwater management within a highly urbanized study area. To support the removal of illicit discharges, the City has undertaken flow capacity analyses, GIS mapping of infrastructure components, dry and wet weather sampling, flow isolation studies, IDDE plan detections and removals. Building upon the results of dry weather mass balance /flow isolation studies, the City maintains a very aggressive IDDE program that has resulted in readily apparent improvement in the quality of stormwater discharges.

City representatives have been meeting with stewardship organizations such as the Mystic River Watershed Association (MyRWA) and the Friends of the Malden River throughout the last year to develop partnerships and transfer information. During this reporting period, the City continued to meet with representatives of the Department of Conversation and Recreation (DCR) in an attempt to address long needed repairs to flow conveyance channels at the along Town Line Brook and at Oak Grove. At this time, funding constraints have been indicated by DCR and conditions continue to degrade in this major flow conveyance network. As such, outside assistance from political and regulatory representatives is needed to avoid continued degradation of both surface water quality and channel integrity. Through its Capital Improvement Plan (CIP), the City has funded over 450 linear feet of bank repair and stabilization at Fellsmere Pond to improve stormwater runoff characteristics and corresponding surface water quality. In addition, two nearby areas of groundwater breakout were found to be attributable, at least in large part, to compromises to the drainage system that serves the study area, which were mitigated through manhole repairs and the installation of new piping. At South Broadway and Callahan Parks, significant improvements in the form of synthetic and grass recreational cover and infrastructure improvements were performed as a continuation of the City's commitment to improved stormwater runoff. The City is also continuing to work with and support the U.S. Amy Corps of Engineers (ACOE) National Ecosystem Restoration (NER) Plan that will enhance both habitat and surface water quality along the banks of the Malden River.

Medford- The town prepared a stormwater management plan in 2004, and held meetings to explain the plan to those in town government and the public. The town has worked with the Charles River and Neponset River(s) Watershed Associations to sample the Mill Mine Brook area. The town has a webpage on its website to describe on- going stormwater activities. The town has completed GIS mapping of 90% of the town's stormdrain network, including catch basins, and principal outfalls. Specifically, 100 outfalls have been screened and sampled for dry weather flows. Additionally, 103 outfalls have been identified on DCR properties located in town. There are plans for selected wet weather outfall screening in the future. The city's formal stormwater ordinance, including an illicit discharge control component, was approved by the City Council in March, 2010. Stormwater regulations, from that ordinance, are being promulgated by a newly formed Stormwater Board during 2010. As of 2014, these rules are under review by the Stormwater Board. The year 2014 saw considerable IDDE work, including inspection of numerous manholes, building dye tests taken, which turned up 2 illicit connections of which 1 was removed. Considerable additional inspections were planned for 2015-16. During 2009-10, 2,725 catch basins were cleaned. During 2014, the town cleaned 12,950 linear feet of stormdrain pipes. Street sweeping occurred up to two times per year on all streets during 2013-14, with 826 tons of sweepings collected.

Melrose- Public education efforts 2006-2013 have included: (1) an annual stormwater message placed in water/sewer bills; (2) distribution of stormwater brochures throughout the city; (3) a stormwater page on the town website; (4) a stormwater booth at the annual Victorian Day city fair; (5) pet waste signs in all public parks and athletic fields; (6) broadcast of the EPA program, "Reining in the Storm, One Building at a Time"; and, (7) supporting the effort in teaching classes in elementary schools on stormwater related issues. A stenciling program began in 2010 with the intention of marking 25 catch basins per year 'don't dump', etc. Illicit connection detection work has included mapping of the stormwater collection system and outfalls on GIS. There have been plans in the works to identify and remove non- stormwater discharges going into stormwater conveyances, including several illicit discharges which were removed. During 2008, the MassDEP NERO Bacteria Source Tracking Program was actively monitoring in the northern part of the Ell Pond area, and found some very high bacteria readings. The NERO has been working with the city to come up with a plan to find and fix the pollution sources. Annual cleanups have been sponsored by the Scouts for Ell and Swain's Ponds. In 2012-13, the city received a 104b grant to conduct a mapping study of the Ell Pond subwatershed. In 2008, the town and MassDEP conducted dry weather outfall sampling in the Tremont and Melrose Street areas, and discovered two suspect septic systems that exist near drain lines that connect to city stormwater lines. 2011-12 saw TV inspections of 23 sections of stormdrain piping. An illicit connection ordinance, which includes authority to access buildings to inspect for illicit connections, was approved by the city's Aldermen in April, 2008. Housekeeping includes street sweeping of all streets in the spring, plus twice weekly in commercial districts. As of 2007, up to 2/3rds of total catch basins are cleaned annually. There is concern for proper disposal of all collected residuals from catch basins, streets and municipal yards.

Quincy- Public education efforts have recently included (2011-14) a televising several times a year on QATV the program 'How Quincy Works', emphasizing the separation of sewage and stormwater lines, pet waste disposal, where stormwater goes (Quincy Harbor), etc. A stormwater newsletter model format was developed, which is updated periodically with up-to-date news and information, and mailed out twice annually to all homes. As of 2007, the city website has a stormwater webpage. A stormwater committee was set up in 2007-8, consisting of representation from three regions in the city: Monclair Bog at Wollaston Beach; Blacks Creek at Mallard Marsh; and Town Brook. Pet waste control efforts have included maintaining signs and pooper scooper stations in public parks, and plans for mailers on pet waste to all residents. Additionally, the city is looking for a location for a dog park. The city has mapped the stormwater drainage system as well as all connecting outfalls. An illicit discharge control ordinance was formally adopted in 2005. IDDE efforts have coalesced with flood control concerns since 2010. For instance in 2011-12, a $5.3 million a West Quincy Flood Relief project was conducted, which constructed a diversion and by-pass flow tunnel underneath downtown Quincy going directly to the Town River.

During 2012-14 the city's stormwater drainage system was updated using GIS mapping, showing 190 outfalls, 9,329 catch basins, manholes, ditches, and 43 tidegates. A GIS viewer is available for residents on the town website. In 2013, five I-Pads were purchased to help with catch basin cleaning in the sense of setting priorities, and keeping maintenance records. During 2009, the city conducted the Wollaston Beach Drainage Water Quality Study, which involved dye testing and sampling of outfalls, catch basins and manholes throughout this beach area. Also in 2009, the city inspected 200 sewer manholes in tidal areas, put nearly 100 of these on a construction contract (bid) list for repair, and during the inspections, discovered several illicit connections. Follow-up work (2010-13 period) has focused on beach areas, such as Wollaston and Spence Avenue areas with frequent outfall inspections and testing (including dye testing) in conjunction with regular Enterococcus testing during the beach season at these locations. Some illicit connections have been discovered and fixed as a result. The year 2014-15 saw $ 1/2 million spent on I/I control at Hough's Neck and the Adams Shore Region. As of 2014, housekeeping has included regular street sweeping once per year, catch basin cleaning (at least 1,145 tons removed/yr), and the installation of at least 3 “storm septor” retrofits in catch basins that are refurbished by the city each year.

Randolph- Phase II progress in this town was delayed several years until a $150K revolving loan fund allotment to help fund the Program was awarded by the State and accepted by the town in 2007. Public education has included development of a stormwater flyer/ brochure, which was distributed once in 2006 as an accompaniment with all water bills being mailed out in town. Press releases and local newspaper articles on stormwater related issues were prepared and released during 2006. The DPW was scheduled to be conducting stormwater workshops in school curriculums in 2007-8. A town website with a stormwater related webpage was set up in 2007, along with information about an available stormwater phone/webpage hotline. A high school poster project contest on stormwater issues took place in 2007. Illicit connection detection work included the preparation of a draft by-law during 2007-8, use of State Revolving Fund monies during 2007-8 for an outfall inspection and sampling program, as well as completion of mapping on GIS of all stormwater infrastructure and outfalls in the town. During 2009, the town sampled 23 discharges and found 11 possible illicit connections. As of 2014, the town still had not finalized or passed an IDDE by-law. Since 2007, housekeeping has included a beefed- up catch basin cleaning/ prioritization effort, with an annually published schedule of upcoming efforts in this regard. All streets are swept once per year.

Reading- The town DPW has compiled a file on stormwater related education materials and a stormwater handbook, which were both made available in their main office and at the town library. A community calendar and a hotline has been established and available on the town website for stormwater issues in town. The DPW makes an annual progress report on town related stormwater activities and accomplishments at each year’s Town Meeting. A stormwater advisory committee was formed in 2006-7, but has since been dissolved, with stormwater management taken over by the Board of Selectmen. A stormwater management plan was drafted in 2007, with stormwater regulations put into effect in 2009. With respect to illicit connection detection activities, a special aerial digital mapping technology has been employed during 2009 by a contractor to assist in field identification for possible illicit connections. At the same time, a contract has been prepared to be awarded in 2010 for town-wide GIS mapping of the stormwater system to principally assist in the work of illicit connection detection, and identification of failing infrastructure. This work was completed in 2011-12, with 60% of the town’s outfalls and high risk areas screened, with some sampled, and one cross-connection discovered and repaired. An illicit connection by- law has been written for possible adoption by the town. Housekeeping activities have included the preparation of a stormwater related Operation & Maintenance (O & M) plan, along with street sweeping/catch basin cleaning occurring annually. 2012-14 saw a total of 61 catch basins repaired.

Somerville- With public education efforts, a stormwater flyer was prepared and mailed to residents near the end of 2005. The flyer was published on the Mystic River Watershed Association (MyRWA) website, along with other relevant city stormwater information. A pet waste control signage project for all public parks has occurred. An annual update on the city's stormwater management plan occurs at one of the regularly scheduled Alderman's meetings, and this update information is also broadcast on the local cable access TV station. The city has mapped the stormwater collection system with connecting outfalls in GIS. Illicit connection detection efforts include work with MyRWA on bacteria sampling at suspected outfalls (at least 3 sites per year, 2005 through 2014). Illicit connection detection work during 2008-9 included investigations in the Capen Court and Two Penny Brook areas, with one illicit connection found in the Capen Court area, and two suspected situations in the Two Penny Brook area.

A plan has been prepared by the city, with emphasis on repairing collapsed catch basins and broken storm sewers, as well as replacing twin- invert manholes. Emphasis during 2008-9 was on repairing manholes in the Alewife Bk/Mystic River areas, and the issuance of 12 new sanitary sewer connections permits (including inspections) by the city. In 2012-13, illicit connection investigation work in the Capen Court and Two Penny Brook areas discovered another illicit connection, which was removed. Housekeeping includes a staff training program on stormwater controls related to the city. City streets are swept twice yearly, and all catch basins are cleaned once every year. A new clamshell truck was purchased in 2010-11 to better assist with this cleaning effort.

Stoneham- Public education efforts include: (1) stormwater information provided on the town's new website as of 2013, which includes a special click/fix link for citizens to report problems; (2) pet waste/ pooper scooper signs placed in parks, plus a brochure produced and sent out in 2013 on pet waste management "Animal and Fowl, Duty to Dispose", which also outlines violation fines; (3) 2013-14 DPW related brochure, "After the Storm, A Citizen's Guide to Understanding Stormwater" (available at Town Hall, the Library, and DPW office); (4) 2010 DPW related brochure "Town Stormwater Rules/Regulations related to Use of Stormdrains" (updated annually through 2014). These brochures, plus other stormwater information are available on the town's website, and in the town annual report. The town has mapped all stormwater conveyances, outfalls, catch basins, and manholes. The illicit connection detection program began in 2006, with dry weather outfall screening and sampling of all known outfalls. During 2007-8, follow-up activities included identification of illicit connections and their correction. All significant illicit connections activities are recorded in a logbook. A new stormwater by-law, including control of illicit connections, was adopted by Town Meeting in May, 2010. Since 2011, the town has come under an EPA Administrative Order (c/o Todd Borci @ EPA) on illicit connections, to research and determine 'gray water sources'. A contract with Arcadis Consultants was begun to carry out this work. Infiltration and inflow (I/I) control related work has included the rehabilitation of 4 miles of sewer lines as of 2007, with another 4- 6 miles planned for rehabilitation during 2008 (from a $420,000 planned town appropriation). Additional I/I work in 2013 utilized $350,000 of town appropriations. Housekeeping activities include street sweeping and catch basin cleaning, which are done yearly.

Weymouth- In 2007, the EPA wrote an official commendation letter to the town congratulating it for stormwater related efforts over the previous five years. In 2002-3, the town had awarded a $330K contract to Beta Company to develop a draft stormwater management plan. When the plan was instituted, all catch basins were cleaned, the entire SW conveyance system was inspected including all town outfalls, catch basins, and manhole structures, and the entire stormwater conveyance system was mapped on GIS with data layers added on land- uses and soil structure. All suspect outfalls have been inspected and sampled (particularly dry weather flows). Recommendations have been made regarding possible bacteria BMPs that might be instituted in the future. As of 2013-14, public education efforts have expanded to include an environmental core in the high school environmental science class consisting of basic watershed management principles, stormwater pollution, green space LID concepts, impervious surface effects on stormwater, WWTPs versus septic systems for pollution control, eutrophication principles, and a unit on the EPA film, “Protecting WQ from Urban Runoff”. The town encourages citizen involvement in the “Greenspaces Program”, sponsored by the North- South Rivers Association.

As of 2012-13, the town worked with the North-South Rivers Watershed Association, the Whitman’s Pond Association, and the Fore River Watershed Association to sponsor cleanup days in Whitman’s Pond, Fore River, and other waters within the town. There are community hotline phone lines for reporting stormwater related pollution, as well as web- links on stormwater on town’s website, plus a stormwater related newsletter mailed out to all residents. There is an ordinance that directs all people to pick up after their dogs. The DPW, together with the North-South River Watershed Association, hold an annual workshop series on stormwater controls. Part of the town’s stormwater and related bacteria pollution control efforts involve septic system inspections, with recommendations made for repair, and actual tie- ins to existing sewers carried out where practicable (71 out of 728 in 2 years). An illicit discharge ordinance (#8-702) was formally added to the town ordinances in 2008. IDDE is a big priority under the Board of Health (BOH) which conducts bacteria testing throughout the year, with violations identified and fixed. Housekeeping consisted of 1,004 catch basins cleaned by priority plans in 2014, with all streets swept at least once per year (with 3,300 tons collected in 2014).

Winchester- Public education efforts have included: an annual article in the town’s consumer confidence report, a stormwater table display at ‘town day’ fair each year (June 14 in 2014), a stormwater education program at the Middle School, annual progress updates on the town’s stormwater management plan at Selectmens’ meetings and on the town’s website, and as of 2013-14 a stormwater program televised on cable several times per year. The town’s illicit connection detection related efforts have included: (1) completion of mapping of the stormwater collection system, including all outfalls on GIS; (2) the development of a strategy and plan to identify and remove all non-stormwater inputs discharging into MS4’s; and (3) institution of a regulation (adopted by the Board of Selectman in April, 2007) that will allow water/ sewer department personnel to enter and inspect all buildings for possible illicit connections and correct any of these found that drain into stormwater lines. During 2008-9, a number of illicit connections to the stormwater system were found and removed. This work included inspections of 89 outfalls for dry weather flows, in which 6 were found to have flows. In 2012, an aerial flyover of town was conducted to update the GIS map database. During 2011-12, the town received a 604b grant to find pollution sources in the Aberjona River and identify/locate possible

BMPs to improve water quality. As of 2014, housekeeping includes street sweeping twice per year, and the cleaning of 20% of all catch basins each year. Sensitive environmental receptors (certain ponds, wetlands, beaches, rivers, etc) have been identified and listed for future possible BMP stormwater pollution control efforts.

Winthrop- During 2004-07, a consultant for the town developed a set of non point source pollution control posters to be displayed in public buildings, including the library. During the time-period 2011-13, these posters were updated. The town hosts a 'Public Works Day' annually with over 100 attendees, which includes a table plus presentations on stormwater controls. There have been inquiries and referrals to the town's cable TV station and website for stormwater related information. The town passed and incorporated by-laws governing stormwater conveyances and illicit connections during 2009-10. As of 2013, the town's website has stormwater management program information related to impacts to water bodies in town, and the Conservation Commission has a link on illicit connection regulations that are 'on the books' and in effect. The Conservation Commission website also contains information on proper pet waste disposal, stormdrain pollution, and pollution prevention practices. As of the end of 2012, mapping of outfalls, stormwater conveyances, and receiving waters was virtually complete. Field investigations of suspect outfalls started in 2007, and have continued since. As of 2014, housekeeping activities included street sweeping at least twice per year, and 250 catch basins cleaned each year.

Woburn- Public education efforts include: (1) a stormwater poster display and pamphlet table set up at the annual April Earth & Conservation Day Celebration which has been held each year since 2005; (2) a pet waste/doggie waste collection and signage program in all public parks; (3) environmental awareness brochures on stormwater placed in town offices, schools, and special kiosks throughout town; (4) stormwater related information and links set up on the DPW page in the city's website. Illicit connection detection related work thus far has included: the mapping (with GIS) and photographing of 600 outfalls, GIS mapping updates of town conveyance infrastructure each year, inspections of all outfalls as of 2015 with screening and sampling of at least 10 outfalls each year. All screening and sampling results are made available at the town engineering offices. Since 2004, a number of the outfalls sampled had elevated bacteria counts, however further lab studies indicated that most of these were animal in origin, probably from catch basins. However, at least several, including one outfall at Ellis St., between Water St. and the Woburn Parkway, had indications of strong human markers in the samples. With this particular site, further investigations turned up a failing sewer line near the stormwater line on Ellis St. This was repaired in 2007. As of 2009, the DPW, working with Weston and Sampson, Inc., had identified illegal connections at three dry weather outfalls and was working to make sewer system improvements impacting inflow/infiltration reduction within the tributary areas of these outfalls, which should eventually have a beneficial impact on bacteria water quality at these outfalls.

As of 2008, the city had inspected and mapped on GIS over 70 miles of stormwater lines, and had incorporated a special computerized software management system for recordkeeping on fieldwork conditions recorded within this system. Along with this, TV inspection has occurred involving 2,500 linear feet of drain pipe within drainage system tributaries of suspect outfalls having illicit connections. As of 2014, computerized inspection of storm lines, along with TV inspection efforts by the town DPW and Engineering Departments were continuing each year. In 2007, a city Public Ordinance was updated to incorporate language prohibiting illicit connections. During 2011-12, a comprehensive IDDE oriented stormwater plan “IDDE, A Guidance Manual for Program Development & Technical Assessments” was developed and made available to the public. As of 2014, housekeeping included street sweeping twice per year, and catch basin cleaning consisting of 75% of the 4,100 catch basins in the city each year. The city began using I-Pad PCs during 2013 for catch basin cleaning activities, particularly for recording results of field inspections and MS4 conveyance mapping. In September- October 2014, 10,000 linear feet of stormdrain lines on Main St. were cleaned and TV screened.

A list of the municipalities in Massachusetts regulated by the Phase II Rule, as well as the Notices of Intent for each municipality can be viewed at http://www.epa.gov/region01/npdes/stormwater/ma.html.

In addition to the above, the Massachusetts Department of Environmental Protection's proposed new "Stormwater Management Regulations," that would establish a statewide general permit program aimed at controlling the discharge of stormwater runoff from certain privately-owned sites containing large impervious surfaces.

The proposed regulations would require private owners of land containing five or more acres of impervious surfaces to apply for and obtain coverage under a general permit; implement nonstructural best management practices (BMPs) for managing stormwater; install low impact development (LID) techniques and structural stormwater BMPs at sites undergoing development or redevelopment; and submit annual compliance certifications to the Department.

Where the Department has determined that stormwater runoff is causing or contributing to violations of the Massachusetts Surface Water Quality Standards, the proposed regulations would allow MassDEP to impose the same requirements on certain private owners of land with less than five acres of impervious surfaces and require the owners of such land to design and implement the LID techniques and stormwater BMPs needed to address these violations.

The DEP, Bureau of Waste Site Cleanup (BWSC) has been making efforts to improve the quality of stormwater runoff. The City of Boston has a dog fouling ordinance, the “Pooper Scooper Law”, requiring dog owners to properly dispose of pet waste. The BWSC educates people on the importance of this law and also on the importance of not dumping waste into the streets. BWSC’s storm drain stenciling program educates the public on stormwater and stencils messages next to catch basins alerting people that what is dumped in the street can end up in the waterways (BWSC 2005).

8.5 Failing Septic Systems

Septic system bacteria contributions to the Boston Harbor watershed may be reduced in the future through septic system maintenance and/or replacement. Additionally, the implementation of Title 5 (310 CMR 15.00), which requires inspection of private sewage disposal systems before property ownership may be transferred, building expansions, or changes in use of properties, will aid in the discovery of poorly operating or failing systems. The majority of the Boston Harbor watershed is on municipal sewer. Significant improvement to water quality as a result of septic system upgrades is likely to be minimal. Regulatory and educational materials for septic system installation, maintenance and alternative technologies may be found on the MassDEP website at: www.mass.gov/dep/water/wastewater/septicsy.htm.

8.6 Wastewater Treatment Plants

WWTP discharges are regulated under the NPDES program when the effluent is released to surface waters. Each WWTP has an effluent limit included in its NPDES or groundwater permit. Some NPDES permits are listed on the following website: www.epa.gov/region1/npdes/permits_listing_ma.html. Details on the Massachusetts groundwater permit program is available at: http://www.mass.gov/eea/agencies/massdep/water/wastewater/groundwater-discharge-permitting.html

8.7 Recreational Waters Use Management

Recreational waters receive pathogen inputs from swimmers and boats. To reduce swimmers' contribution to pathogen impairment, shower facilities can be made available, and bathers should be encouraged to shower prior to swimming. In addition, parents should check and change young children's diapers when they are dirty. Options for controlling pathogen contamination from boats include:

- supporting installation of pump-out facilities for boat sewage;
- educating boat owners on the proper operation and maintenance of marine sanitation devices (MSDs);
- and encouraging marina owners to provide clean and safe onshore restrooms and pump-out facilities.

Currently the area proximal to the Boston Harbor watershed has been established as a "no discharge zone" (NDZ). This designation by the Commonwealth of Massachusetts and approved by the EPA provides protection of this area by a Federal Law which prohibits the release of raw or treated sewage from vessels into navigable waters of the U.S. The law is enforced by the Massachusetts Environmental Police. Massachusetts State Representative Bill Strauss has introduced legislation that would clearly define the role of harbormasters and other coastal police officers in enforcing NDZs and would allow them to collect up to $2000 for violations in NDZs (US EPA 2010).

8.8 Funding/Community Resources

A complete list of funding sources for implementation of non-point source pollution is provided in Section VII of the Massachusetts Nonpoint Source Management Plan Volume I (MassDEP 2000) available on line at http://www.mass.gov/dep/brp/wm/nonpoint.htm. This list includes specific programs available for non-point source management and resources available for communities to manage local growth and development. The State Revolving Fund (SRF) provides low interest loans to communities for certain capital costs associated with building or improving wastewater treatment facilities. In addition, many communities in Massachusetts sponsor low cost loans through the SRF for homeowners to repair or upgrade failing septic systems.

State monies are also available through the Massachusetts Office of Coastal Zone Management: Coastal Pollution Remediation, Coastal Nonpoint Source Pollution Control, and Coastal Monitoring programs.

8.9 Mitigation Measures to Address Pathogen Pollution in Surface Water

For a more complete discussion on ways to mitigate pathogen water pollution, see the "*Mitigation Measures to Address Pathogen Pollution in Surface Water: A TMDL Implementation Guidance Manual for Massachusetts"* accompanying this document. *The guidance can be downloaded at:* http://www.mass.gov/eea/docs/dep/water/resources/a-thru-m/impguide.pdf. Also refer to information on the interactive web site, *Massachusetts Clean Water Toolkit*, http://prj.geosyntec.com/npsmanual/default.aspx.

9.0 Monitoring Plan

The long term monitoring plan for the Boston Harbor watershed includes several components:

1. continue with the current monitoring of the Boston Harbor watershed (MyRWA and other stakeholders),
2. monitor areas within the watershed where data are lacking or absent to determine if the waterbody meets the use criteria,
3. monitor areas where BMPs and other control strategies have been implemented or discharges have been removed to assess the effectiveness of the modification or elimination,
4. assemble data collected by each monitoring entity to formulate a concise report where the basin is assessed as a whole and an evaluation of BMPs can be made, and
5. add/ remove/modify BMPs as needed based on monitoring results.

The monitoring plan is an ever changing document that requires flexibility to add, change or delete sampling locations, sampling frequency, methods and analysis. At the minimum, all monitoring should be conducted with a focus on:

- capturing water quality conditions under varied weather conditions,

- establishing sampling locations in an effort to pin-point sources,
- researching new and proven technologies for separating human from animal bacteria sources, and
- assessing efficacy of BMPs.

10.0 Reasonable Assurances

Reasonable assurances that the TMDL will be implemented include both application and enforcement of current regulations, availability of financial incentives including low or no-interest loans to communities for wastewater treatment facilities through the State Revolving Fund (SRF), and the various local, state and federal programs for pollution control. Stormwater NPDES permit coverage is designed to address discharges from municipal owned stormwater drainage systems. Enforcement of regulations controlling non-point discharges includes local enforcement of the state Wetlands Protection Act and Rivers Protection Act, Title 5 regulations for septic systems and various local regulations including zoning regulations. Financial incentives may include Federal monies available under the CWA Section 319 NPS program and the CWA Section 604b and 104b programs, which are provided as part of the Performance Partnership Agreement between MassDEP and the EPA. However, 319 Nonpoint Source funds cannot be used for point source remediation, and therefore cannot be used to address the requirements of NPDES stormwater permits. Additional financial incentives include state income tax credits for Title 5 upgrades, and low interest loans for Title 5 septic system upgrades through municipalities participating in this portion of the state revolving fund program. State monies are also available through the Massachusetts Office of Coastal Zone Management’s Coastal Pollutant Remediation, Coastal Nonpoint Source Pollution Control, and Coastal Monitoring grant programs. The primary goal of all three programs is to improve coastal water quality by reducing or eliminating nonpoint sources of pollution.

A brief summary of many of MassDEP’s tools and regulatory programs to address common bacterial sources is presented below.

10.1 Overarching Tools

Massachusetts Clean Water Act: The MA Clean Water Act (M.G.L. Chapter 21, sections 26-53) provides MassDEP with specific and broad authority to develop regulations to address both point and non-point sources of pollution. There are numerous regulatory and financial programs, including those identified in the preceding paragraph, that have been established to directly and indirectly address pathogen impairments throughout the state. Several of them are briefly described below.

Surface Water Quality Standards (314 CMR 4.00): The MA Water Quality Standards (WQS) assign designated uses and establish water quality criteria to meet those uses. Water body classifications (Class

A, B, and C, for freshwater and SA, SB, and SC for marine waters) are established to protect each class of designated uses. In addition, bacteria criteria are established for each individual classification.

Ground Water Discharge Permit Program (314 CMR 5.00): This program regulates the discharge of pollutants to the groundwaters of the Commonwealth to assure that groundwaters are protected for their actual and potential use as a source of potable water and surface waters are protected for their existing and designated uses and to assure the attainment and maintenance of the MA WQS.

River Protection Act: In 1996 MA passed the Rivers Protection Act (MGL c 258 Acts of 1996). The purposes of the Act were to protect the private or public water supply; to protect the ground water; to provide flood control; to prevent storm damage; to prevent pollution; to protect land containing shellfish; to protect wildlife habitat; and to protect the fisheries. The provisions of the Act are implemented through the Wetlands Protection Regulations, which establish up to a 200-foot setback from rivers in the Commonwealth to control construction activity and protect the items listed above. Although this Act does not directly reduce pathogen discharges it indirectly controls many sources of pathogens close to water bodies. More information on the Rivers Protection Act can be found on MassDEPs web site.

Regulation of Plant Nutrients: In 2012, the Massachusetts Department of Agricultural Resources (MDAR) developed regulations (330 CMR 31.00) to ensure that plant nutrients are applied in an effective manner to provide sufficient nutrients for maintaining healthy agricultural lands as well as turf and lawns while minimizing the impacts of the nutrients on surface and groundwater resources to protect human health and the environment. The regulations include setbacks from surface waters, public drinking water, and wetlands and seasonal application restrictions.

10.2 Additional Tools to Address Combined Sewer Overflows (CSO's)

CSOs discharge stormwater with untreated or partially treated human and industrial waste, toxic materials and debris and as a result are a significant source of bacterial contamination. Control or reduction of CSOs will result in improvements to water quality in the receiving waters. CSO Program/Policy: Massachusetts, in concert with EPA Region 1, has established a detailed CSO abatement program and policy. CSO discharges are regulated by the Commonwealth in several ways. Like any discharge of pollutants, CSOs must have an NPDES/MA Surface Water Discharge Permit under federal and state regulations. Municipalities and districts seeking funding for wastewater treatment, including CSO abatement, must comply with the facilities planning process at 310 CMR 41.00. Entities obtaining funding or exceeding specific thresholds must also comply with the Massachusetts Environmental Policy Act (MEPA) regulations at 301 CMR 11.00. Each of these regulations contains substantive and procedural requirements. Because both MEPA and facilities planning require the evaluation of alternatives, these processes are routinely coordinated.

All permits for a CSO discharge must comply with Massachusetts Surface Water Quality Standards at 314 CMR 4.00. The water quality standards establish goals for waters of the Commonwealth, and provide the basis for water quality-based effluent limitations in NPDES permits. Any discharge, including CSO discharges, is allowed only if it meets the criteria and the antidegradation standard for the receiving segment. EPA's 1994 CSO Control Policy revised some features of its 1989 version to provide greater flexibility by allowing a minimal number of overflows, which are compatible with the water quality goals of the Clean Water Act. MassDEP's 1995 regulatory revisions correspondingly decreased reliance on partial use designation as the sole regulatory vehicle to support CSO abatement plans[1].

In all cases, NPDES/MA permits require the nine minimum controls necessary to meet technology-based limitations as specified in the 1994 EPA Policy. The nine controls may be summarized as; operate and maintain properly; maximize storage, minimize overflows, maximize flows to Publicly Owned Treatment Works (POTW), prohibit dry weather CSO's, control solids and floatables, institute pollution prevention programs, notify the public of impacts, and observe monitoring and reporting requirements. The nine minimum controls may be supplemented with additional treatment requirements, such as screening and disinfection, on a case-by-case basis. The Department's goal is to eliminate adverse CSO impacts and attain the highest water quality achievable. Separation or relocation of CSOs is required wherever it can be achieved based on an economic and technical evaluation.

As untreated CSOs cause violations of water quality standards, and thus are in violation of NPDES permits, all of the state's CSO permittees are under enforcement orders to either eliminate the CSO or plan, design, and construct CSO abatement facilities. Each long-term control plan must identify and achieve the highest feasible level of control. The process also requires the permittee to comply with any approved TMDL. Presently, there are twenty–four (24) CSO communities in the Commonwealth.

10.3 Additional Tools to Address Failed Septic Systems

Septic System Regulations (Title 5) (310 CMR 15.00): The MassDEP has regulations in place that require minimum standards for the design of individual septic systems. Those regulations ensure, in part, protection for nearby surface and ground waters from bacterial contamination. The regulations also provide minimum standards for replacing failed and inadequate systems, and include a requirement that all septic systems must be inspected and upgraded to meet Title 5 requirements at the time of sale or transfer of the each property.

---

[1] DEP's 1990 CSO Policy was based on EPA's 1989 CSO Control Policy and established the goal of eliminating adverse impacts from CSOs, using partial use designation where removal or relocation was not feasible. The three month design storm was identified as the minimum technology-based effluent limitation, which would result in untreated overflows an average of four times a year. Abatement measures to meet these minimum standards were necessary for a CSO discharge to be eligible for partial use designation. Presumably, all CSOs exceeding this standard required downgrading to Class C or SC status. No partial use designations or downgrades to Class C were actually made, because the process was perceived as administratively cumbersome.

10.4 Additional Tools to Address Stormwater

Stormwater is regulated through both federal and state programs. Those programs include, but are not limited to, the federal and state Phase I and Phase II NPDES stormwater program, and, at the state level, the Wetlands Protection Act (MGL Chapter 130, Section 40), the state water quality standards, and the various permitting programs previously identified.

Federal Phase I & 2 NPDES Stormwater Regulations: Existing stormwater discharges are regulated under the federal and state Phase I and Phase II stormwater program. In MA there are two Phase I communities, Boston and Worcester. Both communities have been issued individual permits to address stormwater discharges. In addition, 20 communities in the Boston Harbor Watershed are covered by Phase II. These include: Arlington, Belmont, Boston (covered under Phase I), Braintree, Chelsea, Everett, Hingham, Holbrook, Malden, Medford, Melrose, Quincy, Randolph, Reading, Somerville, Stoneham, Weymouth, Winchester, Winthrop, and Woburn. Phase II is intended to further reduce adverse impacts to water quality and aquatic habitat by instituting use controls on the unregulated sources of stormwater discharges that have the greatest likelihood of causing continued environmental degradation including those from municipal separate storm sewer systems (MS4s) and discharges from construction activity. Any new construction that complies with state stormwater standards and permits is presumed to comply with antidegradation requirements of the state water quality standards.

The Phase II Final Rule, published in the Federal Register on December 8, 1999, requires permittees to determine whether or not stormwater discharges from any part of the MS4 contribute, either directly or indirectly, to a 303(d) listed waterbody. Operators of regulated MS4s are required to design stormwater management programs to 1) reduce the discharge of pollutants to the "maximum extent practicable" (MEP), 2) protect water quality, and 3) satisfy the appropriate water quality requirements of the Clean Water Act. Implementation of the MEP standard typically requires the development and implementation of BMPs and the achievement of measureable goals to satisfy each of the six minimum control measures. Those measures include 1) public outreach and education, 2) public participation, 3) illicit discharge detection and elimination, 4) construction site runoff control, 5) post-construction runoff control, and 6) pollution prevention/good housekeeping. In addition, each permittee must determine if a TMDL has been developed and approved for any water body into which an MS4 discharges. If a TMDL has been approved then the permittee must comply with the TMDL including the application of BMPs or other performance requirements. The permittee's must report annually on all control measures currently being implemented or planned to be implemented to control pollutants of concern identified in TMDLs. Finally, the Department has the authority to issue an individual permit to achieve water quality objectives. Links to the MA Phase II permit and other stormwater control guidance can be found at: http://www.mass.gov/dep/water/wastewater/stormwat.htm

EPA and MassDEP reissued the MS4 permit which became effective July 1, 2018. A full list of MS4 Phase II communities in MA can be found at on the EPA website. This TMDL forms the basis for the implementation plans to meet the Pathogen loading capacity. MS4 permittees within the Boston Harbor Watershed, are required to identify in their respective Stormwater Management Plans and Annual Reports those discharges that are subject to TMDL related requirements, as identified in part 2.2.1 of the renewal permit, and those that are subject to additional requirements to protect water quality, as identified in part 2.2.2. of the renewal permit. The Boston Harbor communities are required to comply with the applicable provisions in Appendix H to address their respective bacteria discharges to the maximum extent practicable, as required by CWA Section 402(p)(3)(B)(iii). Although EPA's Phase II MS4 regulations only require a small MS4 to implement its program in the urbanized area subject to permitting, EPA and MassDEP nonetheless encourage permittees, to update and implement their respective SWMPs jurisdiction-wide to further water quality improvements.

The MassDEP Wetlands regulations (310 CMR 10.0) direct issuing authorities to enforce the MassDEP Stormwater Management Policy, place conditions on the quantity and quality of point source discharges, and to control erosion and sedimentation. The Stormwater Management Policy was issued under the authority of the 310 CMR 10.0. The policy and its accompanying Stormwater Performance Standards apply to new and redevelopment projects where there may be an alteration to a wetland resource area or within 100 feet of a wetland resource (buffer zone). The policy requires the application of structural and/or non-structural BMPs to control suspended solids, which have associated co-benefits for bacteria removal. The Massachusetts Stormwater Handbook was developed to promote consistent interpretation of the Stormwater Management Policy and Performance Standards: Volumes 1 through 3, can be found at: http://www.mass.gov/eea/agencies/massdep/water/regulations/massachusetts-stormwater-handbook.html, as well as, the Stormwater Policy at http://www.mass.gov/eea/agencies/massdep/water/regulations/water-resources-policies-and-guidance-documents.html#11.

10.5 Financial Tools

Nonpoint Source Control Program: MassDEP has established a non-point source program and grant program to address non-point source pollution sources statewide. The Department has developed a Nonpoint Source Management Program Plan, http://www.mass.gov/eea/docs/dep/water/resources/n-thru-y/npsmp.pdf, that sets forth an integrated strategy and identifies important programs to prevent, control, and reduce pollution from nonpoint sources and more importantly to protect and restore the quality of waters in the Commonwealth. The Clean Water Act, Section 319, specifies the contents of the management plan. The plan is an implementation strategy for BMPs with attention given to funding sources and schedules. Statewide implementation of the Management Plan is being accomplished through a wide variety of federal, state, local, and non-profit programs and partnerships. It includes partnering with the Massachusetts Coastal Zone Management on the implementation of Section 6217 program. That program outlines both short and long term strategies to address urban areas and stormwater, marinas and recreational boating, agriculture, forestry, hydromodification, and wetland restoration and assessment. The CZM 6217 program also addresses TMDLs and nitrogen sensitive embayments and is crafted to reduce water quality impairments and restore segments not meeting state standards.

In addition, the state is partnering with the Natural Resource Conservation Service (NRCS) to provide implementation incentives through the national Farm Bill. As a result of this effort, NRCS now prioritizes its Environmental Quality Incentive Program (EQIP) funds based on MassDEP's list of impaired waters. The program also provides high priority points to those projects designed to address TMDL recommendations. Over the past several years EQIP funds have been used throughout the Commonwealth to address water quality goals through the application of structural and non-structural BMPs.

MassDEP, in conjunction with EPA, also provides a grant program to implement nonpoint source BMPs that address water quality goals. The section 319 funding provided by EPA is used to apply needed implementation measures and provide high priority points for projects that are designed to address 303d listed waters and to implement TMDLs. MassDEP has funded numerous projects through 319 that were designed to address stormwater and bacteria related impairments. It is estimated that 75% of all projects funded since 2002 were designed to address bacteria related impairments. Under new EPA guidance issued in 2003, 319 funds cannot be used to address the requirements of NPDES permits, including MS4, Residual Designation, Phase I and Phase II permits. This severely curtails eligibility of most urban implementation work that had previously been accomplished using 319 funds.

The 319 program also provides additional assistance in the form of guidance. The Massachusetts Clean Water Toolkit (http://prj.geosyntec.com/npsmanual/default.aspx) will provide detailed guidance in the form of BMPs by landuse to address various water quality impairments and associated pollutants.

State Revolving Fund: The State Revolving Fund (SRF) Program provides low interest loans to eligible applicants for the abatement of water pollution problems across the Commonwealth. MassDEP has issued millions of dollars in loans for the planning and construction of CSO facilities and to address stormwater pollution.

Loans have also been distributed to municipal governments statewide to upgrade and replace failed Title 5 systems. These programs all demonstrate the State's commitment to assist local governments in implementing the TMDL recommendations. Additional information about the SRF Program may be found on the MassDEP website at: http://www.mass.gov/dep/water/wastewater/wastewat.htm#srf.

In summary, MassDEP's approach and existing programs set out a wide variety of tools both MassDEP and 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, stormwater 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. MassDEP's authority combined with the programs identified above provide sufficient reasonable assurance that implementation of remedial actions will take place.

11.0 Public Participation

Two public meetings were held at 2 p.m. and 7 p.m. at Tufts University, Medford on August 30, 2005 to present the 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 attached as Appendix B.

12.0 References

Brander 2015. Personal communication. Updated CSO and other Water Quality Information provided on Boston Harbor. Kevin Brander, Wastewater Program Chief, DEP, Northeast Regional Office, Wilmington.

Center for Watershed Protection 1999. Watershed Protection Techniques. Vol. 3, No. 1.

Chiasson 2009. Personal communication with Michael Chiasson, Town of Weymouth Engineering Dept.

CZM 2005a. Massachusetts Clean Marina Guide. The Coastal Nonpoint Source Pollution Control Program, EEA Coastal Management Program, Boston, MA.

CZM 2005b. The Coastal Nonpoint Source Pollution Control Program, EEA Coastal Management Program through Reauthorization of the Coastal Zone Management Act. EEA Coastal Management Program, Boston, MA.

DMF 2016. Massachusetts Division of Marine Fisheries. Programs and Projects. Shellfish Sanitation and Management. Information from website, downloaded August 2016. http://www.mass.gov/eea/agencies/dfg/dmf/programs-and-projects/shellfish-sanitation-and-management.html

DMF 2010. Personal communication with various staff. Massachusetts Division of Marine Fisheries, Gloucester Office.

DMF 2015a. Massachusetts Designated Shellfish Growing Areas Datalayer. Compiled by the Department of Fish and Game's (DFG) Division of Marine Fisheries, as of August 2015. -

DMF 2015b. Personal communication with Devon Winkler. Updated data provided on Water Quality Data, and Shellfish Classifications within MassDEP Boston Harbor Estuarine WQ Segments. Massachusetts Division of Marine Fisheries, Gloucester Office.

DMF 2015b. Map of No Discharge Zones in Massachusetts. Mass Division of Marine Fisheries, Gloucester, MA.

EMPACT 2004. Mystic River Watershed Real-Time Water Quality Monitoring Website. Information from website, downloaded March 2005. http://www.mysticriver.org/

ENSR 2005. ENSR International, Westford, MA. "Mitigation Measures to Address Pathogen Pollution in Surface Water: A TMDL Implementation Guidance Manual for Massachusetts"

EPA 1983. Results of the Nationwide Urban Runoff Program. Volume I. Final Report. Water Planning Division. Washington, D.C. 159 pp.

EPA 1986. Ambient Water Quality Criteria for Bacteria – 1986. EPA 440/5-84-002.

EPA 1997. Urbanization of Streams: Studies of Hydrologic Impacts. EPA 841-R-97-009

EPA 2001. Protocol for Developing Pathogen TMDLs. EPA 841-R-00-002

EPA 2004. United States Environmental Protection Agency. Center for Watershed Protection and the University of Alabama entitled Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments.

EPA 2012. 2012 Recreational Water Quality Criteria. https://www.epa.gov/wqc/2012-recreational-water-quality-criteria.

EPA 2015. No Discharge Areas in Massachusetts. Information from website, downloaded March 2005. http://www.epa.gov/region01/eco/nodiscrg/ma.html

FRWA 2016. "Clean, Beautiful, & Accessible." Fore River Watershed Association. Information from website, August 2016. http://www.foreriver.org/index.html

MassBays 2004. Massachusetts Bays Comprehensive Management Plan, EEA Mass Bays Program, Boston, MA.

MassDEP 2000. Nonpoint Source Management Plan Volume I Strategic Summary. Massachusetts Department of Environmental Protection. Available for download at www.mass.gov/dep/water/resources/nonpoint.htm.

MassDEP 2002a. Boston Harbor 1999 Water Quality Assessment Report. Massachusetts Department of Environmental Protection, Division of Watershed Management.

MassDEP 2002b. Cape Cod Watershed Water Quality Assessment Report. Massachusetts Department of Environmental Protection, Division of Water Management. Worcester, Massachusetts.

MassDEP 2002c. Final Total Maximum Daily Loads of Bacteria for Neponset River Basin. Massachusetts Department of Environmental Protection, Bureau of Resource Protection, Division of Watershed Management. Report MA73-01-2002 CN 121.0. Boston, Massachusetts.

MassDEP 2007. 314 CMR 4.00: Massachusetts Surface Water Quality Standards. Massachusetts Department of Environmental Protection, 1 Winter Street, Boston, MA.

MassDEP 2008. Final Determination to Extend Variance for Combined Sewer Overflow Discharges to Alewife Brook/ Upper Mystic River- Fact Sheet. Division of Watershed Management. Boston Massachusetts.

MassDEP 2009. Final Pathogen TMDL for Buzzards Bay Watershed, MassDEP, Bureau of Water Resources, CN 251.1, Boston, MA.

MassDEP 2010a. Boston Harbor, 2004-2008 Water Quality Assessment Report. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, Massachusetts. Report # 7-AC-2, CN 170.0.

MassDEP 2010b. Weymouth and Weir River Basin Water Quality Assessment Report. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, Massachusetts. Report #74-AC-1. CN 170.6.

MassDEP 2010c. Mystic River Watershed and Coastal Drainage Area, 2004-2008. Water Quality Assessment Report. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, Massachusetts. Report #71-AC-2. CN 170.2.

MassDEP 2012a. Addendum Final Total Maximum Daily Load of Bacteria for Neponset River Basin, Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA. CN 121.5.

MassDEP 2012b. Final Pathogen TMDL for the North Coastal Watershed, MassDEP, Bureau of Water Resources, CN 155.0, Boston, MA.

MassDEP 2014. *Massachusetts Clean Water Toolkit*, interactive website for Non-Point Source Pollution: https://www.mass.gov/service-details/nonpoint-source-pollution

MassDEP 2014a. Final Pathogen TMDL for the South Coastal Watershed. MassDEP, Bureau of Water Resources, CN 255.0, Boston, MA.

MassDEP 2014b. Personal Communication with MassDEP Water Quality staff for Mystic River Basin data, 2013. Bureau of Water Resources, Division of Watershed Management, Worcester, MA.

MassDEP 2015. Massachusetts Year 2014 Integrated List of Waters. Final Listing of the Condition of Massachusetts' Waters Pursuant to Sections 305(b), 314, and 303(d) of the Clean Water Act. Massachusetts Department of Environmental Protection, Bureau of Resource Protection, Division of Watershed Management. Worcester, Massachusetts. http://www.mass.gov/eea/docs/dep/water/resources/07v5/14list2.pdf

MassDEPa. Undated. Massachusetts Department of Environmental Protection Report to the Senate and House of Representatives on water quality at beaches under the care and control of the Department of Conservation and Recreation, 2008 - 2012. Massachusetts Department of Environmental Protection, Boston, MA. http://www.mass.gov/eea/docs/dep/water/resources/a-thru-m/dcrbeachfin.pdf

MassGIS 2015. Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs. MassDEP 2014 Integrated List of Waters (305(b)/303(d)); Land Use as of 2005; Town Boundaries as of 2015. Census TIGER Roads as of 2010. Major Drainage Boundaries as of 2015. Designated Shellfish Growing Areas as of July 2015.

MassDEP 2016. Massachusetts Consolidated Assessment and Listing Methodology Guidance Mannual, or CALM, MassDEP, Watershed Planning Program, Worcester, MA.

MWRA 2001. Comparison of water quality in Boston Harbor before and after inter-island transfer. Massachusetts Water Resources Authority. Information from website, downloaded March 2005. http://www.mwra.com/harbor/enquad/trlist.html

MWRA 2003. Final CSO Variance Report for Alewife Brook and the Upper Mystic River, July 2003. Massachusetts Water Resources Authority. Cambridge, Massachusetts.

MWRA 2006. Second Stipulation of the United States and the Massachusetts Water Resources Authority on "Responsibility and Legal Liability for Combined Sewer Overflow Control" filed in US District Court on March 15, 2006

MWRA 2008. Personal communications with, and information collaboration from, MWRA staff persons: Fred Laskey; David Kubiac; Nadine Smoske.

MWRA 2010. Combined Sewer Overflow Plan, Annual Progress Report 2009, March 2010. Massachusetts Water Resources Authority. Charlestown MA.

MRWA 2014. Personal communications with and data information collaboration from MWRA staff person: Kelly Coughlin, Water Quality Specialist. All MWRA Water Quality Data Tables in Section 4 prepared by Kelly Coughlin and other MWRA water quality staff.

MWRA 2015 Combined Sewer Overflow Plan, Annual Progress Report 2014, March 2015. Massachusetts Water Resources Authority. Charlestown MA. Section 8.2 Figures. from this MWRA report.

MWRA 2016 Combined Sewer Overflow Plan, Annual Progress Report 2015, March 2016. Massachusetts Water Resources Authority. Charlestown MA.

Metcalf and Eddy 1991. Wastewater Engineering: Treatment, Disposal, Reuse. Third Edition.

MyRWA 2015. Personal Communication with Patrick Herron, Water Quality Specialist. Updated MyRWA Data Collected and reported throughout Mystic Watershed (2010-2015).

NEERS 2006. Annual Spring Conference of the New England Estuarine Research Society, April 6-8, 2006. Numerous papers presented on water quality related conditions in Boston Harbor subsequent to the MRWA sewer outfall diversion in 2001. Hull Massachusetts.

NEIWPCC 2003. New England Interstate Water Pollution Commission, Publication "Illicit Discharge Detection and Elimination Manual, A Handbook for Municipalities".

NRWA, UMass, BHA, FRWA, and WRWA. 2004. Boston Harbor South Watersheds 2004-2009 Action Plan. Neponset River Watershed Association, University of Massachusetts, Urban Harbors Institute, Boston Harbor Association, Fore River Watershed Association, and Weir River Watershed Association. Information from website, downloaded March 2005. https://www.neponset.org/projects/publications/

Save the Harbor/Save the Bay 2016. What's new at Save the Harbor/Save the Bay? Information from website, downloaded August 2016. http://www.savetheharbor.org/

Taylor 2006. Wastewater Diversion, and Changes to The Harbor Water- Column A paper presented to the Annual Spring Conference of The New England Estuarine Research Society, April 6-8, 2006. Hull Massachusetts.

Taylor 2011. "Estuaries and Coasts", a paper published on updated changes in Boston Harbor water column since completion of the Boston Harbor Project.

Taylor 2013. MWRA Water Quality Data and Analysis Summary in the Boston Harbor Area.

Taylor 2015. Personal Communication with David Taylor, Water Quality Specialist, MWRA.

TBHA 2016. The Boston Harbor Association Programs. Information from website, August 2016, http://www.bostonharbornow.org/

USGS 2002. Measured and Simulated Runoff to the Lower Charles River, Massachusetts, October 1999-September 2000. 02-4129. United States Geological Survey. Northborough, Massachusetts.

WRWA 2005. Weir River Watershed Association. Information from website, August 2016. http://www.weirriver.org

APPENDIX A

Public Meeting Information and Response to Comments
Pathogen TMDL for the Boston Harbor Watershed

Public Meeting Announcement Published in the Monitor	8/10/2005
Date of Public Meeting	8/30/2005
Location of Public Meeting	Tufts University Medford / Somerville Campus Medford, MA
Times of Public Meeting	2 P.M. and 7 P.M.

Public Meeting Attendees

Date 8/30/2005 Time 2 P.M.

Name	Organization
1. Jan Dolan	Mystic River Watershed Association
2. Nancy Hammett	Mystic River Watershed Association
3. Jenny Birnbaum	Mystic River Watershed Association
4. Lisa Boukelab	Tufts University
5. Paul Kirshen	Tufts University
6. Rachel Szyman	Tufts University
7. Andrew B. DeSantis	City of Chelsea-DPW
8. Mike Hill	EPA Region 1
9. Ted Lavery	EPA Region 1
9. Russell Isaac	MassDEP
10. Eben Chesebrough	MassDEP

Date 8/30/2005 Time 7 P.M.

Name	Organization
1. Alison Field-Juma	Mystic River Watershed Association

2. Jenny Birnbaum	Mystic River Watershed Association
3. Russell Isaac	MassDEP
4. Eben Chesebrough	MassDEP

Boston Harbor Watershed Comments / Responses

This appendix provides detailed responses to comments received during the public comment process. MassDEP received many comments/questions that were of a general nature (i.e. related to terminology, statewide programs, the TMDL development process and regulations, etc.) while others were watershed specific. Responses to both are presented in the following sections.

General Comments:

1. Question: On the slide titled "components of a TMDL" what does "WLA" and "LA" stand for.

Response: Waste load allocation (WLA) refers to pollutants discharged from pipes and channels that require a discharge permit (point sources). Load allocation (LA) refers to pollutants entering waterbodies through overland runoff (non point sources). A major difference between the two categories is the greater legal and regulatory control generally available to address point sources while voluntary cooperation added by incentives in some cases is the main vehicle for addressing non-point sources.

2. Question: What is the Septic System Program?

Response: Cities and Towns can establish a small revolving fund to help finance repairs and necessary upgrades to septic systems. The initial funding is from the Commonwealth's State, Revolving Fund Program (SRF). These programs generally offer reduced interest rate loans to homeowners to conduct such improvements. Many communities have taken advantage of this effort. A discussion of the septic system programs may be seen in the TMDL companion document "A TMDL Implementation Guidance Manual for Massachusetts" under Section 3.2.

3. Question: What is the WQS for non-contact recreation in terms of bacteria?

Response: The Massachusetts Surface Water Quality Standards, 314 CMR 4.00 (WQS), do not have any waters designated for "non-contact recreation." All Massachusetts surface waters currently are designated in the WQS for both primary and secondary contact recreation, among other uses. The bacteria criteria protect waters for their most sensitive uses, accordingly, the recreation based bacteria criteria for all Class A, SA, B and SB waters are protective of primary contact recreation. While the WQS do contain C and SC water classifications, with associated criteria, which are described to include waters designated for secondary contact recreation, there are no waters assigned to these classes. The bacteria criteria for Class C fresh waters are: "The geometric mean of all *E. coli* samples taken within the most recent six months shall not exceed 630 colonies per 100 ml, typically based on a minimum of five samples, and 10% of such samples shall not exceed 1260 colonies per 100 ml. This criterion may be applied on a seasonal basis at the discretion of the Department."

The Class C geometric mean bacteria criterion is five times the Class A and B geometric mean bacteria criterion for primary contact recreation. The WQS take the same approach with the Class SC bacteria criteria, that is, the SC geometric mean is five times that for SA and SB waters. With respect to bacteria criteria for secondary contact recreational waters, EPA has guidance that “states and authorized tribes may wish to adopt a criterion five times that of the geometric mean component of the criterion adopted to protect primary contact recreation, similar to the approach states and authorized tribes have used historically in the adoption of secondary contact criterion for Fecal coliforms.” Note that in the Massachusetts WQS, secondary contact recreation is defined to include water contact that is "incidental" so that contact incidental to such activities as boating and fishing would be anticipated.

4. Question: On the topic of DNA testing for bacterial source tracking what is MassDEP doing or planning to do?

Response: DNA testing is a promising but as yet not fully reliable tool in distinguishing between human and other sources of fecal bacteria. When perfected, this tool will be extremely valuable in helping target sources of pathogens and remedial actions. At the same time, one needs to recognize that even if the source of the bacteria is identified as non-human, any concentrations exceeding the criteria still impair the use, such as swimming or shellfishing, associated with those criteria. MassDEP is already working with our Wall Experiment Station to help develop reliable techniques to address this issue. Once developed MassDEP will include those techniques into our sampling programs, however, we hope local monitoring programs will also benefit from them.

5. Question: What is the current thought on *E. coli* / entero bacteria survival and reproduction in the environment, especially in wetlands?

Response: There are reports that indicator bacteria can survive in sediment longer than they can in water. This may be a result of being protected from predators. Also, there is some indication that reproduction may occur in wetlands, but until wildlife sources can be ruled out through, for example, a reliable DNA testing, this possibility needs to be treated with caution. Also, die off of indicator bacteria tends to be more rapid in warm water than in cold.

6. Question: For the implementation phase of TMDLs who will do the regular progress reporting and who will pay for it?

Response: Phase I and Phase II municipalities already do regular reporting and provide annual status reports on their efforts. Any additional information can be coupled with existing reporting requirements and monitoring results to determine the success and failure of implementation measures. For non-Phase II municipalities it gets more difficult and MassDEP may have to work directly with each community or possibly add communities with known impairments to the Phase II list. The TMDL does not require volunteer groups, watershed organizations or towns to submit periodic reports - it is not mandatory. The MassDEP is relying on self interest and a sense of duty for communities to move ahead with the needed controls facilitated by some state aid. The MassDEP feels that the cooperative approach is the most desirable and effective but also believes that we possess broad regulatory authority to require action if and when it is deemed appropriate.

7. Question: How does the Phase II program and TMDL program coordinate with each other?

Response: The National Pollutant discharge Elimination System (NPDES) Stormwater Phase II General Permit Program became effective in Massachusetts in March 2003. The municipal separate storm sewer systems

(MS4) general permit, was reissued April 2016 and became effective July 1, 2018. The permit requires the regulated entities to develop, implement and enforce a stormwater management program (SWMP) that effectively reduces or prevents the discharge of pollutants into receiving waters to the Maximum Extent Practicable (MEP). Stormwater discharges must also comply with meeting state water quality standards. The Phase II permit uses a best management practice framework and measurable goals to meet MEP and water quality standards. If there is a discharge from the MS4 to a waterbody that is subject to an approved TMDL identified in part 2.2.1 of the re-issued permit, the permittee shall comply with all applicable schedules and requirements for that TMDL listed in Appendix F. If there is a discharge from the MS4 to a waterbody that is water quality limited identified in part 2.2.2 of the re-issued permit, the permittee shall comply with all applicable schedules and requirements for that water quality limited waters listed in Appendix H. A permittees' compliance with its requirements in Appendix F and/or H shall constitute compliance with its requirement to ensure that its discharges do not cause or contribute to an exceedance of water quality standard. As TMDLs are developed and approved, permittees' stormwater management programs and annual reports must include a description of the BMPs that will be used to control the pollutant(s) of concern, to the maximum extent practicable. Annual reports filed by the permittee should highlight the status or progress of control measures currently being implemented or plans for implementation in the future. Records should be kept concerning assessments or inspections of the appropriate control measures and how the pollutant reductions will be met.

8. Question: Will Communities be liable for meeting bacteria water quality standards for bacteria at the point of discharge?

Response: No. While this is the goal stated in the TMDL, compliance with the water quality standards is judged by in-stream measurements. For instance, in an extreme case, it could be possible for a community to meet water quality standards in their storm drains and yet still be responsible for reducing the impacts of overland runoff if the in-stream concentrations of bacteria exceeded the water quality standard. So no matter how the TMDL is expressed, compliance is measured by the concentrations in the ambient water.

This approach is consistent with current EPA guidance and regulations. As stated in the November 22, 2002 Wayland/Hanlon memorandum (TMDL Appendix B, Attachment A), "WQBELs for NPDES-regulated stormwater 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)" (TMDL Appendix B, Attachment A Wayland/Hanlon memo, page 2). This memorandum goes on to state:

"...because stormwater 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 stormwater 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" (TMDL Appendix B, Attachment A Wayland, Hanlon memorandum, November 22, 2002, page 4).

The TMDL attempts to be clear on the expectation that BMPs will be used to achieve WQS as stated in the Wayland/Hanlon memorandum: "If it is determined that a BMP approach (including an iterative BMP approach) is appropriate to meet the stormwater component of the TMDL, EPA recommends that the TMDL reflect this." (TMDL Appendix B, Attachment A Wayland, Hanlon memorandum, page 5). Consistent with this, the Massachusetts' pathogen TMDLs state that BMPs may be used to meet WQS. The actual WLA and LA for stormwater will still be expressed as a concentration-based/WQS limit which will be used to guide BMP implementation. The attainment of WQS, however, will be assessed through ambient monitoring.

In stormwater TMDLs, the issue of whether WQSs will be met is an ongoing issue and can never be answered with 100% assurance. MassDEP believes that the BMP-based, iterative approach for addressing pathogens is appropriate for stormwater. Indeed, "[t]he policy outlined in [the Wayland/Hanlon] memorandum affirms the appropriateness of an iterative, adaptive management BMP approach, whereby permits include effluent limits (e.g., a combination of structural and non-structural BMPs) that address stormwater discharges, implement mechanisms to evaluate the performance of such controls, and make adjustments (i.e., more stringent controls or specific BMPs) as necessary to protect water quality" (TMDL Appendix B, Attachment A Wayland, Hanlon memorandum, page 5).

A more detailed discussion / explanation of this response can be found in TMDL Appendix B, Attachment A, a memorandum titled “Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) for Stormwater Sources and NPDES Permit Requirements Based on Those WLAs” by Robert H. Wayland and James A. Hanlon of EPA (11/22/02)..

9. Question: What are the regulatory hooks for this TMDL in regards to non-point sources?

Response: In general, the MassDEP is pursuing a cooperative approach in addressing non-point sources of contamination by bacteria. A total of 247 cities and towns in Massachusetts do have legal requirements to implement best management practices under their general NPDES storm-water permits. In addition, failing septic systems are required to be corrected once the local Board of Health becomes aware of them and at the time of property transfer should required inspections reveal a problem. Other activities, such as farming involving livestock, are the subject of cooperative control efforts through such organizations as the Natural Resources Conservation Service (NRCS) which has a long history of providing both technical advice and matching funds for instituting best management practices on farms. While MassDEP has broad legal authority to address non-point source pollution and enforcement tools available for use for cases of egregious neglect, it intends to fully pursue cooperative efforts which it feels offer the most promise for improving water quality.

10. Question: Why is there little mention in the draft TMDL reports on incorporation of LID (Low Impact Development) principles as a way through implementation to control Bacteria pollution?

Response: Part of the Statewide TMDL project was to produce an accompanying TMDL implementation guidance document for all the TMDL reports, “Mitigation Measures to Address Pathogen Pollution in Surface Waters: A TMDL Implementation Guidance Document for MA”. There is an entire section in that document (Section D.4) that discusses LID principles and TMDL implementation in detail. There is additional information on LID on the interactive web site for non-point source pollution, *Massachusetts Clean Water Toolkit*, http://prj.geosyntec.com/npsmanual/default.aspx.

11. Question: What about flow issues and TMDL requirements?

Response: Although flow can have both positive and negative impacts on water quality, flow is not a pollutant and therefore is not covered by a TMDL. TMDLs are required for each “pollutant” causing water quality impairments.

12. Question: Is there a way that the TMDL can be integrated with grants, and can the grants be targeted at TMDL implementation?

Response: The 319 Grant program is a major funding program providing up to $2 million per year in grants in MA. TMDL implementation is a high priority in the 319 program. In fact, projects designed to address TMDL requirements are given higher priority points during project evaluation.

The 319 grant program RFP Includes this language: "Category 4a Waters: TMDL and draft TMDL implementation projects – The 319 program prioritizes funding for projects that will implement Massachusetts' Total Maximum Daily Load (TMDL) analyses. Many rivers, streams and water bodies in the Commonwealth are impaired and thus do not meet Massachusetts' Surface Water Quality Standards. The goal of the TMDL Program is to determine the likely cause(s) of those impairments and develop an analysis (the TMDL) that lists those cause(s)."

Several comments were also directed towards the complications associated with applying for and reporting details that are required with state grant programs. The MassDEP is sympathetic to the paper work requirements of State and Federal grant programs. The MassDEP will review the body of requirements to assess what streamlining may be possible. At the same time, the MassDEP underscores that accountability for spending public funds continues to be an important and required component of any grant program.

13. Question: How will implementation of the TMDL address the major problem of post- construction run-off?

Response: Proper design and implementation of stormwater systems during construction will address both pre and post-construction runoff issues and thus eliminate future problems. Post-construction runoff is also one of the six minimum control measures that Phase II communities are required to include in their stormwater management program in order to meet the conditions of their National Pollutant Discharge Elimination System (NPDES) permit. In short, Phase II communities are required to:

- Develop and implement strategies which include structural and/or nonstructural best management practices (BMPs);
- Have an ordinance or other regulatory mechanism requiring the implementation of post-construction runoff controls to the extent allowable under State or local law;
- Ensure adequate long-term operation and maintenance controls; and
- Determine the appropriate best management practices (BMPs) and measurable goals for their minimum control measure.

The general permit implementing the Phase II requirements also contains requirements for permittees that discharge into receiving waters with an approved TMDL. In summary, municipalities covered under Phase II are required to incorporate and implement measures and controls into their plans that are consistent with an established TMDL and any conditions necessary for consistency with the assumptions and requirements of the TMDL.

It should be noted that there are a number of other permitting programs that regulate pre/post construction run-off including the construction general permit, wetlands requirements and the Mass DEP General Stormwater permit. EPA and MassDEP reissued the MS4 permit in April 2016 with an effective date of July 1, 2018. A full list of MS4 Phase II communities in MA can be found at on the EPA website. This TMDL forms the basis for the implementation plans to meet the Pathogen loading capacity. Although EPA's Phase II MS4 regulations only require a small MS4 to implement its program in the urbanized area subject to permitting, EPA and MassDEP nonetheless encourage permittees, to update and implement their respective SWMPs jurisdiction-wide to further water quality improvements.

14. Question: How does a pollution prevention TMDL work?

Response: MassDEP recommends that the information contained in the pathogen TMDLs guide management activities for all other waters throughout the watershed to help maintain and protect existing water quality. For non-impaired waters, Massachusetts is proposing "pollution prevention TMDLs" consistent with CWA s. 303(d)(3). Pollution prevention TMDLs encourage the Commonwealth, communities and citizens to maintain and protect existing water quality. Moreover it is easier and less costly in the long term to prevent impairments rather than retrofit controls and best management practices to clean up pollution problems. The goal of this approach is take a more proactive role to water quality management.

The analyses methods employed for the pathogen impaired segments in this TMDL would apply to the non-impaired segments, since the sources and their characteristics are similar. The waste load and/or load allocation for each source and designated use would be the same as specified in the TMDL documents. Therefore, the pollution prevention TMDLs would have comparable waste load and load allocations based on the sources present and the designated use of the waterbody segment.

The TMDLs may, in appropriate circumstances, also apply to segments that are listed for pathogen impairment in subsequent Massachusetts CWA s. 303(d) Integrated List of Waters. For such segments, this TMDL may apply if, after listing the waters for pathogen impairment and taking into account all relevant comments submitted on the CWA's 303(d) list, the Commonwealth determines with EPA approval of the CWA's 303(d) list that this TMDL should apply to future pathogen impaired segments.

Pollution prevention best management practices form the backbone of stormwater management strategies. Operation and maintenance should be an integral component of all stormwater management programs. This applies equally well with the Phase II Program as well as TMDLs. A detailed discussion of this subject and the BMPs involved can be found in the TMDL companion document "Measures to Address Pathogen Pollution in Surface Waters: A TMDL Implementation Guidance Document for Massachusetts" in Section 3.

It should also be noted that sometimes the MassDEP will develop a "preventative" TMDL. Preventative TMDLs are not required by Federal law, however, MassDEP does establish them on occasion to prevent waters from becoming impaired or where it is necessary to maintain waters at a certain level of water quality to meet the goals of a TMDL where the impaired water body is downstream from a non-impaired segment. In simple terms a preventative TMDL establishes goals to prevent degradation of good water quality.

15. Comment: The TMDL methodology uses concentrations based on water quality standards to establish TMDL loads, not traditional "loads".

Response: The TMDL has been revised to provide not only a concentration based approach but also a loading approach. It should be noted, however, that MassDEP believes that a concentration-based approach is consistent with EPA regulations and more importantly more understandable to the public and easier to assess through monitoring activities. Clean Water Act Section 130.2(i) states that "TMDLs can be expressed in terms of either mass per time, toxicity, or other appropriate measure". The TMDL in this case is set at the water quality standard. Pathogen water quality standards (which are expressed as concentrations) are based on human health, which is different from many of the other pollutants. It is important to know immediately when monitoring is conducted if the waterbody is safe for human use, without calculating a "load" by multiplying the concentration by the flow – a complex function involving variable storm flow, dilution, proximity to source, etc.

The expectation to attain water quality standards at the point of discharge is conservative and thus protective, and offers a practical means to identify and evaluate the effectiveness of control measures. In addition, this approach establishes clear objectives that can be easily understood by the public and individuals responsible for monitoring activities.

MassDEP believes that it is difficult to provide accurate quantitative loading estimates of indicator bacteria contributions from the various sources because many of the sources are diffuse and intermittent, and flow is highly variable. However, based on public comment we have included loads for each segment based on variable flow conditions and the water quality standards. Because of the high variability of bacteria and flows experienced over time, loads are extremely difficult to monitor and model. Therefore, "loadings" of bacteria are less accurate than a concentration-based approach and do not provide a way to quickly verify if you are achieving the TMDL.

16. Comment: There is concern with the "cookie-cutter" nature of the draft TMDL. Particularly the lack of any determination about the causes and contributions to pathogen impairment for specific river and stream segments.

Response: The MassDEP feels the pathogen TMDL approach is justified because of the commonality of sources affecting the impaired segments and the commonality of best management practices used to abate and control those sources. The MassDEP monitoring efforts are targeted towards the in-stream ambient water quality and not towards tracking down the various sources causing any impairments. It should be noted however that MassDEP has conducted additional efforts to try to identify sources where information was available. Based on this additional information, MassDEP added tables to help identify and prioritize important segments and sources where that information was known. Also MassDEP revised Section 7 of the document to include segment-by-segment load allocations required to meet standards. All of these actions were intended to provide additional guidance on potential sources and areas of concern and to help target future activities.

17. Comment: While Table 8-1 of each TMDL lists the Tasks that the agencies (MassDEP/EPA) believe need to be achieved, it isn't clear exactly how these tasks line up with and address the eight sources of impairment listed in Table 7-1. CZM recommends that the final TMDL be more specific and couple the Implementation Plan tasks with the known or expected sources of contamination. This would make the document more useful to a community

Response: Because Table 7-1 and 8-1 serve significantly different purposes it was not intended that the tasks needed to align with and exactly address the eight sources of impairment. With regard to pollution sources, it might be more pertinent to compare Table 7-1 with Table 5-1, where it would be appropriate according to geographic location of known potential sources in Table 5-1. Table 8-1 is more of a suggested possible planning tool, matching tasks with potential organizations for action.

18. Comment: While the text in sections 8.1-8.7 of each TMDL describe some actions that can address the sources in Table 7-1, the issue of failing infrastructure is only mentioned in a sub-section title and in the text, but not addressed in any detail.

Response: Failing infrastructure is a very broad term, and is addressed, in part in such discussions as those on leaking sewer pipes, sanitary sewer overflows, and failed septic systems. It should be mentioned that in the Final TMDL reports, information on infrastructure rehabilitation efforts and progress has been expanded in Section 8. It is outside of the scope of the TMDL documents to detail every possible type of infrastructure failure. Nonetheless, additional information is provided in the TMDL companion document titled: "Measures to Address Pathogen Pollution in Surface Waters: A TMDL Implementation Guidance Document for Massachusetts."

19. Comment: There is a need for more specific information about what individual communities are currently doing and how much more effort is required (e.g., how many more miles of pipe need to be inspected for illegal connections in a specific community).

Response: MassDEP and the EPA recognize that the municipalities have done, and are continuing to do, a tremendous amount of work to control bacterial contamination of surface waters. The TMDL has been expanded to provide additional examples of that overall effort. However, the additional discussion is not designed nor intended to include an exhaustive listing of all the work required by each municipality to finalize this effort and provide as status of that work. Programs, such as Phase II Stormwater, require such status reports, and those will be very valuable in assessing priorities and future work. Phase II reports for each community are available on EPAs website: https://www.epa.gov/npdes-permits/2003-small-ms4-general-permit-archives-massachusetts-new-hampshire

20. Comment: There are no milestones to which individual communities should aim (e.g., all stormwater lines upstream of known contamination inspected for illegal connections in five years). As another example, Sections 7 and 8 of each TMDL state that "The strategy includes a mandatory program for implementing stormwater BMPs and eliminating illicit sources" but it is not clear over what timeframe a community should be acting.

Response: MassDEP recognizes that the addition of timelines in the TMDLs would appear to strengthen the documents; however, the complexity of each source coupled with the many types of sources which vary by municipality simply does not lend itself to the TMDL framework and therefore must be achieved through other programmatic measures.

For example, the Phase II stormwater program, revised permit effective July 1, 2018, establishes a 10-year timeline for each regulated community with specific goals related to the identification and control of illicit pollution sources. A second example would be the control of combined sewer overflows (CSOs). Many municipalities are required by NPDES permits to develop and implement initial measures (commonly referred to as the Nine Minimum Controls (NMCs) and long-term control plans to address the issue. Since CSO discharges are defined as a point source under the Clean Water Act, an NPDES permit must be jointly issued by EPA and MassDEP for those discharges. The permit sets forth the requirements for implementation and assessment of the EPA mandated NMCs and the requirement for developing a long-term CSO control strategy. CSOs within the Boston Harbor and Mystic watersheds have Long Term Control Plans in place. There are no CSOs within the Weymouth-Weir watersheds.

21. Comment: Under "Control Measures" does "Watershed Management" include NPDES permitting?

Response: Stormwater management includes NPDES Phase I and II and could include additional permitting actions where deemed necessary and appropriate. Properly functioning wastewater treatment plants already have permit limitations equal to the water quality standards and as such are not generally a source of bacteria that would result in water quality exceedences therefore they are not included as a control measure.

22. Comment: Absent from each report under “Who should read this document?” are the government agencies that provide planning, technical assistance, and funding to groups to remediate bacterial problems.

Response: The TMDL report has been edited to include groups and individuals that can benefit from the information in this report. It is beyond the scope of the TMDL to provide an exhaustive list of agencies that provide funding and support. Chapter 8.0, however, includes a link to this information, which is provided in the Massachusetts Nonpoint Source Strategy.

23. Comment: For coastal watersheds the section that describes funding sources should include grant programs available through the Massachusetts Office of Coastal Zone Management.

Response: Please see response to comment #22.

24. Comment: Table ES-1 and the similar tables throughout the report do not list B,or SB(CSO) or as a surface water classification – this classification and its associated loadings allocations are missing. Although the footnote to the table refers to Long term CSO Control Plans, the relationship between the TMDL, LTCP, and the B(CSO) water classification are unclear.

Response: The 1995 revisions to the MA Water Quality Standards created a B,or SB (CSO) water quality category by establishing regulatory significance for the notation “CSO” shown in the “Other Restriction” column at 314 CMR 4.06 for impacted segments. The B, or SB (CSO) designation was given, after public review and comment, to those waters where total elimination of CSOs was not economically feasible and could lead to substantial and widespread economic and social impact and the impacts from remaining CSO discharges were minor. Although a high level of control must be achieved, Class B standards may not be met during infrequent, large storm events.

The goal of the TMDL and the long-term control plan is to minimize impacts to the maximum extent feasible, attain the highest water quality achievable, and to protect critical uses. Given this, the TMDL establishes in Table ES-1 (as well as other tables) the goal of meeting class B, or SB standards in CSO impacted waters but recognizes that this criteria cannot be met at all times and therefore defers to the EPA and MassDEP approved MWRA Long-Term CSO Control Plan to define the infrequent occasions when the criteria may not be met.

25. Comment: The implementation of new bacteria water quality criteria into NPDES permits should be determined during the permit writing process rather than by the TMDL process – and that should be made clear in the TMDL document.

Response: MassDEP agrees that implementation of new bacteria water quality criteria should be incorporated into the permitting process as well as the state Water Quality Standards. This is already the case. The criteria are also being included in the TMDL because it is a required element of the TMDL process. Readers / users of the bacteria TMDL reports should be aware that new water quality standards were developed and included in the December 29, 2006 revisions to 314 CMR 4.00: Massachusetts Surface Water Quality Standards. These standards have been included in the final Pathogen TMDL for the Boston Harbor Watersheds.

26. Comment: Coastal resources are significantly impacted from the stormwater run-off from Mass Highway roads. This goes beyond the control of municipalities to upgrade and is often beyond the capability of local groups to monitor. MHD (Massachusetts Highway Department (Mass Highway)) continues to evade stormwater standards and it is thus our opinion that MHD deserves special recognition, complete with implementation strategy to upgrade the drainage systems along its web of asphalt.

Response:
The Mass Highway Department, now officially known as the Massachusetts Department of Transportation (MassDOT), has not been included in the new MS4 permit which became effective 7/1/2018. They are currently covered under the 2003 MS4 permit, and have requested that EPA issue an individual MS4 permit to DOT. EPA plans to include MassDOT under the umbrella of individually issued permittees for facilities such as transportation depots, airports, military facilities and other such enterprise operations. Each of these facility permittees has separate requirements depending on the particular operations that occur at that facility. EPA anticipates a draft permit will go out for public review later this year.

27. Comment: What is the current 303d list of impaired waters?

Response: This TMDL was written to reflect the 2014 303d list, however, the analyses conducted for the bacteria impaired segments in this TMDL would apply to the non-impaired segments, since the sources and their characteristics are equivalent. The concentration waste load and/or load allocation for each source and designated use would be the same as specified in this TMDL. Therefore, the pollution prevention TMDLs would have identical waste load and load allocations based on the sources present and the designated use of the water body segment (see ES-4 and Table 7.1). This Boston Harbor watershed TMDL may, in appropriate circumstances, also apply to segments that are listed for bacteria impairment in future Massachusetts CWA § 303(d) Integrated List of Waters. For such segments, this TMDL may apply if, after listing the waters for bacteria impairment and taking into account all relevant comments submitted on the CWA § 303(d) list, the Commonwealth determines with EPA approval of the future CWA § 303(d) Integrated List of Waters that this TMDL should apply to newly listed bacteria impaired segments.

28. Comment: Does the NPDES non-delegated state status of Massachusetts affect the TMDLs in any way?

Response: No. The MassDEP and EPA work closely together and the non-delegated status will not affect the TMDLs. The EPA has not written any of the pathogen TMDLs but has helped fund them.

29. Comment: The TMDL report does not tell the watershed associations anything they didn't already know.

Response: True. The MassDEP is taking a cooperative approach and by working together as a team (federal, state, local, watershed groups) we can make progress in addressing bacterial problems – especially stormwater related bacterial problems.

30. Comment: What will the MassDEP do now for communities that they have not already been doing?

Response: Grants that can be used for implementation (such as the 319 grants) will be targeted toward TMDL implementation. Also, the more TMDLs a state completes and gets approved by EPA the more funding it will receive from EPA and thus the more TMDL implementation it can initiate.

31. Comment: The State Revolving Fund (SRF) should support municipalities with TMDLs and Phase II status a lot more.

Response: As with any grant program, there are some very competitive projects looking for funds from the SRF. A lot of these are the traditional sewage treatment plants and sewering projects which are very expensive. The SRF currently does allocate funds to stormwater related projects and gives higher priority points to projects developed in response to TMDLs.

32. Comment: Who will be doing the TMDL implementation?

Response: Each pathogen TMDL report has a section on implementation which includes a table that generally lists the various tasks and the responsible entity. Most of the implementation tasks will fall on the authority of the municipalities. Probably two of the larger tasks in urban areas include implementing stormwater BMPs and eliminating illicit sources. The MassDEP working with EPA and other team partners shall make every reasonable effort to assure implementation of the TMDLs.

33. Comment: Several watershed groups believe that active and effective implementation and enforcement is essential to carry out the objectives in the pathogen TMDLs. They define effective implementation as the MassDEP partnering with them and municipalities to identify funding opportunities to develop stormwater management plans, implement Title 5 upgrades, and repair failing sewer infrastructure. The groups define effective enforcement as active MassDEP application of Title 5 regulations and implementation of Stormwater Phase II permitting requirements for Phase II municipalities.

Response: The MassDEP has every intention of assisting watershed groups and municipalities with implementing the high priority aspects of the pathogen TMDLs, including identification of possible funding sources. With respect to Title 5 regulations and the Phase II program requirements, the MassDEP will continue to emphasize and assist entities with activities that lead to compliance with those program requirements.

34. Comment: The MassDEP Division of Watershed Management (DWM) should network implementation planning efforts in the coastal watersheds with the Coastal Zone Management's (CZM) Coastal Remediation Grant Program and the EPA Coastal Nonpoint Source Grant Program. Also, the DWM should make the pathogen TMDL presentation to the Mass Bays Group, and network with them in regards to coordinating implementation tasks.

Response: This is a good comment. The MassDEP DWM intends, through its basin planning program, to do both.

35. Comment: Why are specific segments or tributaries of watersheds addressed in the Draft TMDL but not all of the segments?

Response: In accordance with the EPA regulations governing TMDL requirements, only segments that are included on the state's 303(d) list of impaired waterbodies need to be included in any TMDL. An addendum TMDL will be issued at a later date that will include segments that have been listed as impaired for pathogens after the public notification period.

36. Comment: When a TMDL is developed for waters impaired by both point and nonpoint sources, and the WLA is based on an assumption that nonpoint source reductions will occur; EPA's 1991 TMDL Guidance states that the TMDL should provide reasonable assurances that nonpoint source control measures can achieve expected load reductions in order for the TMDL to be approvable.

Response: Section 10.0, Reasonable Assurances, should provide these assurances. This section has been drastically expanded in the Final version of the Draft Pathogen TMDL reports. The revised section 10.0 describes all of the appropriate state programs and their enabling statutes and relevant regulations which actively address nonpoint source pollution impacting waters of the Commonwealth. Many of these programs involve municipality first line defense mechanisms such as the Wetlands Protection Act (which includes the Rivers Protection Act). This expanded section also covers grant programs available to municipalities to control and abate nonpoint source pollution such as 319 grants, 604b grants, 104b(3) funds, 6,217 coastal nonpoint source grants, low interest loans for septic system upgrades, state revolving fund grants, and many others.

37. Comment: The Draft TMDLs indicate that for non-impaired waters the TMDL proposes "pollution prevention BMPs". The term is not defined in any state regulation and the origin of the term is unclear.

Response: An explanation of pollution prevention BMPs can be found in the pathogen TMDL companion document "Mitigation Measures to Address Pathogen Pollution in Surface Waters: A TMDL Implementation Guidance Manual for Massachusetts". Section 3.1 of that manual describes pollution prevention as one of the six control measures for minimizing stormwater contamination under the EPA Phase I or II Stormwater Control Program. Control Measure #6, "Pollution Prevention / Good Housekeeping" involves a number of activities such as maintenance of structural and nonstructural stormwater controls, controls for reducing pollutants from roads, municipal yards and lots, street sweeping and catch basin cleaning, and control of pet waste. Also, the term "pollution prevention" can include a far wider range of pollution control activities to prevent bacterial pollution at the source. For instance, under Phase I and II, minimum control measures #4 and #5, construction site and post construction site runoff controls, would encompass many pollution prevention type BMP measures. Proper septic system maintenance and numerous agricultural land use measures can also be considered pollution prevention activities. Further information may be found in Sections 3.0, 4.0, and 5.0 in the Guidance Manual.

38. Comment: EPA regulations require that a TMDL include Load Allocations (LAs) which identify the portion of the loading capacity attributed to existing and future nonpoint sources and to natural background. Load allocations may range from reasonably accurate estimates to gross allotments (40 C.F.R. s.130.2(g)). Where possible, load allocations should be described separately for natural background and nonpoint sources. The Draft TMDL makes no such allocation. Also, EPA regulations require that a TMDL include Waste Load Allocations (WLAs) which identify the portion of the loading capacity allocated to individual existing and future point sources. The Draft TMDL makes no such allocation. Because it makes no estimate of the TMDL, it makes no WLA for point sources.

Response: This comment (and several others which addressed the same topic) relates to the establishment and allocation of an acceptable pollutant load so that water quality standards can be met and maintained (see response to comment 9 & 16). As touched upon elsewhere in this document, TMDLs can be expressed in a variety of ways so long as they are rational. MassDEP has chosen to use concentration as the metric for bacteria TMDLs for several reasons. First, there is a numeric standard that can be used. Second, and more important, bacteria, unlike some other pollutants, can increase with flow rather than decrease. As such, the bacteria load applicable at low flow (7Q10) would be very stringent if applied to higher flows. In essence, this TMDL recognizes that higher loads are likely at higher flows and therefore the emphasis is on meeting the in-stream water quality.

Watershed Specific Comments

<u>**MYSTIC RIVER WATERSHED ASSOCIATION COMMENTS:**</u>

1. Comment- The Mystic River Watershed Association in a formal, detailed, letter to Russell Isaac, September 15, 2005, requested that the DEP elect to take one of two approaches to assure that the pathogen TMDL will accomplish the goal of restoring pathogen impaired waters: (A) either conduct further monitoring and assessment to characterize the specific contributors to pathogen contamination in each impaired water body, and set specific performance targets and deadlines for each party responsible for each source, consistent with a traditional TMDL approach; <u>*or*</u> (B) Commit to specific actions DEP will take as part of the TMDL implementation, and specify deadlines and specific actions municipalities and other responsible stakeholders must take, consistent with their existing obligations. After a four- year implementation period, DEP needs to assess the need for additional actions in specific waterbodies to address remaining impairments.

Response- In the Mystic River watershed, each of the communities is subject to Phase II stormwater requirements. As such, each community has obligations under that program to accomplish the tasks set forth. Once those efforts are completed, MassDEP will evaluate whether more controls are needed to meet water quality standards. Monitoring will be conducted as part of the basin cycle. In the meantime, MassDEP welcomes the efforts of both the communities and others to put in implementation controls, and continue monitoring water quality in the Mystic River.

The Final Report has been greatly expanded from the original Draft TMDL. Section 4, Problem Assessment, has been substantially updated with current DEP, MWRA, MyRWA, and CZM data, along with information on all important NPDES dischargers. Sections 5 and 6 have been reworked to give more information on both possible and actual sources of pathogen pollution. Section 7 has been modified to include giving WLA and LA loadings calculations for each segment. Section 8, Implementation, has been rewritten to include detailed up-to- date information on CSO and SSO dischargers, along with progress on CSO and SSO control efforts. Also added to Section 8 is a detailed update on activities and progress of each community in the watershed under the Phase II Stormwater Program. Section 10, Reasonable Assurances has been expanded to give details on various tools and resources that are potentially available to communities and organizations for pathogen pollution controls.

2. Comment- This TMDL bypasses the task of establishing the total loadings that could be discharged from various sources while still meeting water quality standards in different water bodies. Instead, DEP proposes to make the TMDL equal to the water quality standards from all sources. The TMDL document and the accompanying Implementation Guidance provide a useful compendium of information on bacterial sources and pollution control methods. Given the wide range of options presented, the wide variation in their effectiveness in reducing loadings, and the lack of any specific deadlines, however, the proposed TMDL does little to ensure that reasonable progress will be made in practice to address pathogen impairments.

Response- With regard to establishing total loadings, **s**ee Comment #15 and its response under general comments above. The Final Report contains total loadings calculations for both WLA and LA. With regard to the TMDL providing assurance for reasonable progress to address pathogen impairments, see Section 10, Reasonable Assurances in this Final Report.

3. Comment- In presenting the proposed TMDL at public meetings, DEP staff have emphasized the agency's preference to proceed quickly to implementation of the TMDLs, rather than spending the time and resources required to do a fuller evaluation of bacteria sources and allocate loads to specific sources. DEP has also emphasized its expectation that the TMDLs will encourage other stakeholders (municipalities and watershed associations) to better understand and take action to reduce bacterial loadings. Finally, DEP notes that they want to work cooperatively with other stakeholders to achieve the goals of the TMDLs. Laudable as these goals and expectations are in theory, the effect is a TMDL approach that lacks any real assurance that progress will be made.

Response- MassDEP has both the intention of implementation of the TMDLs in segments and areas where sources of bacteria pollution are known, and doing a fuller evaluation of bacteria sources in segments and areas where specific sources are less known. Comments #32- 34, and 37 outlines steps stakeholders (municipalities and watershed associations) can take to better understand and take action to reduce bacterial loadings. With regard to the concern that the TMDL approach lacks any real assurance of tools and resources available, and that progress will be made in reducing loadings, see the expanded Section 10, Reasonable Assurances in this Final Report.

4. Comment- The TMDL notes that municipalities will be responsible for taking action to address many of the likely sources that contribute pathogens to Mystic Watershed waters. These include illicit discharges to storm drains and leading sanitary sewer lines (both violations of the state's regulations), and stormwater runoff (addressed under the Phase I and Phase II stormwater permits.) Absent strong DEP and EPA enforcement of existing requirements, and specific schedules for meeting concrete performance targets, MyRWA is concerned that many municipalities' efforts will fall far short of what would be required to make a significant improvement in water quality. Most communities are struggling with reduced budgets, and the demands of repairing and upgrading sewer and stormwater infrastructure often lose out in the local budget process to investments with more visible benefits (like schools, fire departments, police and fixing potholes). It will take specific requirements and deadlines, as well as expanded funding resources, to encourage real action at the municipal level.

Response- See Questions 6, 7, and 20, with responses under general comments above. This addresses the concern about DEP and EPA enforcement (under the Phase II Stormwater Program), and explains both this program itself and the 'six points of controls', as well as this program's relationship to the TMDL process. See Comments #19, 20 with responses under general comments above for information on required progress reports under the Phase II Program, and goal/milestone setting. See Section 10 in this Final Report for assurances of available tools and funding resources potentially available.

5. Comment- MyRWA is also concerned that simply setting the TMDL at the water quality standard for every source will reinforce the perception that little will in practice be required of municipalities and other responsible stakeholders. The requirements of the Phase II stormwater permit for MS4s are vague, and do not hold municipalities to very high standards in controlling stormwater. It is hard to imagine that DEP will be willing or able to take widespread enforcement action against sources whose discharges do not meet the water quality standards anytime soon. Setting an unrealistically high standard without any concrete interim schedules and requirements does not achieve anything in practice.

Response- The response to Question #8 in the general comments section above answers the concern about meeting water quality standards at every source. Comments #19 and 20 with responses in the general comments above gives information on the structure and expectations of communities under the Phase II Stormwater Program.

6. Comment- To ensure that this TMDL achieves its goals, MyRWA recommends that the TMDL implementation strategy include the following commitments by DEP:

(A) Sufficient bacteria monitoring of all pathogen-impaired waterbodies over the next three years to characterize the relative contributions of different sources to total bacteria loadings. Monitoring should be sufficient to identify specific sources, not just categories of sources – e.g. a particular town's sewers rather than "municipal sewers" as a general category. The monitoring could be performed by DEP, performed by MyRWA under grants from the state or other funders, or required of municipalities, the MWRA, and other responsible stakeholders. It should be DEP's responsibility to ensure that the required monitoring is accomplished, however.

Response- MassDEP will continue its Basin Cycle Monitoring Program on a 5 year basis in the Mystic, Neponset, and Weymouth- Weir sub- watersheds. We generally do not have the resources to conduct extensive monitoring for every potential pathogen problem in all the communities in the watershed. Currently, MassDEP does not conduct sampling in the open ocean waters of Boston Harbor, however, considerable monitoring is conducted by MWRA, CZM, and MyRWA in these waters. We have greatly expanded the available pathogen data- base in Section 4 of the Final Report. This is comprised of data from MassDEP, MWRA, CZM, MyRWA, various communities, and other entities. MassDEP relies on all these agencies to provide a reasonable pathogen data- base. Section 10 of this Final Report gives tools and resources potentially available to help communities and other entities obtain possible funding for further monitoring efforts.

(B) Appropriate enforcement action taken in all cases of violations of pathogen water quality standards identified by this monitoring. Graduated responses, including requests for information, notices of non-compliance, and administrative orders (consent or unilateral), can be used as appropriate. DEP should commit to reviewing and taking some action with each responsible party on a regular basis, however. For example, we request that DEP review the performance of each municipality and take appropriate action based on progress no less often than twice a year. In addition, DEP should not allow continued non-action over time, but should increase the severity of enforcement action after a specified period of time. The results of these reviews should be available to the public.

Response: MassDEP takes pride with its past and present program emphasis in overall pollution related enforcement efforts. This has largely been carried out through its Regional Offices. Graduated responses, including requests for information, notices of non-compliance, and administrative orders (consent or unilateral), have been used as appropriate on a regular basis when required. Both DEP and EPA Region I staff regularly review and refer to the Phase II Stormwater Annual Reports which are maintained on the publicably accessible EPA Stormwater website: http://www.epa.gov/NE/npdes/stormwater/2003-permit-archives.html. MassDEP will continue all of these efforts as a top program priority in the future.

(C) Convening meetings of relevant state agencies, municipalities, and community stakeholders for each impaired water body, to review the evidence on the level and sources of bacteria contamination, to discuss the steps being taken by various parties to address the contamination, and to establish schedules and commitments for further actions. Such meetings should be held for all of the impaired waterbodies within two years, and the results accumulated into a detailed Implementation Plan for the watershed as a whole.

Response: MassDEP has been and continues to do this. The Department was a principal player in the Massachusetts Watershed Initiative, 1995- 2003, which facilitated major stakeholder involvement in water quality improvement actions throughout the Commonwealth. In this regard, in the present sense with the Mystic watershed, the Department has actively supported EPA Region I efforts to hold watershed- wide ½ day seminars twice yearly on the water quality situation and implementation improvement program being coordinated by agencies, organizations, and municipalities throughout that watershed. All stakeholders have been invited to attend and participate in each of these meetings, which have been held at the EPA Region I Headquarters in Boston. The last meeting was held on January 11, 2011. Additionally, MassDEP has been instrumental in recent years in supporting or facilitating similar water quality related meetings and workshops in other watersheds and forums throughout the Commonwealth. For instance, it has actively supported the Annual Water Conference which is held in April each year at the Water Resources Center at the University of Massachusetts, Amherst Campus.

MASSACHUSETTS WATER RESOURCES AUTHORITY COMMENTS:

General comments:

1. Comment: MWRA believes that this TMDL is fundamentally flawed because it is not supported by data. The purpose of a TMDL is to use monitoring data to allocate load reductions among pollution sources. TMDLs establish the allowable pollutant loadings, thereby providing the basis for states to establish water-quality based controls. This TMDL does not do that. It does not provide the basis for equitable and effective permit limits. It makes assumptions that lead to unrealistic goals.

Response: Section 4 in the Final Report has been substantially expanded as far as data is concerned. This includes recent MassDEP, MWRA, and other agencies' water quality pathogen data. WLA and LA bacteria pollution reduction loading targets for each segment have been added to Section 7 (see Comment #15 and its response in general comments above). Information, by impaired segment, on principal permits and their various discharges has been added in Section 4.

2. Comment: The load allocations for stormwater, which are the same as the standard for the ambient receiving water, are unrealistic and likely to be impossible to achieve through BMP's except in the most pristine areas. Such an unrealistic goal confuses the process of prioritizing and addressing the most significant sources.

Response: see response to Question #8 in the general comments section above.

3. Comment: Although expressing the TMDL as a concentration (and the same concentration for all point sources to a particular segment) rather than an allowed loading has the virtue of simplicity, and must, if successful, theoretically result in meeting water quality standards, it is not helpful in a practical sense. The volume and flow of a discharge are as important as the concentration of a pollutant in determining the ultimate impact on the receiving water. The TMDL therefore doesn't help communities to determine where to focus their efforts, nor how to measure when the stormwater is as clean as practicable. Communities *will* need to determine relative loadings, not just concentrations.

Response: see response to Comment #15 in the general comments section above.

4. Comment: The TMDL tables do not include a classification for B or SB (CSO). Therefore, there are no WLA's shown for segments with this classification, although there is a footnote that is related. MWRA recommends that DEP state that waste loads to B or SB (CSO) waters are based on approved CSO control plans, because water quality classifications in Boston Harbor were changed as a result of MWRA's LTCP.

Response: see response to Comment #24 in the general comments section above.

5. Comment: The relationship between the TMDL process and the NPDES permitting process is unclear.

Response: see responses to Comments #7, 9, 13, 20, and 21 in the general comments section above.

6. Comment The implementation of new bacteria water quality criteria into NPDES permits should be determined during the permit writing process rather than by the TMDL process-and that should be made clear in the TMDL document. (e.g. single sample maxima).

Response: see response to Comment #25 in the general comments section above.

7. Comment The description of the monitoring plan (section 9) is slim. It mentions MADEP's five-year water quality monitoring, but there is no reference to a monitoring plan in the reference section, and no monitoring plan or Quality Assurance Project Plan for the Boston Harbor Watershed is available on MADEP's website. There doesn't appear to be an MADEP overall plan (apart from MyRWA and MWRA) for monitoring water quality in the Boston Harbor watershed in order to either detect the relative importance of sources or to measure the effectiveness of TMDL implementation. This is crucial, as the TMDL emphasizes the difficulties of knowing the sources of pathogen contamination. EPA's Protocol for Developing Pathogen TMDLs emphasizes that the more uncertainty exists about the source of a pollutant, the more monitoring should be done.

Response: MassDEP continues its five year cycle monitoring program in each area (basin) throughout the Commonwealth. The Mystic, Neponset, and Weymouth-Weir subwatersheds were sampled at numerous points for bacteria in 2009. MassDEP currently does not have the resources to conduct monitoring in salt water areas of the Commonwealth, and therefore, does not monitor in the salt water portions of Boston Harbor, but instead depends on other agencies such as the MWRA, BWSC, CZM, MDPH, and local communities beaches data for bacteria monitoring and reporting.

Specific comments:

1. Comment: In Figure 1-1, the legend doesn't indicate how the divisions between segments are drawn on the map. Since the report is organized by segment, it's important to know where the divisions are. Are segments indicated by red lines? VERY hard to see in Boston Harbor with the red cross-hatching- suggest using black lines to delineate segments. Do the green lines signify DMF shellfishing designations? The legend should make this clear. Figure 1-1 does not show that Dorchester Bay is conditionally restricted for shellfishing.

Response: MassDEP has attempted to improve the accuracy and readability of Figure 1-1 in the Final Report. Geographic segment descriptions are presented in Section 4 with each sub- part for each segment where water quality data and NPDES information are presented. This is far more descriptive and precise than can be indicated on any map.

2. Comment: On Pg. 29**,** In the Pleasure Bay Segment MA70-11 subsection, mention that MWRA project beginning to be completed by May 2006 in compliance with the Court-ordered schedule, will eliminate stormwater discharges to Pleasure Bay.

Response: This was corrected in the Final Report.

3. Comment: On Pg. 30, in the Dorchester Bay-Segment MA070-03 subsection, it is erroneously stated that it is classified as SB, Shellfishing Restricted, CSO—it is not CSO. Carson and L-Street Beaches have 6 CSO outfalls, not 7 (BOS-087 is now a storm drain). Add "MWRA projects will eliminate CSO to Dorchester Bay by 2011."

Response: This was corrected in the Final Report: (1) CSO removed after Shellfishing Restricted; (2) "MWRA projects will eliminate CSO discharges to Dorchester Bay by 2011" was added; (3) BOS-087 was converted to a stormdrain as of 9/2005, was added.

4. Comment: On Pg 31 Quincy Bay Segment MA70-04, it is erroneously stated that it is classified as SA, Shellfishing Open, CSO—it is not CSO.

Response: Mention of CSO was removed for Quincy Bay MA70-04 in the Final Report.

5. Comment: On Page 31 Quincy Bay Segment MA70-05 it is erroneously stated that it is classified as SB, Shellfishing Restricted, CSO—it is not CSO.

Response: Mention of CSO was removed for Quincy Bay MA70-04 in the Final Report.

6. Comment: On Pg. 32 Hingham Bay Segment MA70-06 Class SB Shellfishing Restricted. The text says there are 9 wastewater discharge permits to MWRA. This should be corrected to show that MWRA has only one NPDES discharge to this segment, the Nut Island Emergency Spillway. Other NPDES discharges to this segment were construction-related permits for discharges that no longer exist. Other NPDES-permitted emergency discharges from Nut Island headworks are to Boston Harbor segment MA70-01.

Response: These have all been corrected in the Final Report.

7. Comment: On Pg. 34 Boston Harbor Segment MA70-01. MWRA has 3 permitted emergency outfalls from the Nut Island Headworks and 4 permitted emergency outfalls from the Deer Island Treatment Plant that discharge to this segment.

Response: This was corrected in the Final Report.

8. Comment: On Pg. 36, Town River Bay it is described as Class SA, but it is not indicated that it is classified by DEP for shellfishing (although there is a DMF designation).

Response: This was corrected in the Final Report.

9. Comment: On Pg. 36, it Refers to MWRA dewatering construction permit for inter-island tunnel-this discharge no longer exists.

Response: This was corrected in the Final Report.

10. Comment: On Pg. 39 Alewife Brook segment MA71-04 the text reads: "MWRA Deer Island WWTP discharges treated wastewater via an outfall and 15 CSOs into Alewife Brook, Inner Harbor, Mystic River, Charles River, and Dorchester Bay. Somerville previously discharged combined sewage through their six CSOs but have eliminated five. Cambridge discharges via seven CSOs into the brook." Substitute the following text. Should be "There are 8 CSO outfalls discharging to Alewife Brook, two are slated to be closed by 2013.

Response: This was corrected in the Final Report.

11. Comment: On Pg. 53, **c**hange the text "The Weymouth Fore River and Back River watersheds have chronic problems with SSOs in both their municipal sewer systems and the MWRA interceptor system", to "The Weymouth Fore River and Back River watersheds have chronic problems with SSOs in both their municipal sewer systems. Problems with the and the MWRA interceptor system are being alleviated by the new Intermediate Pumping Station".;

and, change:

"The MWRA regional sewer system discharges overflows into the Fore River, Monatiquot River and Smelt Brook. The MWRA Smelt Brook Siphon overflows several times each year for periods up to 11 days because of excessive wet weather flows contributed by Weymouth, Braintree, Randolph, Holbrook, and Hingham." to: "The MWRA regional sewer system can discharge overflows into the Fore River, Monatiquot River and Smelt Brook. In the past, the MWRA Smelt Brook Siphon overflowed several times each year for periods up to 11 days because of excessive wet weather flows contributed by Weymouth, Braintree, Randolph, Holbrook, and Hingham. However, MWRA's Intermediate Pumping Station, which went on-line in December 2004, has alleviated most of these discharges."

Response: Both of these suggested statement changes have been put in the Final Report.

COASTAL ZONE MANAGEMENT COMMENTS:

1. Comment: p. iii, Under "Control Measures," does "Watershed Management" include NPDES permitting? If not, NPDES stormwater and point source permitting are certainly valuable bacterial control measures and should be included under "Control Measures."

Response: See response to Comment #21 in the general comments section above.

2. Comment: p. iv, First Paragraph, Executive Summary, "Illicit discharges of boat waste" should be changed to "Discharges of inadequately treated boat waste" because people using small boats (those under 65') with a Type I Marine Sanitation Device attached to the head can legally discharge waste with up to 1000 CFU/100 ml, well above the state standard for SA and SB waters. A similar change should be made to p. 51 (Section 5.0) where illicit boat discharges are mentioned as a dry weather source.

Response: MassDEP has made the suggested changes in the Final Report.

3. Comment: p. iv, Absent from the "Who should read this document?" are the governmental agencies that provide planning, technical assistance, and funding to groups to remediate these problems. CZM recommends adding such language.

Response: The following has already been added to the Final Report document on p. iii: "(e) government agencies that provide planning, technical assistance, and funding to groups for bacterial remediation".

4. Comment: p. vii, Table ES-1, It isn't clear what the difference is between "Waste Load Allocation" and "Load Allocation." The distinction is not made until p. 57 (Section 6). CZM suggests making this distinction earlier (e.g., in footnote 1 of Table ES-1).

Response: First of all, Table ES-1 that you refer to in the Draft Report has been changed to Table ES-4 in the Final Report. For the definitions of Waste Load Allocation and Load Allocation, please refer to Comment #1 and its response in the General Comments Section just above. In direct response to your comment, we have added brief statement definitions of WLA and LA to the first paragraph, pp xiv, following the footnote explanations for Table ES-4, and in Table 7.1 in Section 7 of the Final Report. Additionally, these terms are defined and discussed in much greater detail in Section 7, Pathogen TMDL Development.

5. Comment: Please note that some figures did not display in the PDF format: Figs. 1-1, 2-1, 2-2, and 7-2, did not appear.

Response: The Final Report has been checked to insure that figures are legible in both the pdf and word versions.

6. Comment: pp. 27-39, Sections 4.1, 4.2, There are several vessel sewage pumpout facilities that are located in the Boston Harbor watershed but that are not referenced in this section. For a list of pumpout facilities, please see http://www.mass.gov/czm/potoc.htm.

Response: Where appropriate, when sewage pumpout facilities are located in a particular segment, these are mentioned in the Final submittal.

7. Comment: p. 42, Mystic River Segment MA71-03, This paragraph states that there are no permitted withdrawals in this section, however, the Mystic Station power plant is permitted to withdraw cooling water from this area (see http://www.epa.gov/region1/npdes/permits/mysticpermit.pdf).

Response: MA0004740, Mystic Station Power Plant (now the Mystic Exelon Station) has been added as a permittee to that section in the Final Report.

8. Comment: p. 54, fourth paragraph (Section 5.0), In the discussion of boat waste disposal, CZM suggests changing "…MSDs may discharge sewage in concentrations higher than allowed in ambient water for fishing or shellfishing" to "…MSDs may discharge sewage in concentrations higher than allowed in ambient water for shellfishing or primary and secondary contact recreational activities." Swimming and other primary contact activities should be included as activities that may be impaired by boat sewage disposal.

Response: We have made that change in the Final Report.

9. Comment: pp. 57-63 (Section 6.1), There is no discussion of load allocations to SB-CSO waters or waters that are under a variance. If a waterbody is currently under a variance from water quality standards for bacteria, will the TMDL standards laid out in this document on p. 58 nullify the variance? Regarding this issue, the following sentence from p. 59 (last sentence) should probably be noted on p. 58 "The specific goal for controlling discharges from combined sewer overflows (CSOs) will be based on the site specific studies embodied in the Long Term Control Plan being developed by each community with combined sewers."

Response: Please note that Section 6 of the Draft Report has been changed to Section 7 in the Final Report. Also, this section in the Draft report has been reorganized in the Final Report, with Water Quality Standards information from the Draft Report (pp 34) incorporated into Table 7-1 (as well as Table ES-4), 'Waste Load Allocations (WLAs) and Load Allocations (LAs)' in the Final Report. In Table 7-1 (and Table ES-4), under column "Surface Water Classification", footnote SB[10] refers to your comment above, "The specific goal for controlling discharges from combined sewer overflows (CSOs) will be based on the site specific studies embodied in the Long Term Control Plan". Footnote SB[10], in Table 7-1, refers to (at the bottom of the page): 'SB segments designated as CSO, as having a long term control plan in place that is compatible with water quality goals'. Water bodies covered by this TMDL will not require a variance. Please also refer to Comment # 24 and its response in the General Comments Section just above for further explanation on the variance issue of B or SB (CSO).

10. Comment: p. 64, Section 6.3 "Seasonal Variability," last sentence, The following sentence suggests that primary contact does not take place in winter months: "However, for discharges that do not affect shellfish beds, intakes for water supplies and primary contact recreation is not taking place (i.e., during the winter months) seasonal disinfection is permitted for NPDES point source discharges." However, surfing occurs in many of the Commonwealth's waters year-round. CZM suggests removing this sentence (i.e., the last sentence of Section 6.3 on p. 64) or editing it to: "However, for discharges that do not affect shellfish beds, intakes for water supplies and where primary contact recreation does not take place, seasonal disinfection is permitted for NPDES point source discharges."

Response: Please note that the section on "Seasonal Variability" is Section 7.6 in the Final Report. We have edited this last sentence in the Final Report.

11. Comment: p. 66, Table 7-1, While this table lists the tasks that the agencies (DEP/EPA) believe need to be achieved, it isn't clear exactly how these tasks line up with and address the eight sources of impairment listed in Table 6-1. While some of the text in sections 7.1-7.7 describes actions that can address the sources in Table 6-1, again there is no direct connection. CZM recommends that the final TMDL be more specific and couple the Implementation Plan tasks with the known or expected sources of contamination. This would make the document more useful to a community. For example, it could be stated that the task “illicit discharge detection and elimination” from Table 7-1 addresses the pathogen source “illicit discharges to storm drains” found in Table 6-1.

There is also a need for more specific information about what individual communities are currently doing and how much more effort is required (e.g., how many more miles of pipe need to be inspected for illegal connections in a specific community). In addition there are no milestones to which individual communities should aim (e.g., all stormwater lines upstream of known contamination inspected for illegal connections in five years). As another example, on p. 65 (Section 7.0, fourth paragraph) it is stated that “The strategy includes a mandatory program for implementing stormwater BMPs and eliminating illicit sources” but it is not clear over what timeframe a community should be acting.

It would be helpful to the communities trying to implement this plan if the Department were to provide a short list of probable sources of impairment in each community for each of the impaired segments so that funds could be allocated to specific BMPs or other remedial actions in those segments. For example, Table 5-1 should be expanded to include the responsible entities (e.g., community or MWRA) and should be referenced in the Implementation section. Suggesting that more data be collected in certain areas would also be helpful.

Response: With regard to issues raised in paragraph # 1 of this comment, (i.e., Tasks in Table 7-1 lining up with sources of impairment listed in Table 6-1), please refer to Comment # 17 and its response in the General Comments Section just above. Additionally, for known sources of contamination, please refer to the expanded data and permit information in Section 4, and the greatly expanded information given related to sources in Sections 8.2 and 8.3 of the Final Report. Please note that the Table 7-1 and Table 6-1 that you refer to in the Draft Report, have been changed to Table 8-1 and Table 7-1 in the Final Report.

With regard to specific milestones to be achieved, as well as infrastructure and implementation activities in specific communities mentioned in paragraph #1 and paragraph 2 of this comment, please refer to the next five paragraphs below.

First, with regard to infrastructure and implementation activities, it should be pointed out that Section 8, Implementation, has been significantly updated and expanded in the Final Report submittal as compared to the original Draft Report. Specifically, considerable discussion has been added in Section 8, Subsections 8.1 and 8.2, on the vast amount of grant and infrastructure bacteria pollution control improvement activities and accomplishments that have been achieved to date in the immediate Boston Harbor watershed.

Subsection 8.1 discusses in detail recent water quality related activities of various active organizations in the Boston Harbor watershed who are concerned about pathogen pollution, including the Mystic River Watershed Association (MyRWA), Tufts University, the Massachusetts Bays Program (MassBays), Save the Harbor/Save the Bay, The Boston Harbor Association (TBHA), the Weir River Watershed Association (WRWA), and the Fore River Watershed Association (FRWA). This subsection also outlines numerous grant assessment and implementation projects that have been carried out under the Massachusetts Watershed Initiative, the 319 and 604b Grant programs, CZM Coastal Remediation Programs, as well as Division of Marine Fisheries Studies. Additionally, this section discusses significant bacteria pollution findings under the newly established DEP NERO Bacteria Source Tracking Program.

Section 8.2 in the Final Report covers infrastructure improvements such as fixing illicit sewer connections, failing infrastructure, SSOs and CSOs. Many organizations, along with at least several major programs, have been trying to address these problems, with considerable progress to date. The Massachusetts Department of Environmental Protection (MassDEP), U.S. Environmental Protection Agency (EPA), U.S. Geological Survey (USGS), Metropolitan District Commission (MDC), Massachusetts Department of Conservation and Recreation (DCR), Massachusetts Water Resources Authority (MWRA), Boston Water and Sewer Commission (BWSC), Mystic River Watershed Association (MyRWA), Save the Harbor/Save the Bay, have all been active in the identification, and mitigation of bacterial related pollution problems for many years. For instance, in the Mystic River and Alewife Brook watersheds, the Mystic River Watershed Association has for years conducted dry weather sampling of storm drains and outfalls, and has identified a number of illicit sanitary flows going into these drains, which go directly to receiving waters from the outfalls. The MassDEP has issued Notices of Noncompliance to the responsible communities within these watersheds, requiring them to create programs to identify the location of the illicit connections and to eliminate them.

Subsection 8.2 of the Final Report also discusses in great detail the problems associated with CSOs, SSOs, failing infrastructure, and illicit sewer connections. It outlines the history of increased control efforts with these problems, starting with the forming of the Massachusetts Water Resources Authority in 1982, as well as the beginning of the massive $5 Billion Boston Harbor Project, including the upgrading of the Deer Island WWTP. This project is now virtually complete, and it has already resulted in substantial improvement of water quality, including pathogens throughout the Harbor area. Along with this, the Boston Harbor Court Case No. 85-0489, resulted in the order to set up a CSO implementation and elimination plan. Section 8.2 details the whole story of its progress to the present, including several amendments to the original plan. This also includes bringing in a number of communities into this overall CSO Control Plan program,(e.g., Cambridge, City of Boston (through the BWSC), Brookline, Winthrop and Chelsea). Schedules, and details of accomplishments are fully explained in this section. Illiicit discharges are also discussed, with goals for developing Illicit Discharge Detection and Elimination (IDDE) programs, including EPA and MassDEP policies, and protocols, as well as suggested steps for municipalities to develop and activate effective control plans in this regard. Subsection 8.3 on Stormwater Runoff contains detailed updates of the implementation activities and accomplishments for each MS4 community included under the Phase II Stormwater Program. Additionally, Section 10, Reasonable Assurances, provides supportive information on financial resources and tools available for addressing pollution problems once these are identified in the communities.

In addition to then above specifics on implementation progress in Boston Harbor watershed, please refer to Comments # 19 and #20 and their responses in the General Comments Section just above. Please note that Section 7.0 that you refer to in the Draft Report has been changed to Section 8.0 in the Final Report.

With regard to the concern in the third paragraph of this particular comment, that more data should be gathered in certain areas, please refer to Section 9, 'Monitoring Plan', of the Final Report. This outlines suggestions for future monitoring efforts, and what the monitoring goals should be. The MassDEP depends on many other agencies and organizations besides itself for production of water quality data. Available data from various agencies and groups, utilized for this particular TMDL report has been expanded, and is outlined in Section 4, 'Problem Assessment', along with suggested links where additional data in the watershed can be accessed. In Section 8, 'Implementation', Table 8-1 outlines possible organizations besides MassDEP who could potentially gather data. Other parts of Section 8 suggest the need for additional monitoring following the incorporation of pollution reduction implementation BMPs in specific communities in the watershed. Also, the Department has engaged in the new bacteria Source Tracking Program in its NERO and SERO offices, which gathers bacteria data in areas where there have been documented bacteria related pollution problems.

12 Comment: p. 76, Section 7.6, last sentence, Please change this sentence to read "Massachusetts State Representative Bill Strauss has introduced legislation that would clearly define the role of harbormasters and other coastal police officers in enforcing NDZs and would allow them to collect up to $2000 for violations in NDZs."

Response: We have made that change in the Final Report. Please note that Section 7.6, 'Recreational Waters Use Management' in the Draft Report has been changed to Section 8.6 in the Final Report.

13. Comment: p. 77, Section 8, item 5, It isn't clear who is expected to collate the data collected throughout Boston Harbor and where the data would be stored. Is the Department expected to fill this role?

Response: Section 9 of the Final Report refers to MassDEP collecting data for Water Quality Assessment and related planning purposes (such as TMDL reports). MassDEP periodically monitors (on a five year rotating basis) the Waters of the Commonwealth. The MassDEP generated data will be stored in its own specifically developed and maintained data base. MassDEP does not anticipate fulfilling the role of gathering, and storing and maintaining data generated by other organizations and entities. Data outside of MassDEP are generally maintained by the particular organization that generates the data. Subject to the degree of QA/QC and QAPP followed with this outside data, MassDEP will access and utilize this data for various purposes.

14. Comment: p. 77, Section 9, After the sentence "Financial incentives include Federal monies available under the CWA Section 319 NPS program and the CWA Section 604 and 104b programs, which are provided as part of the Performance Partnership Agreement between MADEP and the EPA," CZM requests that the following be added: "State monies are also available through the Massachusetts Office of Coastal Zone Management's Coastal Pollutant Remediation, Coastal Nonpoint Source Pollution Control, and Coastal Monitoring grant programs. The primary goal of all three programs is to improve coastal water quality by reducing or eliminating nonpoint sources of pollution."

Response: We have added those two sentences to that paragraph in the Final Report. Please note that Section 9, Reasonable Assurances in the Draft Report has been changed to Section 10 in the Final Report, and that this section has been significantly expanded.

<u>CONSERVATION LAW FOUNDATION COMMENTS:</u>

1. Comment: A TMDL proposal must include a description of the point and nonpoint sources of the pollutant of concern, including the magnitude and description of the sources. This Draft (like all the other 14 Draft Pathogen reports) has identically the same core narrative sections, with only brief summaries of existing data in Section 4 of each report. This is DEP's statewide, "cookie- cutter" approach to Statewide Pathogen TMDLs. These reports should have specifics of pathogen impairment, including an inventory of contributing sources.

Response: See Comment #16 and its response in General Comments above. MassDEP has greatly expanded many sections in the Final Report. For instance, in Section 4, much recent data from MassDEP, MWRA, MyRWA, various communities, and other sources has been added, which gives much more perspective on actual principal pathogen pollution sources. Sections 5, 6, and particularly 8, have been expanded to give more specifics on point and nonpoint pathogen pollution sources. In section 6, pollution prioritization, based on water uses, for each segment has been added. In section 8, detailed information and analysis has been added on the principal pathogen pollution sources related to WWTPs, CSOs, SSOs, as well as MS4 programs in each community, and specifically what each community is doing to satisfy the "six points' required, particularly in regards to illicit connection controls. Also, Section 10, Reasonable Assurances, has been expanded to give a more comprehensive presentation of tools and resources available to communities and organizations for pollution reduction implementation programs. MassDEP is of the opinion that we have satisfied as much as possible what is required under 40CFR Section 130.7(c)(1)(i) in this regard.

2. Comment: MassDEP's Draft Pathogen Report is unconventional in that it simply sets an end-of-pipe limit equal to the water quality standard for bacteria (a concentration of so many organisms per 100mL for Class B waters), rather than actually calculating the allowable loading to a receiving water and the allocation of the allowable load to point sources, nonpoint sources and background, plus a margin of safety.

Response: See Comment #15 and its response in General Comments above. Also refer to Section 7 in the Final Report for the inclusion of loadings calculations, WLA and LA, for each impaired segment.

3. Comment: Perhaps if MassDEP insists on this sole unconventional end-of-pipe approach, rather than the allowable loadings calculations in the Final TMDL submittal to EPA, it should seriously consider another approach suggested by EPA, whereby controls to achieve water quality standards in certain water bodies are developed without TMDLs, namely the “4b Alternative”. In such instances, states may exclude certain water bodies from Category 5 (the 303(d) list), and instead list them in Category 4b, a use impairment caused by a pollutant that is being addressed by the state through other pollution control requirements for which no TMDL is required. If this course were chosen, DEP and EPA would have to make a binding agreement on commitments dealing with bacteria minimization plans to be adopted by all NPDES facilities, Phase I and II permits, annual water quality management plans in the pathogen- impaired segments, and a definitive implementation plan with a schedule to incorporate pollution controls necessary to attain water quality standards.

Response: Since Section 7 in the Final Report has WLA and LA loadings calculations for each impaired segment, MassDEP will continue on the path of utilizing the TMDL process, and will not be considering the utilization of the “4b Alternative” for pathogen controls in this particular watershed.

APPENDIX B

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

NOV 2 6 201 4

OFFICE OF WATER

MEMORANDUM
SUBJECT: Revisions to the November 22, 2002 Memorandum "Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) for Stormwater Sources and NPDES Permit Requirements Based on LAs"
FROM: Andrew D. Sawyers, Director
Office of Wastewater Management
Benita Best-Wong, Director
Office of Wetlands, Oceans and Water
TO: Water Division Directors
Regions 1 - 10

This memorandum updates aspects of EPA's November 22, 2002 memorandum from Robert H. Wayland, III, Director of the Office of Wetlands, Oceans and Watersheds, and James A. Hanlon, Director of the Office of Wastewater Management, on the subject of "Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) for Stormwater Sources and NPDES Permit Requirements Based on Those WLAs" (hereafter "2002 memorandum' '). Today's memorandum replaces the November 12, 2010, memorandum on the same subject; the Water Division Directors should no longer refer to that memorandum for guidance. This memorandum is guidance. It is not a regulation and does not impose legally binding requirements on EPA or States. EPA and state regulatory authorities should continue to make permitting and TMDL decisions on a case-by-case basis considering the particular facts and circumstances and consistent with applicable statutes, regulations, and case law. The recommendations in this guidance may not be applicable to a particular situation. EPA may change or revoke this guidance at any time.

Background

Stormwater discharges are a significant contributor to water quality impairment in this country, and the challenges from these discharges are growing as more land is developed and more impervious surface is created. Stormwater discharges cause beach closures and contaminate shellfish and surface drinking water supplies. The increased volume and velocity of stormwater discharges causes streambank erosion, flooding, sewer overflows, and basement backups. The decreased natural infiltration of rainwater reduces groundwater recharge, depleting our underground sources of drinking water.[1] There are stormwater management solutions, such as green infrastructure, that can protect our waterbodies from stormwater discharges and, at the same time, offer many other benefits to communities.

Section III of the 2002 memorandum recommended that for NPDES-regulated municipal and small construction stormwater discharges, effluent limits be expressed as best management practices (BMPs) or other similar requirements, rather than as numeric effluent limits. The 2002 memorandum went on to provide guidance on using "an iterative, adaptive management BMP approach" for improving stormwater management over time as permitting agencies, the regulated community, and other involved stakeholders gain more experience and knowledge. EPA continues to support use of an iterative approach, but with greater emphasis on clear, specific, and measurable permit requirements and, where feasible, numeric NPDES permit provisions, as discussed below.

Since 2002, States and EPA have obtained considerable experience in developing TMDLs and WLAs that address stormwater sources (see Box 1 in the attachment for specific examples). Monitoring of the impacts of stormwater discharges on water quality has become more sophisticated and widespread.[2] The experience gained during this time has provided better information on the effectiveness of stormwater controls to reduce pollutant loadings and address water quality impairments. In many parts of the country, permitting agencies have issued several rounds of stormwater permits. Notwithstanding these developments, stormwater discharges remain a significant cause of water quality impairment in many places, highlighting a continuing

---

[1] See generally Urban Stormwater Management in the United States (National Research Council, 2009), particularly the discussion in Chapter 3, Hydrologic, Geomorphic, and Biological Effects of Urbanization on Watersheds.

[2] Stormwater discharge monitoring programs have expanded the types pollutants and other indices (e.g., biologic integrity) being evaluated. This information is being used to help target priority areas for cleanup and to assess the effectiveness of stormwater BMPs. There are a number of noteworthy monitoring programs that are ongoing, including for example those being carried out by Duluth, MN, Capitol Region Watershed District, MN, Honolulu, HI, Baltimore or Montgomery County, MD, Puget Sound, WA, Los Angeles County, CA, and the Alabama Dept. of Transportation, among many others. See also Section 4.2 (Monitoring/Modeling Requirements) of EPA's Municipal Separate Storm Sewer System Permits: Post-Construction Performance Standards & Water Quality-Based Requirements – A Compendium of Permitting Approaches (EPA, June 2014), or "MS4 Compendium" available at http://water.epa.gov/polwaste/npdes/stormwater/upload/sw_ms4_compendium.pdf, for other examples of note.

need for more meaningful WLAs and more clear, specific, and measurable NPDES permit provisions to help restore impaired waters to their beneficial uses.

With this additional experience in mind, on November 12, 2010, EPA issued a memorandum updating and revising elements of the 2002 memorandum to better reflect current practices and trends in permits and WLAs for stormwater discharges. On March 17, 2011, EPA sought public comment on the November 2010 memorandum and, earlier this year, completed a nationwide review of current practices used in MS4 permits[1] and industrial and construction stormwater discharge permits. As a result of comments received and informed by the reviews of EPA and state-issued stormwater permits, EPA is in this memorandum replacing the November 2010 memorandum, updating aspects of the 2002 memorandum and providing additional information in the following areas:

- Including clear, specific, and measurable permit requirements and, where feasible, numeric effluent limitations in NPDES permits for stormwater discharges;
- Disaggregating stormwater sources in a WLA; and
- Designating additional stormwater sources to regulate and developing permit limits for such sources.

Including Clear, Specific, and Measurable Permit Requirements and, Where Feasible, Numeric Effluent Limitations in NPDES Permits for Stormwater Discharges

At the outset of both the Phase I and Phase II stormwater permit programs, EPA provided guidance on the type of water quality-based effluent limits (WQBELs) that were considered most appropriate for stormwater permits. See Interim Permitting Policy for Water Quality-Based Limitations in Stormwater Permits [61 FR 43761 (August 26, 1996) and 61 FR 57425 (November 6, 1996)] and the Phase II rulemaking preamble 64 FR 68753 (December 8, 1999). Under the approach discussed in these documents, EPA envisioned that in the first two to three rounds of permit issuance, stormwater permits typically would require implementation of increasingly more effective best management practices (BMPs). In subsequent stormwater permit terms, if the BMPs used during prior years were shown to be inadequate to meet the requirements of the Clean Water Act (CWA), including attainment of applicable water quality standards, the permit would need to contain more specific conditions or limitations.

There are many ways to include more effective WQBELs in permits. In the spring of 2014, EPA published the results of a nationwide review of current practices used in MS4 permits in Municipal Separate Storm Sewer Systems Permits: Post-Construction Performance Standards & Water Quality-Based Requirements – A Compendium of Permitting Approaches (June 2014). This MS4 Compendium demonstrates how NPDES authorities have been able to effectively

---

[1] See EPA's MS4 Permit Compendium, referenced in the above footnote.

establish permit requirements that are more specifically tied to a measurable water quality target, and includes examples of permit requirements expressed in both numeric and non-numeric form. These approaches, while appropriately permit-specific, each share the attribute of being expressed in a clear, specific, and measurable way. For example, EPA found a number of permits that employ numeric, retention-based performance standards for post-construction discharges, as well as instances where permits have effectively incorporated numeric effluent limits or other quantifiable measures to address water quality impairment (see the attachment to this memorandum).

EPA has also found examples where the applicable WLAs have been translated into BMPs, which are required to be implemented during the permit term to reflect reasonable further progress towards meeting the applicable water quality standard (WQS). Incorporating greater specificity and clarity echoes the approach first advanced by EPA in the 1996 Interim Permitting Policy, which anticipated that where necessary to address water quality concerns, permits would be modified in subsequent terms to include "more specific conditions or limitations [which] may include an integrated suite of BMPs, performance objectives, narrative standards, monitoring triggers, numeric WQBELs, action levels, etc."

EPA also recently completed a review of state-issued NPDES industrial and construction permits, which also revealed a number of examples where WQBELs are expressed using clear, specific, and measurable terms. Permits are exhibiting a number of different approaches, not unlike the types of provisions shown in the MS4 Compendium. For example, some permits are requiring as an effluent limitation compliance with a numeric or narrative WQS, while others require the implementation of specific BMPs that reduce the discharge of the pollutant of concern as necessary to meet applicable WQS or to implement a WLA and/or are requiring their permittees to conduct stormwater monitoring to ensure the effectiveness of those BMPs. EPA intends to publish a compendium of permitting approaches in state-issued industrial and construction stormwater permits in early 2015.

Permits for MS4 Discharges

The CWA provides that stormwater permits for MS4 discharges "shall require controls to reduce the discharge of pollutants to the maximum extent practicable … and such other provisions as the Administrator or the State determines appropriate for the control of such pollutants." CWA section 402(p)(3)(B)(iii). Under this provision, the NPDES permitting authority has the discretion to include requirements for reducing pollutants in stormwater discharges as necessary for compliance with water quality standards. Defenders of Wildlife v. Browner, 191 F.3d 1159, 1166 (9th Cir. 1999).

The 2002 memorandum stated "EPA expects that most WQBELs for NPDES-regulated municipal and small construction stormwater discharges will be in the form of BMPs, and that numeric limitations will be used only in rare instances." As demonstrated in the MS4 Compendium, NPDES permitting authorities are using various forms of clear, specific, and measurable requirements, and, where feasible, numeric effluent limitations in order to establish a more objective and accountable means for reducing pollutant discharges that contribute to water quality problems.[1] Where the NPDES authority determines that MS4 discharges have the reasonable potential to cause or contribute to a water quality standard excursion, EPA recommends that the NPDES permitting authority exercise its discretion to include clear, specific, and measurable permit requirements and, where feasible, numeric effluent limitations[2] as necessary to meet water quality standards.

NPDES authorities have significant flexibility in how they express WQBELs in MS4 permits (see examples in Box 1 of the attachment). WQBELs in MS4 permits can be expressed as system-wide requirements rather than as individual discharge location requirements such as effluent limitations on discharges from individual outfalls. Moreover, the inclusion of numeric limitations in an MS4 permit does not, by itself, mandate the type of controls that a permittee will use to meet the limitation.

EPA recommends that NPDES permitting authorities establish clear, specific, and measurable permit requirements to implement the minimum control measures in MS4 permits.

With respect to requirements for post-construction stormwater management, consistent with guidance in the 1999 Phase II Rule, EPA recommends, where feasible and appropriate, numeric

---

[1] The MS4 Compendium presents examples of different permitting approaches that EPA has found during a nationwide review of state MS4 permits. Examples of different WQBEL approaches in the MS4 Compendium include permits that have (1) a list of applicable TMDLs, WLAs, and the affected MS4s; (2) numeric limits and other quantifiable approaches for specific pollutants of concern; (3) requirements to implement specific stormwater controls or management measures to meet the applicable WLA; (4) permitting authority review and approval of TMDL plans; (5) specific impaired waters monitoring and modeling requirements; and (6) requirements for discharges to impaired waters prior to TMDL approval.

[2] For the purpose of this memorandum, and in the context of NPDES permits for stormwater discharges, "numeric" effluent limitations refer to limitations with a quantifiable or measurable parameter related to a pollutant (or pollutants). Numeric WQBELs may include other types of numeric limits in addition to end-of-pipe limits. Numeric WQBELs may include, among others, limits on pollutant discharges by specifying parameters such as on-site stormwater retention volume or percentage or amount of effective impervious cover, as well as the more traditional pollutant concentration limits and pollutant loads in the discharge.

requirements that attempt to maintain pre-development runoff conditions (40 CFR § 122.34(b)(5)) be incorporated into MS4 permits. EPA's MS4 Compendium features examples from 17 states and the District of Columbia that have already implemented retention performance standards for newly developed and redeveloped sites. See Box 2 of the attachment for examples.

Permits for Industrial Stormwater Discharges

The CWA requires that permits for stormwater discharges associated with industrial activity comply with section 301 of the Act, including the requirement under section 301(b)(1)(C) to contain WQBELs to achieve water quality standards for any discharge that the permitting authority determines has the reasonable potential to cause or contribute to a water quality standard excursion. CWA section 402(p)(3)(A), 40 CFR § 122.44(d)(1)(iii). When the permitting authority determines, using the procedures specified at 40 CFR § 122.44(d)(1)(ii), that the discharge causes or has the reasonable potential to cause or contribute to an in-stream excursion of the water quality standards, the permit must contain WQBELs as stringent as necessary to meet any applicable water quality standard for that pollutant. EPA recommends that NPDES permitting authorities use the experience gained in developing WQBELs to design effective permit conditions to create objective and accountable means for controlling stormwater discharges. See box 3 in the attachment for examples.

Permits should contain clear, specific, and measurable elements associated with BMP implementation (e.g., schedule for BMP installation, frequency of a practice, or level of BMP performance), as appropriate, and should be supported by documentation that implementation of selected BMPs will result in achievement of water quality standards. Permitting authorities should also consider including numeric benchmarks for BMPs and associated monitoring protocols for estimating BMP effectiveness in stormwater permits. Benchmarks can support an adaptive approach to meeting applicable water quality standards. While exceeding the benchmark is not generally a permit violation, exceeding the benchmark would typically require the permittee to take additional action, such as evaluating the effectiveness of the BMPs, implementing and/or modifying BMPs, or providing additional measures to protect water quality.[1] Permitting authorities should consider structuring the permit to clarify that failure to implement required corrective action, including a corrective action for exceeding a benchmark, is

---

[1] For example, Part 6.2.1 of EPA's 2008 MSGP provides: "This permit stipulates pollutant benchmark concentrations that may be applicable to your discharge. The benchmark concentrations are not effluent limitations; a benchmark exceedance, therefore, is not a permit violation. Benchmark monitoring data are primarily for your use to determine the overall effectiveness of your control measures and to assist you in knowing when additional corrective action(s) may be necessary to comply with the effluent limitations …"

a permit violation. EPA notes that, as many stormwater discharges are authorized under a general permit, NPDES authorities may find it more appropriate where resources allow to issue individual permits that are better tailored to meeting water quality standards for large industrial stormwater discharges with more complex stormwater management features, such as multiple outfalls and multiple entities responsible for permit compliance.

All Permitted Stormwater Discharges

As stated in the 2002 memorandum, where a State or EPA has established a TMDL, NPDES permits must contain effluent limits and conditions consistent with the assumptions and requirements of the WLAs in the TMDL. See 40 CFR § 122.44(d)(1)(vii)(B). Where the TMDL includes WLAs for stormwater sources that provide numeric pollutant loads, the WLA should, where feasible, be translated into effective, measurable WQBELs that will achieve this objective. This could take the form of a numeric limit, or of a measurable, objective BMP-based limit that is projected to achieve the WLA. For MS4 discharges, CWA section 402(p)(3)(B)(iii) provides flexibility for NPDES authorities to set appropriate deadlines for meeting WQBELs consistent with the requirements for compliance schedules in NPDES permits set forth in 40 CFR § 122.47.

The permitting authority's decision as to how to express the WQBEL(s), either as numeric effluent limitations or as BMPs, with clear, specific, and measurable elements, should be based on an analysis of the specific facts and circumstances surrounding the permit, and/or the underlying WLA, including the nature of the stormwater discharge, available data, modeling results, and other relevant information. As discussed in the 2002 memorandum, the permit's administrative record needs to provide an adequate demonstration that, where a BMP-based approach to permit limitations is selected, the BMPs required by the permit will be sufficient to implement applicable WLAs. Permits should also include milestones or other mechanisms where needed to ensure that the progress of implementing BMPs can be tracked. Improved knowledge of BMP effectiveness gained since 2002[1] should be reflected in the demonstration and supporting rationale that implementation of the BMPs will attain water quality standards and be consistent with WLAs.

EPA's regulations at 40 CFR § 122.47 govern the use of compliance schedules in NPDES permits. Central among the requirements is that the effluent limitation(s) must be met "as soon as possible." 40 CFR § 122.47(a)(1). As previously discussed, by providing discretion

---

[1] See compilation of current BMP databases and summary reports available at http://water.epa.gov/infrastructure/greeninfrastructure/gi_performance.cfm, which has compiled current BMP databases and summary reports.

to include "such other provisions" as deemed appropriate, CWA section 402(p)(3)(B)(iii) provides flexibility for NPDES authorities to set appropriate deadlines towards meeting WQBELs in MS4 permits consistent with the requirements for compliance schedules in NPDES permits set forth in 40 CFR § 122.47. See Defenders of Wildlife v Browner, 191 F.3d at 1166. EPA expects the permitting authority to document in the permit record the basis for determining that the compliance schedule is "appropriate" and consistent with the CWA and 40 CFR § 122.47. Where a TMDL has been established and there is an accompanying implementation plan that provides a schedule for an MS4 to implement the TMDL, or where a comprehensive, integrated plan addressing a municipal government's wastewater and stormwater obligations under the NPDES program has been developed, the permitting authority should consider such schedules as it decides whether and how to establish enforceable interim requirements and interim dates in the permit.

EPA notes that many permitted stormwater discharges are covered by general permits. Permitting authorities should consider and build into general permits requirements to ensure that permittees take actions necessary to meet the WLAs in approved TMDLs and address impaired waters. A general permit can, for example, identify permittees subject to applicable TMDLs in an appendix, and prescribe the activities that are required to meet an applicable WLA.

Lastly, NPDES permits must specify monitoring requirements necessary to determine compliance with effluent limitations. See CWA section 402(a)(2); 40 CFR 122.44(i). The permit could specify actions that the permittee must take if the BMPs are not performing properly or meeting expected load reductions. When developing monitoring requirements, the NPDES authority should consider the variable nature of stormwater as well as the availability of reliable and applicable field data describing the treatment efficiencies of the BMPs required and supporting modeling analysis.

Disaggregating Stormwater Sources in a WLA

In the 2002 memorandum, EPA said it "may be reasonable to express allocations for NPDES-regulated stormwater discharges from multiple point sources as a single categorical wasteload allocation when data and information are insufficient to assign each source or outfall individual WLAs." EPA also said that, "[i]n cases where wasteload allocations are developed for categories of discharges, these categories should be defined as narrowly as available information allows." Furthermore, EPA said it "recognizes that the available data and information usually are not detailed enough to determine waste load allocations for NPDES-regulated stormwater discharges on an outfall-specific basis."

EPA still recognizes that "[d]ecisions about allocations of pollutant loads within a TMDL are driven by the quantity and quality of existing and readily available water quality data," but has noted the difficulty of establishing clear, specific, and measurable NPDES permit limitations for sources covered by WLAs that are expressed as single categorical or aggregated wasteload allocations. Today, TMDL writers may have more information—such as more ambient monitoring data, better spatial and temporal representation of stormwater sources, and/or more permit-generated data—than they did in 2002 to develop more disaggregated TMDL WLAs.

Accordingly, for all these reasons, EPA is again recommending that, “when information allows,” WLAs for NPDES-regulated stormwater discharges be expressed “as different WLAs for different identifiable categories” (e.g., separate WLAs for MS4 and industrial stormwater discharges). In addition, as EPA said in 2002, “[t]hese categories should be defined as narrowly as available information allows (e.g., for municipalities, separate WLAs for each municipality and for industrial sources, separate WLAs for different types of industrial stormwater sources or dischargers).” EPA does not expect states to assign WLAs to individual MS4 outfalls; however, some states may choose to do so to support their implementation efforts. These recommendations are consistent with the decision in Anacostia Riverkeeper, Inc. v. Jackson, 2011 U.S. Dist. Lexis 80316 (July 25, 2011).

In general, states are encouraged to disaggregate the WLA when circumstances allow to facilitate implementation. TMDL writers may want to consult with permit writers and local authorities to collect additional information such as sewer locations, MS4 jurisdictional boundaries, land use and growth projections, and locations of stormwater controls and infrastructure, to facilitate disaggregation. TMDLs have used different approaches to disaggregate stormwater to facilitate MS4 permit development that is consistent with the assumptions and requirements of the WLA. For example, some TMDLs have used a geographic approach and developed individual WLAs by subwatershed[1] or MS4 boundary (i.e., the WLA is subdivided by the relative estimated load contribution to the subwatershed or the area served by the MS4). TMDLs have also assigned percent reductions[2] of the loading based on the estimated wasteload contribution from each MS4 permit holder. Where appropriate, EPA encourages permit writers to identify specific shares of an applicable wasteload allocation for specific permittees during the permitting process, as permit writers may have more detailed information than TMDL writers to effectively identify reductions for

---

[1] Wissahickon Creek Siltation TMDL (Pennsylvania) www.epa.gov/reg3wapd/tmdl/pa_tmdl/wissahickon/index.htm.

[2] Liberty Bay Watershed Fecal Coliform Bacteria TMDL (Washington). https://fortress.wa.gov/ecy/publications/SummaryPages/1310014.html and Upper Minnehaha Creek Watershed Nutrients and Bacteria TMDL (Minnesota) http://www.pca.state.mn.us/index.php/view-document.html?gid=20792

specific sources.

Designating Additional Stormwater Sources to Regulate and Developing Permit Limits for Such Sources

The 2002 memorandum states that "stormwater discharges from sources that are not currently subject to NPDES regulation may be addressed by the load allocation component of a TMDL." Section 402(p)(2) of the Clean Water Act (CWA) requires industrial stormwater sources, certain municipal separate storm sewer systems, and other designated sources to be subject to NPDES permits. Section 402(p)(6) provides EPA with authority to identify additional stormwater discharges as needing a permit.

In addition to the stormwater discharges specifically identified as needing an NPDES permit, the CWA and the NPDES regulations allow for EPA and NPDES authorized States to designate additional stormwater discharges for regulation. See:
40 CFR §§122.26 (a)(9)(i)(C), (a)(9)(i)(D), (b)(4)(iii), (b)(7)(iii), (b)(15)(ii) and 122.32(a)(2). Accordingly, EPA encourages permitting authorities to consider designation of stormwater sources in situations where coverage under NPDES permits would, in the reasonable judgment of the permitting authority and, considering the facts and circumstances in the waterbody, provide the most appropriate mechanism for implementing the pollution controls needed within a watershed to attain and maintain applicable water quality standards.

If a TMDL had previously included a newly permitted source as part of a single aggregated or gross load allocation for all unregulated stormwater sources, or all unregulated sources in a specific category, the NPDES permit authority could identify an appropriate allocation share and include a corresponding limitation specific to the newly permitted stormwater source. EPA recommends that any additional analysis used to identify that share and develop the corresponding limit be included in the administrative record for the permit. The permit writer's additional analysis would not change the TMDL, including its overall loading cap.

In situations where a stormwater source addressed in a TMDL's load allocation is not currently regulated by an NPDES permit but may be required to obtain an NPDES permit in the future, the TMDL writer should consider including language in the TMDL explaining that the allocation for the stormwater source is expressed in the TMDL as a "load allocation" contingent on the source remaining unpermitted, but that the "load allocation" would later be deemed a "wasteload allocation" if the stormwater discharge from the source were required to obtain NPDES permit coverage. Such language would help ensure that the allocation is properly characterized by the permit writer should the source's regulatory status change. This will help the permit writer develop limitations for the NPDES permit applicable to the newly permitted source that are consistent with the assumptions and requirements of the TMDL's allocation to that source.

If you have any questions please feel free to contact us or Deborah Nagle, Director of the Water Permits Division, or Tom Wall, Director of the Assessment and Watershed Protection Division.

cc: Association of Clean Water Administrators
TMDL Program Branch Chiefs, Regions 1 – 10
NPDES Permits Branch Chiefs, Regions 1 – 10

Attachment: MS4 and Industrial Stormwater Permit Examples

ATTACHMENT: MS4 and Industrial Stormwater Permit Examples

BOX 1. Examples of WQBELs in MS4 Permits:

1. Numeric expression of the WQBEL: The MS4 Permit includes a specific, quantifiable performance requirement that must be achieved within a set timeframe. For example: - Reduce fine sediment particles, total phosphorus, and total nitrogen loads by 10 percent, 7 percent, and 8 percent, respectively, by September 30, 2016 (2011 Lake Tahoe, CA MS4 permit) Restore within the 5-year permit term 20 percent of the previously developed impervious land (2014 Prince George's County, MD MS4 permit) - Achieve a minimum net annual planting rate of 4,150 planting annually within the MS4 area, with the objective of an MS4-wide urban tree canopy of 40 percent by 2035 (2011 Washington, DC MS4 permit) - Discharges from the MS4 must not cause or contribute to exceedances of receiving water limits for Diazinon of 0.08μg/L for acute exposure (1 hr averaging period) or 0.05μg/L for chronic exposure (4-day averaging period), OR must not exceed Diazinon discharge limits of 0.072 μg/L for acute exposure or 0.045μg/L for chronic exposure (2013 San Diego, CA Regional MS4 permit)

2. Non-numeric expressions of the WQBEL: The MS4 Permit establishes individualized, watershed-based requirements that require each affected MS4 to implement specific BMPs within the permit term, which will ensure reasonable further progress towards meeting applicable water quality standards. - To implement the corrective action recommendations of the Issaquah Creek Basin Water Cleanup Plan for Fecal Coliform Bacteria (part of the approved Fecal Coliform Bacteria TMDL for the Issaquah Creek Basin), King County is required during the permit term to install and maintain animal waste education and/or collection stations at municipal parks and other permittee owned and operated lands reasonably expected to have substantial domestic animal use and the potential for stormwater pollution. The County is also required to complete IDDE screening for bacteria sources in 50 percent of the MS4 subbasins, including rural MS4 subbasins, by February 2, 2017 and implement the activities identified in the Phase I permit for responding to any illicit discharges found (2013 Western Washington Small MS4 General Permit) - For discharges to Segment 14 of the Upper South Platte River Basin associated with WLAs from the approved *E. coli* TMDL, the MS4 must identify outfalls with dry weather flows; monitor priority outfalls for flow rates and *E. coli* densities; implement a system maintenance program for listed priority basins (which includes storm sewer cleaning and sanitary sewer investigations); install markers on at least 90% of storm drain inlets in areas with public access; and conduct a public outreach program focused on sources that contribute *E. coli* loads to the MS4. By November 30, 2018, dry weather discharges from MS4 outfalls of concern must not contribute to an exceedance of the *E. coli* standard (126 cfu per 100 ml for a geometric mean of all samples collected at a specific outfall in a 30-day period) (2009 Denver, CO MS4 Permit)

3. Hybrid approach with both numeric and non-numeric expressions of the WQBEL: - Discharges of trash from the MS4 to the LA River must be reduced to zero by Sept. 2016. Permittees also have the option of complying via the installation of defined "full capture systems" to prevent trash from entering the MS4 (2012 Los Angeles County, CA MS4 Permit). - To attain the shared, load allocation of 27,000 metric tons/year of sediment in the Napa River sediment TMDL, municipalities shall determine opportunities to retrofit and/or reconstruction of road crossings to minimize road-related sediment delivery (≤ 500 cubic yards/mile per 20-year period) to stream channels (2013 CA Small MS4 General Permit).

Box 2. Examples of Retention Post Construction Standards for New and Redevelopment in MS4 Permits - 2009 WV small MS4 permit: Keep and manage on site the first one inch of rainfall from a 24-hour storm preceded by 48 hours of no measurable precipitation.

- 2011 DC Phase I MS4 permit: Achieve on-site retention of 1.2" of stormwater from a 24-hour storm with a 72-hour antecedent dry period through evapotranspiration, infiltration and/or stormwater harvesting.
- 2012 Albuquerque, NM Phase I MS4 permit: Capture the 90th percentile storm event runoff to mimic the predevelopment hydrology of the previously undeveloped site.
- 2010 Anchorage, AK Phase I MS4 permit: Keep and manage the runoff generated from the first 0.52 inches of rainfall from a 24 hour event preceded by 48 hours of no measureable precipitation. - 2013 Western WA small MS4 permit: Implement low impact development performance standards to match developed discharge durations to pre-developed durations for the range of pre-developed discharge rates from 8% of the 2-year flow to 50% of the 2-year flow.

BOX 3. Examples of WQBELs in Industrial (including Construction) Stormwater Permits:

1. Numeric expression of the WQBEL: The permit includes a specific, quantifiable performance requirement that must be achieved:

- Pollutant concentrations shall not exceed the stormwater discharge limits specified in the permit (based on state WQS), including (for example): Cadmium-0.003 mg/l; Mercury-0.0024 mg/l; Selenium-0.02 mg/l (2013 Hawaii MSGP)
- Beginning July 1, 2010, permittees discharging to impaired waters without an EPA-approved TMDL shall comply with the following effluent limits (based on state WQS), including (for example):

Turbidity-25 NTU; TSS-30 mg/l; Mercury-0.0021 mg/l; Phosphorus, Ammonia, Lead, Copper, Zinc-site-specific limits to be determined at time of permit coverage (2010 Washington MSGP) - If discharging to waters on the 303(d) list (Category 5) impaired for turbidity, fine sediment, or phosphorus, the discharge must comply with the following effluent limit for turbidity: 25 NTU (at the point of discharge from the site), or no more than 5 NTU above background turbidity when the background turbidity is 50 NTU or less, or no more than a 10% increase in turbidity when background turbidity is more than 50 NTU. Discharges to waterbodies on the 303(d) list (Category 5) for high pH must comply with the numeric effluent limit of pH 6.5 to 8.5 su (2010 Washington CGP) (2010 Washington CGP)

2. Narrative expression of the WQBEL: The permit includes narrative effluent limits based on applicable WQS:

- New discharges or new dischargers to an impaired water are not eligible for permit coverage, unless documentation or data exists to show that (1) all exposure of the pollutant(s) of concern to stormwater is prevented; or (2) the pollutant(s) of concern are not present at the facility; or (3) the discharge of the pollutant(s) of concern will meet instream water quality criteria at the point of discharge (for waters without an EPA-approved TMDL), or there is sufficient remaining WLAs in an EPA-approved TMDL to allow the discharge and that existing dischargers are subject to compliance schedules to bring the waterbody into attainment with WQS (2011 Vermont MSGP; similar requirements in RI, NY, MD, VA, WV, SC, AR, TX, KS, NE, AZ, CA, AK, OR, and WA permits)

- In addition to other applicable WQBELs, there shall be no discharge that causes visible oil sheen, and no discharge of floating solids or persistent foam in other than trace amounts. Persistent foam is foam that does not dissipate within one half hour of point of discharge (2014 Maryland MSGP)

3. Requirement to implement additional practices or procedures for discharges to impaired waters:

- For sediment-impaired waters (without an approved TMDL), the permittee is required to maintain a minimum 50-foot buffer zone between any disturbance and all edges of the receiving water (2009 Kentucky CGP)
- For discharges to impaired waters, implement the following: (1) stabilization of all exposed soil areas immediately, but in no case later than 7 days after the construction activity in that portion of the site has temporarily or permanently ceased (as compared to 14 days for no-impaired waters); (2) temporary sediment basins must meet specified design standards if they will serve an area of 5 or more acres (as compared to 10 or more acres for other sites); (3) retain a water quality volume of 1 inch of runoff from the new impervious surfaces created by the project (though this volume reduction requirement is for discharges to all waters, not just impaired waters) (2013 Minnesota CGP).
- If the site discharges to a water impaired for sediment or turbidity, or to a water subject to an EPA-approved TMDL, the permittee must implement one or more of the following practices: (1) compost berms, compost blankets, or compost socks; (2) erosion control mats; (3) tackifiers used with a perimeter control BMP; (4) a natural buffer of 50 feet (horizontally) plus 25 feet (horizontally) for 5 degrees of slope; (5) water treatment by electro-coagulation, flocculation, or filtration; and/or (6) other substantially equivalent sediment or turbidity BMP approved by the state (2010 Oregon CGP)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460
OFFICE OF
WATER
MEMORANDUM

SUBJECT: Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) for Stormwater Sources and NPDES Permit Requirements Based on Those WLAs

FROM: Robert H. Wayland, III, Director
Office of Wetlands, Oceans and Watersheds
James A. Hanlon, Director
Office of Wastewater Management

TO: Water Division Directors
Regions 1 - 10

This memorandum clarifies existing EPA regulatory requirements for, and provides guidance on, establishing wasteload allocations (WLAs) for stormwater discharges in total maximum daily loads (TMDLs) approved or established by EPA. It also addresses the establishment of water quality-based effluent limits (WQBELs) and conditions in National Pollutant Discharge Elimination System (NPDES) permits based on the WLAs for stormwater discharges in TMDLs. The key points presented in this memorandum are as follows:

NPDES-regulated stormwater discharges must be addressed by the wasteload allocation component of a TMDL. See 40 C.F.R. § 130.2(h).

NPDES-regulated stormwater discharges may not be addressed by the load allocation (LA) component of a TMDL. See 40 C.F.R. § 130.2 (g) & (h).

Stormwater discharges from sources that are not currently subject to NPDES regulation may be addressed by the load allocation component of a TMDL. See 40 C.F.R. § 130.2(g).

It may be reasonable to express allocations for NPDES-regulated stormwater discharges from multiple point sources as a single categorical wasteload allocation when data and information are insufficient to assign each source or outfall individual WLAs. See 40 C.F.R. § 130.2(i). In cases where wasteload allocations are developed for categories of discharges, these categories should be defined as narrowly as available information allows.

The WLAs and LAs are to be expressed in numeric form in the TMDL. See 40 C.F.R. § 130.2(h) & (i). EPA expects TMDL authorities to make separate allocations to NPDES- regulated stormwater discharges (in the form of WLAs) and unregulated stormwater (in the form of LAs). EPA recognizes that these allocations might be fairly rudimentary because of data limitations and variability in the system.

NPDES permit conditions must be consistent with the assumptions and requirements of available WLAs. See 40 C.F.R. § 122.44(d)(1)(vii)(B).

WQBELs for NPDES-regulated stormwater 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). If BMPs alone adequately implement the WLAs, then additional controls are not necessary.

EPA expects that most WQBELs for NPDES-regulated municipal and small construction stormwater discharges will be in the form of BMPs, and that numeric limits will be used only in rare instances.

When a non-numeric water quality-based effluent limit is imposed, the permit's administrative record, including the fact sheet when one is required, needs to support that the BMPs are expected to be sufficient to implement the WLA in the TMDL. See 40 C.F.R. §§ 124.8, 124.9 & 124.18.

The NPDES permit must also specify the monitoring necessary to determine compliance with effluent limitations. See 40 C.F.R. § 122.44(i). Where effluent limits are specified as BMPs, the permit should also specify the monitoring necessary to assess if the expected load reductions attributed to BMP implementation are achieved (e.g., BMP performance data).

The permit should also provide a mechanism to make adjustments to the required BMPs as necessary to ensure their adequate performance.

This memorandum is organized as follows:

(I). Regulatory basis for including NPDES-regulated stormwater discharges in WLAs in TMDLs;

(II). Options for addressing stormwater in TMDLs; and

(III). Determining effluent limits in NPDES permits for stormwater discharges consistent with the WLA

I). Regulatory Basis for Including NPDES-regulated Stormwater Discharges in WLAs in TMDLs

As part of the 1987 amendments to the CWA, Congress added Section 402(p) to the Act to cover discharges composed entirely of stormwater. Section 402(p)(2) of the Act requires permit coverage for discharges associated with industrial activity and discharges from large and medium municipal separate storm sewer systems (MS4), i.e., systems serving a population over 250,000 or systems serving a population between 100,000 and 250,000, respectively. These discharges are referred to as Phase I MS4 discharges.

In addition, the Administrator was directed to study and issue regulations that designate additional stormwater discharges, other than those regulated under Phase I, to be regulated in order to protect water quality. EPA issued regulations on December 8, 1999 (64 FR 68722), expanding the NPDES stormwater program to include discharges from smaller MS4s (including all systems within "urbanized areas" and other systems serving populations less than 100,000) and stormwater discharges from construction sites that disturb one to five acres, with opportunities for area-specific exclusions. This program expansion is referred to as Phase II.

Section 402(p) also specifies the levels of control to be incorporated into NPDES stormwater permits depending on the source (industrial versus municipal stormwater). Permits for stormwater discharges associated with industrial activity are to require compliance with all applicable provisions of Sections 301 and 402 of the CWA, i.e., all technology-based and water quality-based requirements. See 33 U.S.C. §1342(p)(3)(A). Permits for discharges from MS4s, however, "shall require controls to reduce the discharge of pollutants to the maximum extent practicable ... and such other provisions as the Administrator or the State determines appropriate for the control of such pollutants." See 33 U.S.C. §1342(p)(3)(B)(iii).

Stormwater discharges that are regulated under Phase I or Phase II of the NPDES stormwater program are point sources that must be included in the WLA portion of a TMDL. See 40 C.F.R. § 130.2(h). Stormwater discharges that are not currently subject to Phase I or Phase II of the NPDES stormwater program are not required to obtain NPDES permits. 33 U.S.C. §1342(p)(1) & (p)(6). Therefore, for regulatory purposes, they are analogous to nonpoint sources and may be included in the LA portion of a TMDL. See 40 C.F.R. § 130.2(g).

(II). Options for Addressing Stormwater in TMDLs

Decisions about allocations of pollutant loads within a TMDL are driven by the quantity and quality of existing and readily available water quality data. The amount of stormwater data available for a TMDL varies from location to location. Nevertheless, EPA expects TMDL authorities will make separate aggregate allocations to NPDES-regulated stormwater discharges (in the form of WLAs) and unregulated stormwater (in the form of LAs). It may be reasonable to quantify the allocations through estimates or extrapolations, based either on knowledge of land use patterns and associated literature values for pollutant loadings or on actual, albeit limited, loading information. EPA recognizes that these allocations might be fairly rudimentary because of data limitations.

EPA also recognizes that the available data and information usually are not detailed enough to determine waste load allocations for NPDES-regulated stormwater discharges on an outfall-specific basis. In this situation, EPA recommends expressing the wasteload allocation in the TMDL as either a single number for all NPDES-regulated stormwater discharges, or when information allows, as different WLAs for different identifiable categories, e.g., municipal stormwater as distinguished from stormwater discharges from construction sites or municipal stormwater discharges from City A as distinguished from City B. These categories should be defined as narrowly as available information allows (e.g., for municipalities, separate WLAs for each municipality and for industrial sources, separate WLAs for different types of industrial stormwater sources or dischargers).

(III). Determining Effluent Limits in NPDES Permits for Stormwater Discharges Consistent with the WLA

Where a TMDL has been approved, NPDES permits must contain effluent limits and conditions consistent with the requirements and assumptions of the wasteload allocations in the TMDL. See 40 CFR § 122.44(d)(1)(vii)(B). Effluent limitations to control the discharge of pollutants generally are expressed in numerical form. However, in light of 33 U.S.C. §1342(p)(3)(B)(iii), EPA recommends that for NPDES-regulated municipal and small construction stormwater 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 Stormwater Permits, 61 FR 43761 (Aug. 26, 1996). The Interim Permitting Approach Policy recognizes the need for an iterative approach to control pollutants in stormwater 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.

EPA's policy recognizes that because stormwater 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 stormwater discharges. The variability in the system and minimal data generally available make it difficult to determine with precision or certainty actual and 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.

Under certain circumstances, BMPs are an appropriate form of effluent limits to control pollutants in stormwater. See 40 CFR § 122.44(k)(2) & (3). If it is determined that a BMP approach (including an iterative BMP approach) is appropriate to meet the stormwater component of the TMDL, EPA recommends that the TMDL reflect this.

EPA expects that the NPDES permitting authority will review the information provided by the TMDL, see 40 C.F.R. § 122.44(d)(1)(vii)(B), and determine whether the effluent limit is appropriately expressed using a BMP approach (including an iterative BMP approach) or a numeric limit. Where BMPs are used, EPA recommends that the permit provide a mechanism to require use of expanded or better-tailored BMPs when monitoring demonstrates they are necessary to implement the WLA and protect water quality.

Where the NPDES permitting authority allows for a choice of BMPs, a discussion of the BMP selection and assumptions needs to be included in the permit's administrative record, including the fact sheet when one is required. 40 C.F.R.§§ 124.8, 124.9 & 124.18. For general permits, this may be included in the stormwater pollution prevention plan required by the permit. See 40 C.F.R. § 122.28. Permitting authorities may require the permittee to provide supporting information, such as how the permittee designed its management plan to address the WLA(s). See 40 C.F.R. § 122.28. The NPDES permit must require the monitoring necessary to assure compliance with permit limitations, although the permitting authority has the discretion under EPA's regulations to decide the frequency of such monitoring. See 40 CFR § 122.44(i). EPA recommends that such permits require collecting data on the actual performance of the BMPs. These additional data may provide a basis for revised management measures. The monitoring data are likely to have other uses as well. For example, the monitoring data might indicate if it is necessary to adjust the BMPs. Any monitoring for stormwater required as part of the permit should be consistent with the state's overall assessment and monitoring strategy.

The policy outlined in this memorandum affirms the appropriateness of an iterative, adaptive management BMP approach, whereby permits include effluent limits (e.g., a combination of structural and non-structural BMPs) that address stormwater discharges, implement mechanisms to evaluate the performance of such controls, and make adjustments (i.e., more stringent controls or specific BMPs) as necessary to protect water quality. This approach is further supported by the recent report from the National Research Council (NRC), Assessing the TMDL Approach to Water Quality Management (National Academy Press, 2001). The NRC report recommends an approach that includes "adaptive implementation," i.e., "a cyclical process in which TMDL plans are periodically assessed for their achievement of water quality standards" ... and adjustments made as necessary. NRC Report at ES-5.

This memorandum discusses existing requirements of the Clean Water Act (CWA) and codified in the TMDL and NPDES implementing regulations. Those CWA provisions and regulations contain legally binding requirements. This document describes these requirements; it does not substitute for those provisions or regulations. The recommendations in this memorandum are not binding; indeed, there may be other approaches that would be appropriate in particular situations. When EPA makes a TMDL or permitting decision, it will make each decision on a case-by-case basis and will be guided by the applicable requirements of the CWA and implementing regulations, taking into account comments and information presented at that time by interested persons regarding the appropriateness of applying these recommendations to the particular situation. EPA may change this guidance in the future.

If you have any questions please feel free to contact us or Linda Boornazian, Director of the Water Permits Division or Charles Sutfin, Director of the Assessment and Watershed Protection Division.

cc:
Water Quality Branch Chiefs
Regions 1 - 10
Permit Branch Chiefs
Regions 1 - 10