Exhibit 16
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MERRIMACK RIVER WATERSHED
2004 WATER QUALITY ASSESSMENT REPORT

COMMONWEALTH OF MASSACHUSETTS
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MERRIMACK RIVER WATERSHED

2004-2009 WATER QUALITY ASSESSMENT REPORT

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Massachusetts Department of Environmental Protection
Division of Watershed Management
Worcester, Massachusetts

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United States Environmental Protection Agency (EPA)
United States Geological Survey (USGS)
- Water Resources Division (WRS)

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CDM

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ATTACHED DATA CD – COMPENDIUM OF MASSDEP DWM MERRIMACK RIVER TECHNICAL MEMORANDUMS AND REPORTS

Merrimack River Watershed 2004 Water Quality Assessment Report
Technical Memorandum TM-84-5 Merrimack River Watershed 2004 Water Quality
Technical Memorandum TM-84-6 Merrimack River Watershed 2004 Benthic Macroinvertebrate Assessment
Technical Memorandum 84-7 2004 Merrimack River Watershed Fish Population Assessment
Technical Memorandum 84-7 2004 Merrimack and French & Quinebaug Periphyton Study - Stream Velocity and Canopy Cover Considerations
Technical Memorandum TM S-16 Baseline Lake Survey 2003 Technical Memorandum (Excerpt)

***Segments not included in the report due to insufficient data to assess any of the uses.**
Beaver Brook (MA84B-05)
Beaver Brook (MA84B-02)
Stony Brook (MA84B-03)
Powwow River (MA84A-28)
Bailey Pond (MA84003)
Mill Pond (MA84038)
Mill Pond (MA84081)
Mill Pond (MA84039)
Uptons Pond (MA84075)
Ward Pond (MA84096)

List of Acronyms and Abbreviations

surface water quality standards	SWQS	Safe Drinking Water Act	SDWA
Waterbody System	WBS	New England Interstate Water Pollution Control Commission	NEIWPCC
Assessment Database	ADB	Massachusetts Department of Public Health	MA DPH
National Hydrography Dataset	NHD	rapid bioassessment protocol	RBP
Clean Water Act	CWA	Massachusetts Department of Fish and Game	MA DFG
U.S. Environmental Protection Agency	EPA	milligrams per liter	mg/L
Massachusetts Department of Environmental Protection	MassDEP	micrograms per liter	ug/L
total maximum daily load	TMDL	milliliter	ml
Division of Watershed Management	DWM	Massachusetts Division of Marine Fisheries	MA DMF
combined sewer overflows	CSO	sanitary sewer overflow	SSO
dissolved oxygen	DO	National Pollutant Discharge Elimination System	NPDES
colony forming units	CFU	water pollution control facility	WPCF
MassDEP Drinking Water Program	DWP	Merrimack River Watershed Assoc.	MRWA

EXECUTIVE SUMMARY

MERRIMACK RIVER WATERSHED 2003 WATER QUALITY ASSESSMENT REPORT

The Massachusetts Surface Water Quality Standards (SWQS) designate the most sensitive uses for which surface waters in the state shall be protected. The assessment of current water quality conditions is a key step in the successful implementation of the Watershed Approach. This critical phase provides an assessment of whether or not the designated uses are supported or impaired, or not assessed, as well as basic information needed to focus resource protection and remediation activities later in the watershed management planning process.

This report presents a summary of current water quality data/information in the Merrimack River watershed used to assess the status of the designated uses as defined in the SWQS. The designated uses, where applicable, include: *Aquatic Life, Fish Consumption, Drinking Water, Primary and Secondary Contact Recreation and Aesthetics*. Each use, within a given assessment segment, is individually assessed as ***support*** or ***impaired***. When too little current data/information exists or no reliable data are available for an assessment segment the use is ***not assessed***. However, if there is some indication of water quality impairment, which is not "naturally-occurring", the use is identified with an "Alert Status". Some rivers and lakes do not have an assigned assessment segment identification number and the status of their designated uses has never been assessed, investigated, and/or reported to the EPA in the Commonwealth's Summary of Water Quality Report (305(b) Report) nor is information on these waters maintained in the Assessment Database (ADB). In the interest of reporting on all river miles and lake acres in the Merrimack River watershed, any waters not currently assigned an assessment segment identification number are classified as ***not assessed other waters***.

The summary of the assessments for the *Aquatic Life, Fish Consumption, Shellfishing, Primary and Secondary Contact Recreation and Aesthetics* uses in the Merrimack River watershed segments are illustrated in Figures 1 through 6, respectively. The percentage of total river miles, lake acreage and estuarine area classified as impaired, support, and not assessed for each designated use are provided in Table 1.

Table 1. Percentage of total river miles (391 miles), lake acreage (5734 acres) and estuarine area (6.7 square miles) in the Merrimack River basin assessed as support, impaired, or not assessed for each use. (National Hydrography Dataset (NHD) 1:24,000 is the source for the total river miles and lake acreage calculations)

	River			Lakes			Estuaries		
Use	**Support**	**Impaired**	**Not Assessed[1]**	**Support**	**Impaired**	**Not Assessed[1]**	**Support**	**Impaired**	**Not Assessed**
Aquatic Life	15.5%	3.3%	81.2%	0.0%	21.1%	78.9%	94.0%	0.0%	6.0%
Fish Consumption	0.0%	6.6%	93.4%	0.0%	53.9%	46.1%	0.0%	0.0%	100%
Shellfishing	Not Applicable						0.0%	72.0%	28.0%
Drinking Water	Not Assessed in this Report[2]						Not Applicable		
Primary Contact	6.3%	20.8%	72.9%	0.0%	0.0%	100%	0.0%	95.5%	4.5%
Secondary Contact	17.1%	10.0%	72.9%	0.0%	0.0%	100%	68.6%	26.9%	4.5%
Aesthetics	19.3%	2.5%	78.4%	0.0%	0.0%	100%	0.04%	0.0%	99.96%

1 - Not Assessed includes river or lakes not assigned assessment segments or not assessed other waters.
2 - While this use is not assessed in this report, information on drinking water source protection and finish water quality is available at http://www.mass.gov/dep/water/drinking.htm and from local public water suppliers.

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Figure 1. *Aquatic Life Use* assessment summary for rivers, estuarine, and lake segments in the Merrimack River watershed

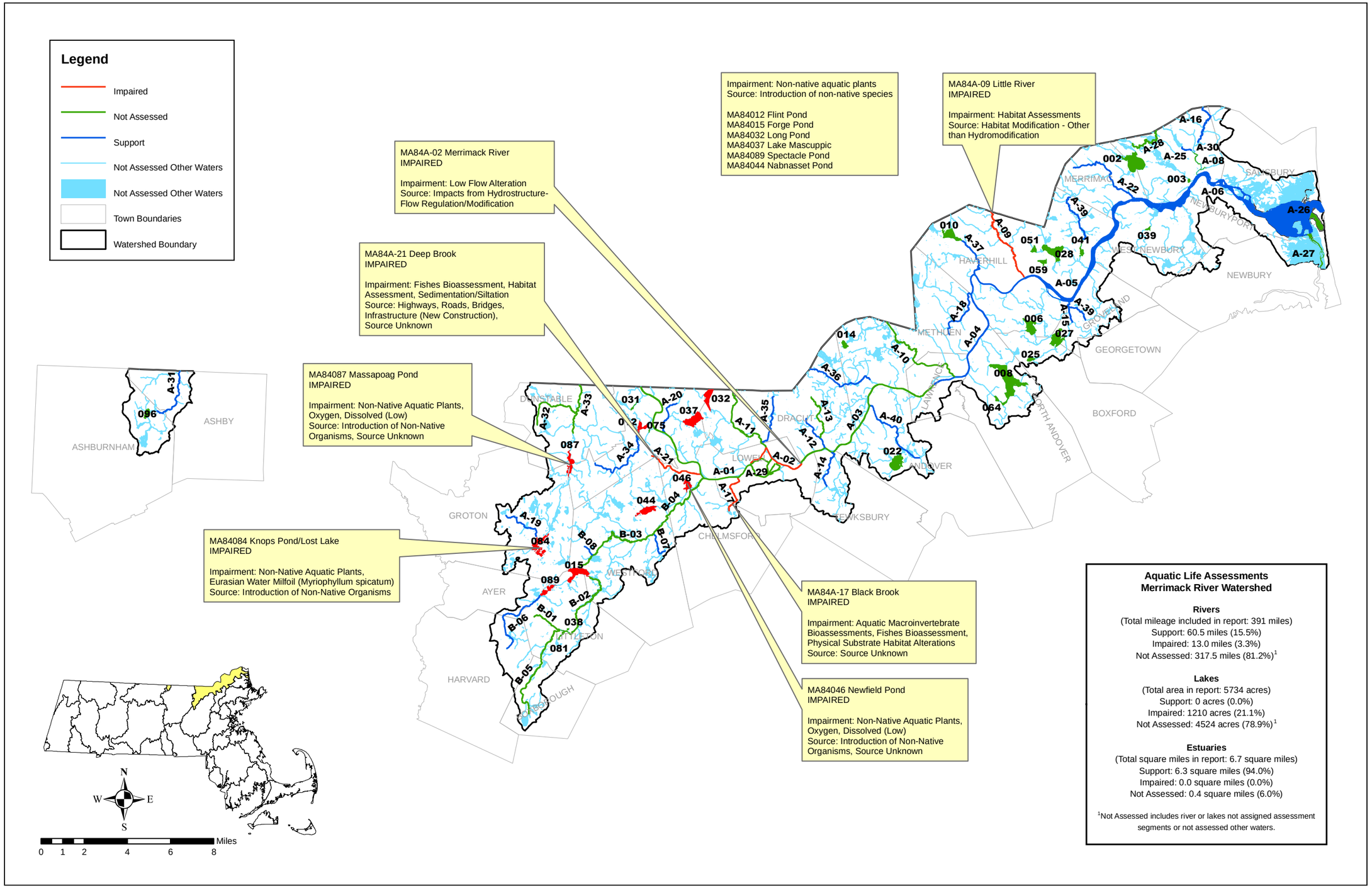

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Figure 2. *Fish Consumption Use* assessment summary for rivers, estuarine, and lake segments in the Merrimack River watershed

Legend

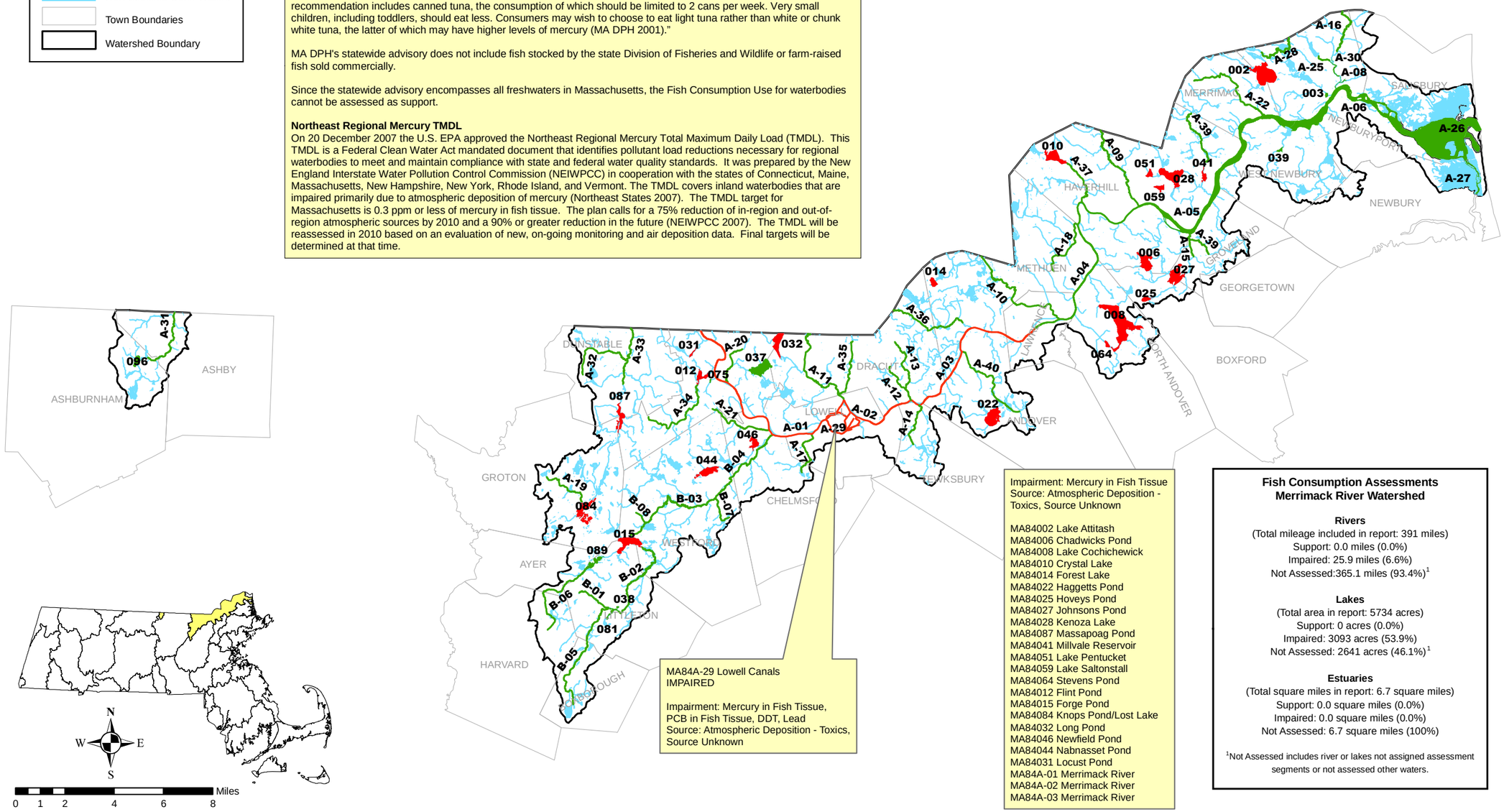
- Impaired
- Not Assessed
- Not Assessed Other Waters
- Not Assessed Other Waters
- Town Boundaries
- Watershed Boundary

Statewide Fish Consumption Advisory due to Mercury Contamination
In July 2001 MA DPH issued new consumer advisories on fish consumption and mercury contamination (MA DPH 2001). The MA DPH "…is advising pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age to refrain from eating the following marine fish; shark, swordfish, king mackerel, tuna steak and tilefish. In addition, MA DPH is expanding its previously issued statewide fish consumption advisory which cautioned pregnant women to avoid eating fish from all freshwater bodies due to concerns about mercury contamination, to now include women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age (MA DPH 2001)." Additionally, MA DPH "…is recommending that pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age limit their consumption of fish not covered by existing advisories to no more than 12 ounces (or about 2 meals) of cooked or uncooked fish per week. This recommendation includes canned tuna, the consumption of which should be limited to 2 cans per week. Very small children, including toddlers, should eat less. Consumers may wish to choose to eat light tuna rather than white or chunk white tuna, the latter of which may have higher levels of mercury (MA DPH 2001)."

MA DPH's statewide advisory does not include fish stocked by the state Division of Fisheries and Wildlife or farm-raised fish sold commercially.

Since the statewide advisory encompasses all freshwaters in Massachusetts, the Fish Consumption Use for waterbodies cannot be assessed as support.

Northeast Regional Mercury TMDL
On 20 December 2007 the U.S. EPA approved the Northeast Regional Mercury Total Maximum Daily Load (TMDL). This TMDL is a Federal Clean Water Act mandated document that identifies pollutant load reductions necessary for regional waterbodies to meet and maintain compliance with state and federal water quality standards. It was prepared by the New England Interstate Water Pollution Control Commission (NEIWPCC) in cooperation with the states of Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont. The TMDL covers inland waterbodies that are impaired primarily due to atmospheric deposition of mercury (Northeast States 2007). The TMDL target for Massachusetts is 0.3 ppm or less of mercury in fish tissue. The plan calls for a 75% reduction of in-region and out-of-region atmospheric sources by 2010 and a 90% or greater reduction in the future (NEIWPCC 2007). The TMDL will be reassessed in 2010 based on an evaluation of new, on-going monitoring and air deposition data. Final targets will be determined at that time.



MA84A-29 Lowell Canals
IMPAIRED

Impairment: Mercury in Fish Tissue, PCB in Fish Tissue, DDT, Lead
Source: Atmospheric Deposition - Toxics, Source Unknown

Impairment: Mercury in Fish Tissue
Source: Atmospheric Deposition - Toxics, Source Unknown

MA84002 Lake Attitash
MA84006 Chadwicks Pond
MA84008 Lake Cochichewick
MA84010 Crystal Lake
MA84014 Forest Lake
MA84022 Haggetts Pond
MA84025 Hoveys Pond
MA84027 Johnsons Pond
MA84028 Kenoza Lake
MA84087 Massapoag Pond
MA84041 Millvale Reservoir
MA84051 Lake Pentucket
MA84059 Lake Saltonstall
MA84064 Stevens Pond
MA84012 Flint Pond
MA84015 Forge Pond
MA84084 Knops Pond/Lost Lake
MA84032 Long Pond
MA84046 Newfield Pond
MA84044 Nabnasset Pond
MA84031 Locust Pond
MA84A-01 Merrimack River
MA84A-02 Merrimack River
MA84A-03 Merrimack River

Fish Consumption Assessments
Merrimack River Watershed

Rivers
(Total mileage included in report: 391 miles)
Support: 0.0 miles (0.0%)
Impaired: 25.9 miles (6.6%)
Not Assessed:365.1 miles (93.4%)[1]

Lakes
(Total area in report: 5734 acres)
Support: 0 acres (0.0%)
Impaired: 3093 acres (53.9%)
Not Assessed: 2641 acres (46.1%)[1]

Estuaries
(Total square miles in report: 6.7 square miles)
Support: 0.0 square miles (0.0%)
Impaired: 0.0 square miles (0.0%)
Not Assessed: 6.7 square miles (100%)

[1]Not Assessed includes river or lakes not assigned assessment segments or not assessed other waters.

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Figure 3. *Shellfishing Use* assessment summary for estuarine segments in the Merrimack River watershed

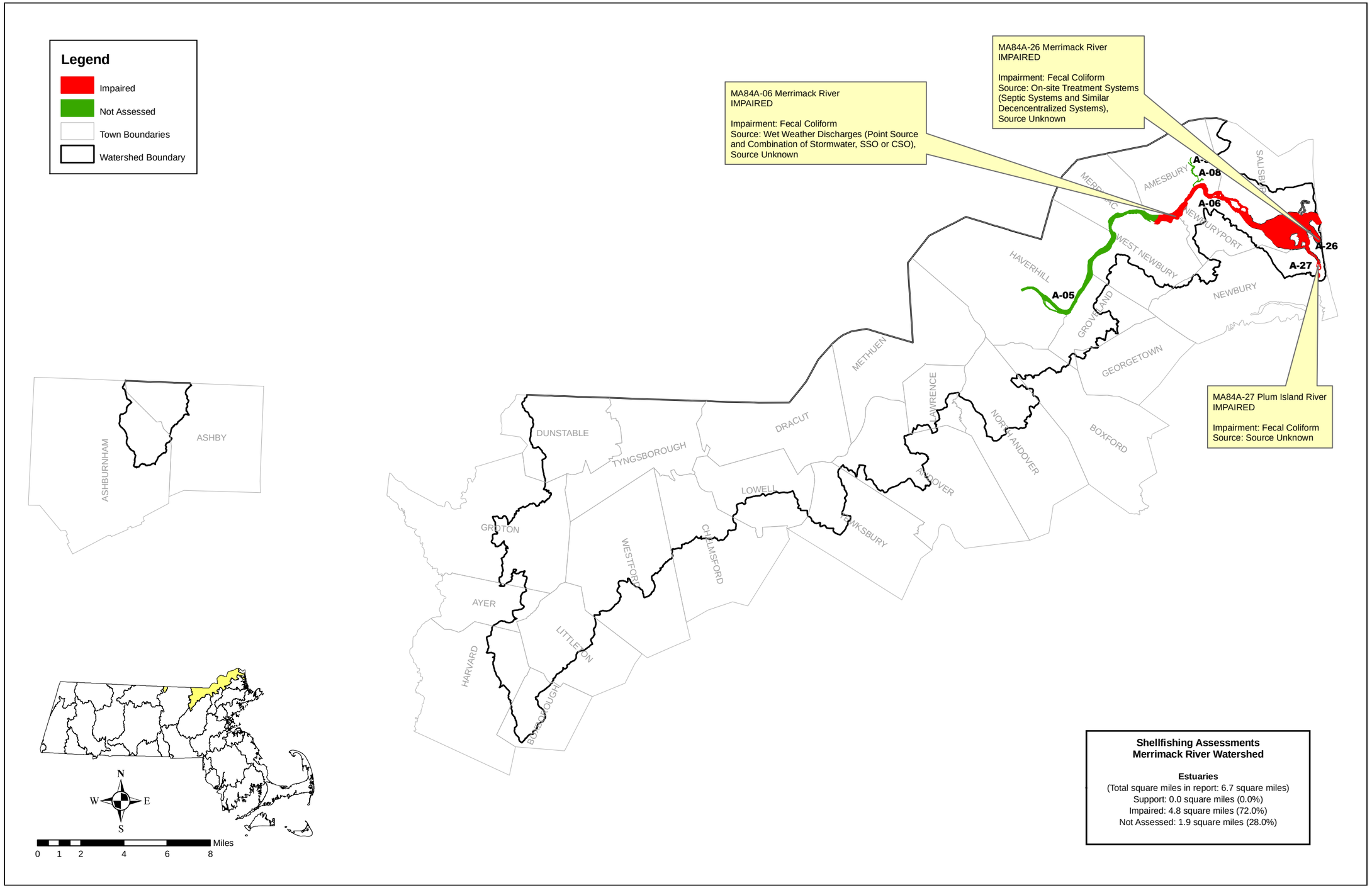

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Figure 4. *Primary Contact Recreational Use* assessment summary for rivers, estuarine, and lake segments in the Merrimack River watershed

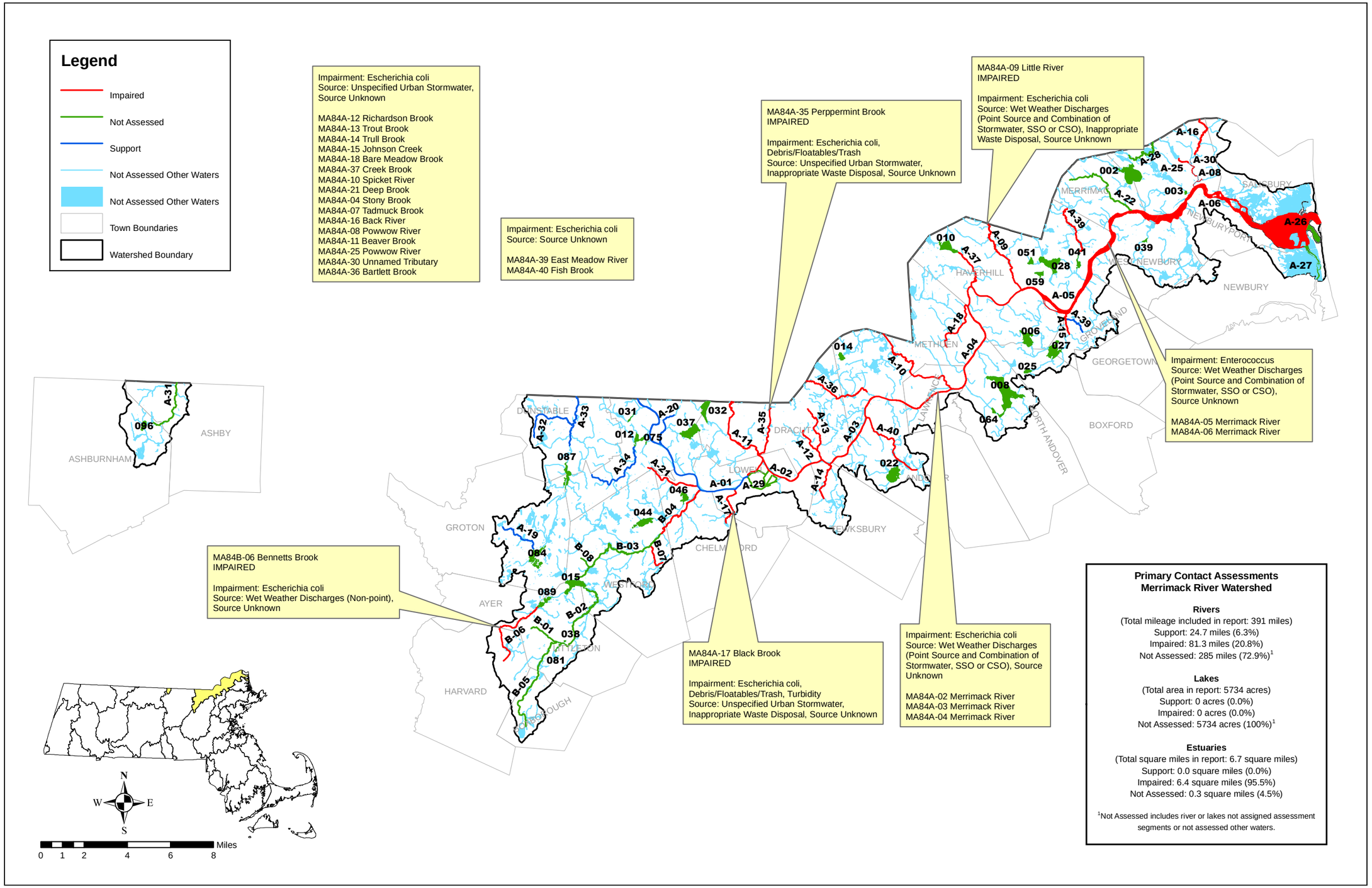

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Figure 5. *Secondary Contact Recreational Use* assessment summary for rivers, estuarine, and lake segments in the Merrimack River watershed

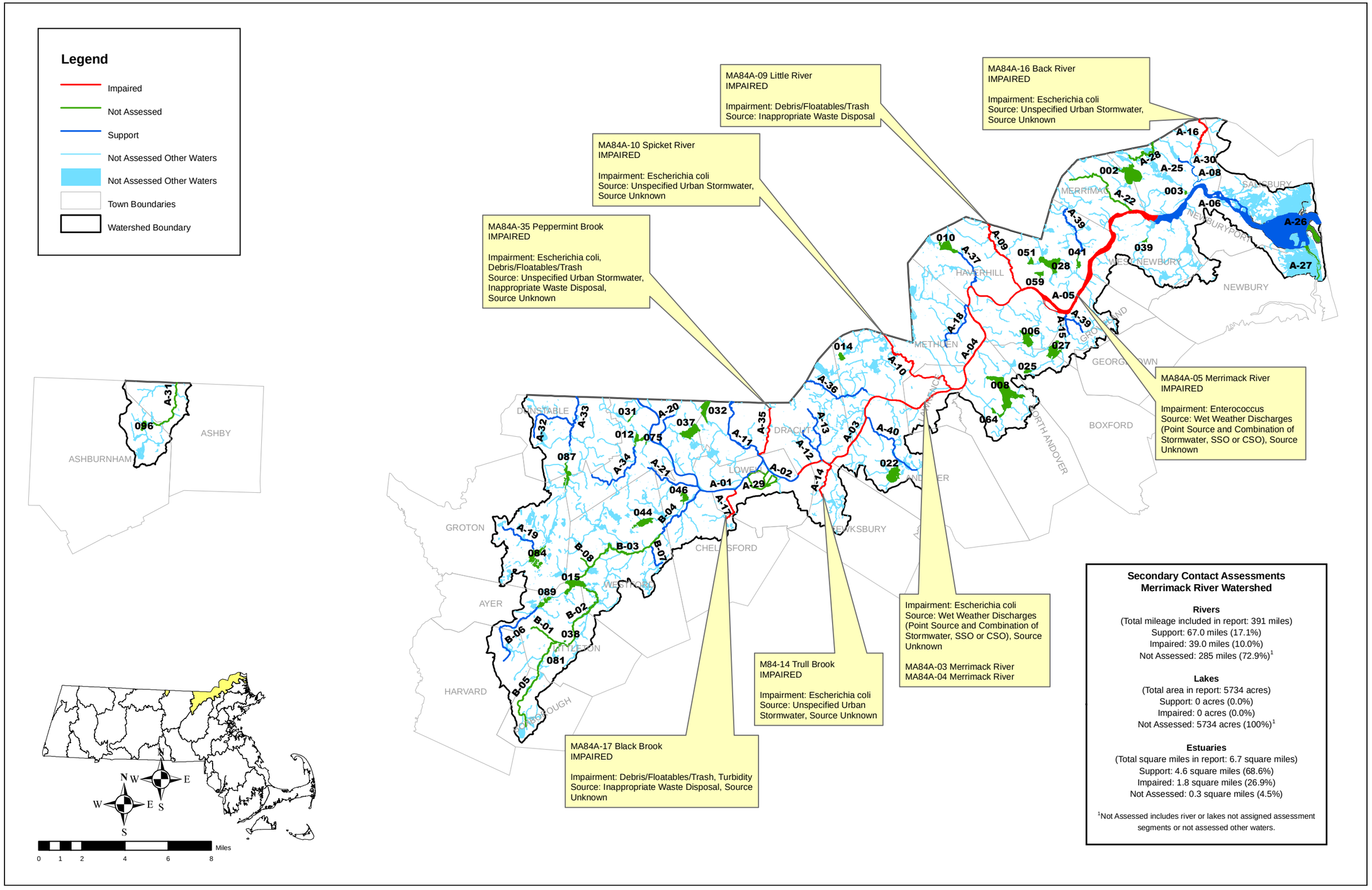

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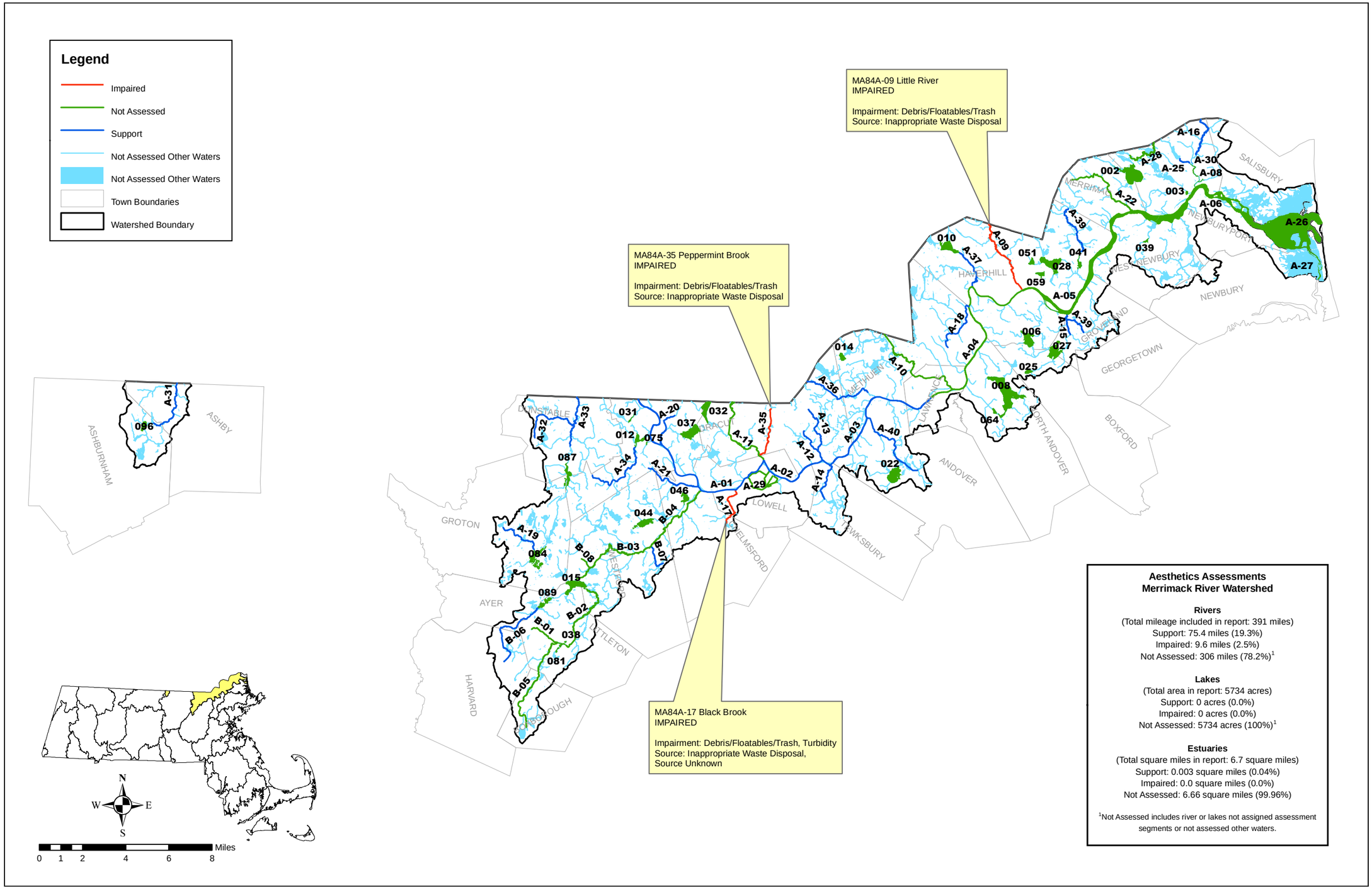
Figure 6. *Aesthetics Use* assessment summary for rivers, estuarine, and lake segments in the Merrimack River watershed



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INTRODUCTION

The goal of the Clean Water Act (CWA) is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. To meet this objective, the CWA requires states to develop information on the quality of the Nation's water resources and report this information to the U.S. Environmental Protection Agency (EPA), the U.S. Congress, and the public. Together, these agencies are responsible for implementation of the CWA mandates. Under Section 305(b) of the Federal Clean Water Act, every two years, the Massachusetts Department of Environmental Protection (MassDEP) must submit to EPA a statewide report that describes the status of water quality in the Commonwealth. Until 2002 this was accomplished as a statewide summary of water quality (the 305(b) Report). States are also required to submit, under Section 303(d) of the CWA, a list of impaired waters requiring a total maximum daily load (TMDL) calculation. In 2002, however, EPA gave states the option to combine elements of the statewide 305(b) Report and the Section 303(d) List of Impaired Waters into one "Integrated List of Waters" (Integrated List). This statewide list is based on the compilation of information for the Commonwealth's 27 watersheds. Massachusetts has opted to write individual watershed surface water quality assessment reports and use them as the supporting documentation for the Integrated List. The assessment reports utilize data compiled from a variety of sources and provide an evaluation of water quality, progress made towards maintaining and restoring water quality, and the extent to which problems remain at the watershed level. Quality-assured in-stream biological, habitat, physical/chemical, toxicity data and other information are evaluated to assess the status of water quality conditions. This analysis follows a standardized process described in the Assessment Methodology Appendix.

This report presents the current assessment of water quality conditions in the Merrimack River watershed. The assessments are based on information that has been researched and developed by the MassDEP through the first three years (information gathering, monitoring, and assessment) of the five-year basin cycle in partial fulfillment of MassDEP federal mandate to report on the status of the Commonwealth's waters under the CWA. Specifically, water quality monitoring data collected by the MassDEP, Division of Watershed Management (DWM) staff in 2004 were utilized to make assessment decisions. All data collected by MassDEP DWM in 2004 are available on the attached data CD in the form of technical memorandums. Water quality data from other sources (see Acknowledgements) used to make use assessment decisions is available from those agencies and organizations.

MASSACHUSETTS INTEGRATED LIST OF WATERS

Section 305(b) of the CWA defines the process whereby states monitor and assess the quality of their surface and groundwater and report on the status of those waters every two years. Section 303(d) of the CWA requires states to periodically identify and list those waterbodies for which existing controls on point and nonpoint sources of pollutants are not stringent enough to attain or maintain compliance with applicable surface water quality standards. Through the year 2000 the MassDEP fulfilled the 305(b) and 303(d) reporting requirements in two completely separate documents. In 2001 the EPA released guidance that provided states with the option of preparing a single Integrated List of Waters to be submitted that would meet the reporting requirements of both sections 305(b) and 303(d) of the CWA.

The EPA approved the Massachusetts Year 2008 Integrated List of Waters in May 2009. In that report each waterbody segment was placed in one of five major categories. Category 1 included those waters that were meeting all designated uses. No Massachusetts waters were listed in Category 1 because a statewide health advisory pertaining to the consumption of fish precludes any waters from being in full support of the fish consumption use. Waters listed in Category 2 were found to support some of the uses for which they were assessed but other uses were not assessed. Category 3 contained those waters for which insufficient or no information was available to assess any uses.

Waters exhibiting impairment for one or more uses were placed in either Category 4 (impaired but not requiring a TMDL report) or Category 5 (impaired and requiring one or more TMDLs) according to the EPA guidance. Category 4 was further divided into three sub-categories – 4A, 4B and 4C – depending upon the reason that TMDLs were not needed. Category 4A included waters for which the required TMDL(s) had

already been completed and approved by the EPA. However, since segments could only appear in one-category waters that had an approved TMDL for some pollutants, but not others, remained in Category 5. Category 4B was to include waters for which other pollution control requirements were reasonably expected to result in the attainment of the designated use before the next listing cycle. Because of the uncertainty related to making predictions about conditions in the future the MassDEP made a decision not to utilize Category 4B in the 2008 Integrated List. Finally, waters impaired by factors, such as flow modification or habitat alteration, that are not subjected to TMDL calculations because the impairment is not related to one or more pollutants were included in Category 4C. See individual segment assessments for information pertaining to the 2008 Integrated List category and causes of impairment.

MERRIMACK RIVER WATERSHED DESCRIPTION

The Merrimack River drainage area is the fifth largest in New England encompassing a total of 5,014 square miles in New Hampshire and Massachusetts. As a New England interstate basin, it is surpassed only by the Connecticut River. The mainstem Merrimack River is formed in central New Hampshire by the confluence of the Pemigewasset and Winnipesaukee rivers. The mainstem flows southward through central New Hampshire (approximately 78 miles) and enters Massachusetts. Nearly one quarter of the Merrimack's drainage area (1,200 square miles) lies within northeastern Massachusetts. In Massachusetts, the Merrimack River Basin is bordered by the Parker River Basin to the east, the Ipswich River Basin to the southeast, the Shawsheen River Basin to the south, the Concord River Basin to the southwest and the Nashua River Basin to the west while the northern portion of the basin is bordered by the state of New Hampshire.

Once in Massachusetts, the Merrimack River flows generally southeast for about six miles then turns northeast near the city of Lowell, Massachusetts. The Merrimack River continues to flow northeast towards the city of Newburyport where it then empties into the Atlantic Ocean. The Merrimack River drops 90 feet in elevation along its 53-mile course through Massachusetts to the Atlantic Ocean. This elevation change includes the two major dams in Lawrence and Lowell, the Pawtucket and Essex dams. The river is tidal downstream from its confluence with Creek Brook in Haverhill (the lower 25 mile linear reach with an area of approximately 6.97 square miles). Excluding the Nashua, Concord and Shawsheen rivers (treated as separate major watersheds in Massachusetts), large tributaries to the Merrimack River in Massachusetts include: Stony Brook and the Spicket, Little and Powwow rivers. In Massachusetts, the Merrimack River watershed contains approximately 391 miles of river and 5734 acres of lakes, ponds, and reservoirs.

In Massachusetts, 24 communities lie wholly or in part within the basin boundaries: Amesbury, Andover, Ayer, Boxford, Boxborough, Chelmsford, Dracut, Dunstable, Groton, Groveland, Harvard, Haverhill, Lawrence, Littleton, Lowell, Merrimac, Methuen, Newburyport, North Andover, Salisbury, Tewksbury, Tyngsborough, Westford, and West Newburyport. The three major cities along the Merrimack River in Massachusetts are Lowell, Lawrence, and Haverhill. As historic industrial centers, these cities were once sources of severe pollution from untreated municipal and industrial wastewater discharges. Water quality problems are still evident today in the watershed due in part to combined sewer overflows (CSO) in Lowell, Lawrence, and Haverhill; various nonpoint sources of pollution; and smaller industrial discharges.

OBJECTIVES

This report summarizes information generated in the Merrimack River watershed since the last water quality assessment report that was published in November 2001. The methodology used to assess the status of water quality conditions of rivers and lakes in accordance with EPA and MassDEP use assessment methods is provided in Appendix A. Data collected by DWM in 2004 are available on the attached DataCD.

The objectives of this water quality assessment report are to:

1. evaluate whether or not surface waters in the Merrimack River watershed, defined as segments in the MassDEP/EPA databases, currently support their designated uses and

2. identify the stressors impairing designated uses and any confirmed sources of those stressors

ASSESSMENT REPORT FORMAT

In this report the assessment information for waters that are assessed for any one or more designated use(s) is summarized in a table format. The tables summarize the assessment decisions for the *Aquatic Life, Fish Consumption, Shellfishing Primary* and *Secondary Contact Recreation* and *Aesthetics* uses, the data that informed those decisions, the cause(s) of any impairment, the confirmed source(s) for the impairment and monitoring recommendations (Table 2).

Table 2. An example of the table format used to present assessment information in the 2004 Merrimack River Watershed Assessment Report.

EXAMPLE BROOK (SEGMENT MA81-99)

Location: Fake Pond, Groton, to confluence with Cat Brook, Shirley.
Segment Length: 4.4 Miles
Classification: Class B
2006 Integrated List of Waters: Category 5 - Waters requiring a TMDL - Cause Unknown, Nutrients-Pathogens

Designated Use	Use Assessment	Alert
Aquatic Life	**Support**	**Yes**
MassDEP DWM measured dissolved oxygen, temperature, and pH six times at one site in 2003 and found no violations of the temperature or pH criterion and five violations of the dissolved oxygen criterion. The dissolved oxygen violations ranged from 2.9 mg/L to 3.6 mg/L. **Cause(s) of Impairment:** Dissolved oxygen **Source(s) of Impairment:** Unknown *Data Sources: 24*		
Fish Consumption	**Not Assessed**	**No**
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		
Primary Contact	**Support**	**No**
MassDEP DWM collected five Escherichia coli samples at one site in 2003. The geometric mean of the samples collected during the primary contact season was 102 CFU/100ml. This result does not violate the geometric mean criterion (126 CFU/100ml) for Escherichia coli. *Data Sources: 24*		
Secondary Contact	**Support**	**No**
MassDEP DWM collected five Escherichia coli samples at one site in 2003. The geometric mean was 102 CFU/100ml. This result does not violate the geometric mean criterion (630 CFU/100ml) for Escherichia coli. *Data Sources: 24*		
Aesthetics	**Not Assessed**	**No**
MassDEP DWM recorded aesthetic field observations at one site in 2003. There were no field observations indicating prolonged or frequent occurrences of objectionable deposits, odors, turbidity or color, floating scum, or overabundant growths of aquatic plants or algae. *Data Sources: 24*		
Monitoring Recommendations		
Conduct additional bacteria monitoring to characterize the impairment and identify unknown sources.		

The *Drinking Water* use is not assessed in this report. MassDEP Drinking Water Program (DWP) has primacy for implementing the provisions of the federal Safe Drinking Water Act (SDWA) and maintains current drinking supply monitoring data. More information is available on the MassDEP website at http://www.mass.gov/dep/water/drinking.htm.

The table is divided into several sections (i.e., one section for each use and one for monitoring recommendations) and the "Designated Use" column in the table indicates which use is being summarized in that section. The "Use Assessment" column states the assessment decision (support, impaired, not assessed) for the use. The "Alert" column is used when an issue was identified that is of concern (i.e., an "Alert Status" was noted for the use but the use was not assessed as impaired). In the space below each use in the table is a summary of the data that directed or influenced the assessment decision and their sources. The numbers identified as the data sources correspond to the numbered citations in the Data Sources section. The "Cause(s) of Impairment" and "Source(s) of Impairment" identify the stressors leading to the impairment decision and the any confirmed source(s) of the stressor(s). The causes and sources come from the list in the EPA Assessment Database Version 2 (ADB). The "Monitoring Recommendations" section lists some recommendations for future monitoring by MassDEP DWM. The recommendations listed are not inclusive and indicate a priority for targeted monitoring.

SPECIAL NOTES

In the data summary of some segments, there is a reference to a special note. Special notes refer to unique assessment situations that apply to several segments and are best described in a separate section rather than repeated for each segment. The special notes for this assessment report are:

1. **USACOE *E. coli* data** - As part of the Merrimack River Watershed Assessment Study, CDM (under contract to USACOE) collected *E. coli* samples during three dry weather and two wet weather events. Only one *E. coli* sample was collected during each dry weather event while multiple samples were collected during the wet weather events. The maximum *E. coli* concentration for each wet weather event was used in calculating the geometric mean to avoid biasing the statistic towards the wet weather events.
2. **USACOE Water Chemistry data** - As part of the Merrimack River Watershed Assessment Study, CDM (under contract to USACOE) measured dissolved oxygen, temperature, and pH and collected total phosphorus and chlorophyll- a samples during three dry weather and two wet weather events. Only one set of measurements were collected during each dry weather event while five measurements were made on regular intervals during the wet weather events. Any site that did not have measurements from all five sampling events was not considered in any assessment decision.
3. **Northeast Regional Mercury TMDL** - On 20 December 2007 the U.S. EPA approved the Northeast Regional Mercury Total Maximum Daily Load (TMDL). This TMDL is a Federal Clean Water Act mandated document that identifies pollutant load reductions necessary for regional waterbodies to meet and maintain compliance with state and federal water quality standards. It was prepared by the New England Interstate Water Pollution Control Commission (NEIWPCC) in cooperation with the states of Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont. The TMDL covers inland waterbodies that are impaired primarily due to atmospheric deposition of mercury (Northeast States 2007). The TMDL target for Massachusetts is 0.3 ppm or less of mercury in fish tissue. The plan calls for a 75% reduction of in-region and out-of-region atmospheric sources by 2010 and a 90% or greater reduction in the future (NEIWPCC 2007). The TMDL will be reassessed in 2010 based on an evaluation of new, on-going monitoring and air deposition data. Final targets will be determined at that time.
4. **Statewide Fish Consumption Advisory due to Mercury Contamination** - In July 2001 MA DPH issued new consumer advisories on fish consumption and mercury contamination (MA DPH 2001). The MA DPH "…is advising pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age to refrain from eating the following marine fish; shark, swordfish, king mackerel, tuna steak and tilefish. In addition, MA DPH is expanding its previously issued statewide fish consumption advisory which cautioned

pregnant women to avoid eating fish from all freshwater bodies due to concerns about mercury contamination, to now include women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age (MA DPH 2001)." Additionally, MA DPH "…is recommending that pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age limit their consumption of fish not covered by existing advisories to no more than 12 ounces (or about 2 meals) of cooked or uncooked fish per week. This recommendation includes canned tuna, the consumption of which should be limited to 2 cans per week. Very small children, including toddlers, should eat less. Consumers may wish to choose to eat light tuna rather than white or chunk white tuna, the latter of which may have higher levels of mercury (MA DPH 2001)."

LITERATURE CITED

MA DPH. 2001. *MA DPH Issues New Consumer Advisories on Fish Consumption and Mercury Contamination.* Massachusetts Department of Public Health, Bureau of Environmental Health Assessment, Boston, MA.

NEIWPCC. 2007. *Northeast Regional Mercury TMDL Fact Sheet October 2007.* [Online]. New England Interstate Water Pollution Control Commission, Lowell, MA. Retrieved 23 January 2008 from http://www.neiwpcc.org/mercury/mercury-docs/FINAL%20Northeast%20Regional%20Mercury%20TMDL%20Fact%20Sheet.pdf.

Northeast States. 2007. *Northeast Regional Mercury Total Maximum Daily Load.* Connecticut Department of Environmental Protection, Maine Department of Environmental Protection, Massachusetts Department of Environmental Protection, New Hampshire Department of Environmental Services, New York State Department of Environmental Conservation, Rhode Island Department of Environmental Management, Vermont Department of Environmental Conservation, New England Interstate Water Pollution Control Commission. October 24, 2007.

MA DPH. 2001. *MA DPH Issues New Consumer Advisories on Fish Consumption and Mercury Contamination.* Massachusetts Department of Public Health, Bureau of Environmental Health Assessment, Boston, MA.

SOUTH BRANCH SOUHEGAN (SEGMENT MA84A-31)

Segment Description: Headwaters, outlet Watatic Pond, Ashburnham to New Hampshire state line, Ashby.
Segment Length: 3.0 Miles
Segment Classification: B
2008 Integrated List of Waters: Not Listed
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Support**	
In 2004, MassDEP DWM collected benthic macroinvertebrates and periphyton at one site (B0524). This site was used as the "reference" or "least disturbed" site for the 2004 Merrimack River basin survey and displayed the diverse and well-balanced aquatic community expected. The *Aquatic Life Use* is assessed as support. *Data Sources: 1, 19*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		
Primary Contact	**Not Assessed**	
Insufficient data were available to assess the *Primary Contact Recreational Use*.		
Secondary Contact	**Not Assessed**	
Insufficient data were available to assess the *Secondary Contact Recreational Use*.		
Aesthetics	**Support**	
In 2004, MassDEP DWM recorded field observations regarding aesthetics at one site (B0524). There were no field observations indicating prolonged or frequent occurences of objectionable deposits, odors, turbidity or color, floating scum, or overabundant growths of aquatic plants or algae. The *Aesthetics Use* is assessed as support. *Data Sources: 17*		
Monitoring Recommendations		
None		

MARTINS POND BROOK (SEGMENT MA84A-19)

Segment Description: Outlet Martins Pond, Groton to inlet Lost Lake, Groton.
Segment Length: 2.3 Miles
Segment Classification: B
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Siltation, Organic enrichment/Low DO, Turbidity).
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Support**	
In July 2004, MassDEP DWM collected benthic macroinvertebrates and periphyton at one site (B0319). The RBP III score in comparison to the "reference" site indicated that the benthic macroinvertebrate community was "slightly impacted". DWM conducted monthly in-situ water quality monitoring at one site (W1188) on three occasions during July, August and September 2004. Parameters measured include dissolved oxygen, percent saturation, temperature, pH, total dissolved solids and conductivity. Early morning DO measurements (between 1:43 and 2:23 am, n=3) and other water quality physico-chemical monitoring data were indicative of good water quality conditions. The maximum water temperature was 21.9℃. None of the dissolved oxyg en, temperature, or pH measurements violated water quality criteria. The *Aquatic Life Use* is assessed as support based on the "slightly impacted" benthic macroinvertebrate community. *Data Sources: 1, 2, 19*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		
Primary Contact	**Support**	
In 2004, MassDEP DWM collected five E. coli samples at one site (W1188) during the primary contact season. The geometric mean of the five samples was 77 CFU/100ml. Based on this result meeting the geometric mean criterion (126 CFU/100ml) for E. coli and the absence of frequent aesthetically objectionable conditions, the *Primary Contact Recreational Use* is assessed as support. *Data Sources: 2, 9, 17*		
Secondary Contact	**Support**	
In 2004, MassDEP DWM collected five E. coli samples at one site (W1188). The geometric mean of the five samples was 77 CFU/100ml. Based on this result meeting the geometric mean criterion (630 CFU/100ml) for E. coli and the absence of frequent aesthetically objectionable conditions, the *Secondary Contact Recreational Use* is assessed as support. *Data Sources: 2, 9, 17*		
Aesthetics	**Support**	
In 2004, MassDEP DWM recorded field observations regarding aesthetics at two sites (W1188, B0319). There were no field observations by DWM field sampling crews or biologists indicating prolonged or frequent occurences of objectionable deposits, odors, turbidity or color, floating scum, or overabundant growths of aquatic plants or algae. The *Aesthetics Use* is assessed as support. *Data Sources: 9, 17*		
Monitoring Recommendations		
None		

JOINT GRASS BROOK (SEGMENT MA84A-32)

Segment Description: Headwaters, between Hollis Street and Hawk Swamp, Dunstable to the confluence with Salmon Brook, Dunstable.
Segment Length: 3.2 Miles
Segment Classification: B
2008 Integrated List of Waters: Not Listed
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Not Assessed**	**Yes**
MassDEP DWM conducted monthly in-situ water quality monitoring at one site (W1208) on three occasions during July, August and September 2004. Parameters measured include dissolved oxygen, percent saturation, temperature, pH, total dissolved solids and conductivity. Early morning DO measurements (between 2:20 and 3:03am, n=3) and other water quality physico-chemical monitoring data were indicative of good water quality conditions. The maximum water temperature was 21.2℃. MA DFG conducted backpack electrofishing in July 2006 at one site (1609) along this segment. All fish collected (n=136), representing four species, were macrohabitat generalists and pollution tolerant. Insufficient data were available to assess the Aquatic Life use. This use is identified with Alert Status due to the lack of any fluvial fish species. *Data Sources: 2, 15*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		
Primary Contact	**Support**	**Yes**
In 2004, MassDEP DWM collected five E. coli samples at one site (W1208) during the primary contact season. The geometric mean of the five samples was 74 CFU/100ml. Based on this result meeting the geometric mean criterion (126 CFU/100ml) for E. coli and the absence of frequent aesthetically objectionable conditions, the *Primary Contact Recreational Use* is assessed as support. An Alert Status is identified for this use due to one elevated E. coli count during a wet weather sampling event. *Data Sources: 2, 9*		
Secondary Contact	**Support**	
In 2004, MassDEP DWM collected five E. coli samples at one site (W1208). The geometric mean of the five samples was 74 CFU/100ml. Based on this result meeting the geometric mean criterion (630 CFU/100ml) for E. coli and the absence of frequent aesthetically objectionable conditions, the *Secondary Contact Recreational Use* is assessed as support. *Data Sources: 2, 9*		
Aesthetics	**Support**	
In 2004, MassDEP DWM recorded field observations regarding aesthetics at one site (W1208). There were no field observations indicating prolonged or frequent occurences of objectionable deposits, odors, turbidity or color, floating scum, or overabundant growths of aquatic plants or algae. The The *Aesthetics Use* is assessed as support. *Data Sources: 9*		
Monitoring Recommendations		
None		

SALMON BROOK (SEGMENT MA84A-33)

Segment Description: Headwaters, outlet Lower Massapoag Pond, Dunstable to New Hampshire state line, Dunstable.
Segment Length: 2.9 Miles
Segment Classification: B
2008 Integrated List of Waters: Not Listed
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Not Assessed**	
MassDEP DWM conducted monthly in-situ water quality monitoring in Salmon Brook (W1199) on three occasions during July, August and September 2004. Parameters measured include dissolved oxygen, percent saturation, temperature, pH, total dissolved solids and conductivity. Early morning DO measurements (between 2:45 and 3:35am, n=3) and other water quality physico-chemical monitoring data were indicative of good water quality conditions with the exception of one DO measurement of 4.6 mg/L. The maximum water temperature was 21.7℃. I nsufficient data were available to assess the Aquatic Life use. *Data Sources: 2*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		
Primary Contact	**Support**	**Yes**
In 2004, MassDEP DWM collected five E. coli samples at one site (W1199) during the primary contact season. The geometric mean of the five samples was 82 CFU/100ml. Based on this result meeting the geometric mean criterion (126 CFU/100ml) for E. coli and the absence of frequent aesthetically objectionable conditions, the *Primary Contact Recreational Use* is assessed as support. An Alert Status is identified for this use due to one elevated E. coli count during a wet weather sampling event. *Data Sources: 2, 9*		
Secondary Contact	**Support**	
In 2004, MassDEP DWM collected five E. coli samples at one site (W1199). The geometric mean of the five samples was 82 CFU/100ml. Based on this result meeting the geometric mean criterion (630 CFU/100ml) for E. coli and the absence of frequent aesthetically objectionable conditions, the *Secondary Contact Recreational Use* is assessed as support. *Data Sources: 2, 9*		
Aesthetics	**Support**	
In 2004, MassDEP DWM recorded field observations regarding aesthetics at one site (W1199). There were no field observations indicating prolonged or frequent occurences of objectionable deposits, odors, turbidity or color, floating scum, or overabundant growths of aquatic plants or algae. The *Aesthetics Use* is assessed as support. *Data Sources: 9*		
Monitoring Recommendations		
Conduct dissolved oxygen monitoring to evaluate diurnal variation by deploying multiprobes overnight.		

MERRIMACK RIVER (SEGMENT MA84A-01)

Segment Description: State line at Hudson, NH/Tyngsborough, MA to Pawtucket Dam, Lowell.
Segment Length: 9.0 Miles
Segment Classification: B\TWS, WWF, CSO
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Metals, Pathogens).
NPDES Permits: Lowell Regional Wastewater Utilities (MA0100633), Lowell Regional Water Utility (MAG640055)

Designated Use	Use Assessment	Alert
Aquatic Life	**Not Assessed**	**Yes**
In 2003, CDM collected five total phosphorus samples and three chlorophyll-a samples from two sites (M011, M012) (See Special Note 2). The total phosphorus concentrations ranged from 0.037 to 0.110 mg/L and the chlorophyll-a concentrations ranged from 1.9 to 11.8 ug/L at these sites. Insufficient data were available to assess the *Aquatic Life Use*. An Alert Status is identified for this use due to elevated total phosphorus concentrations. *Data Sources: 3*		
Fish Consumption	**Impaired**	
MA DPH has issued a fish consumption advisory due to mercury contamination for this portion of the Merrimack River. Children younger than 12 years of age, pregnant women, women of childbearing age who may become pregnant, and nursing mothers should not eat White Sucker or Largemouth Bass fish from this water body. The general public should limit consumption of White Sucker and Largemouth Bass to two meals per month. **Cause(s) of Impairment:** Mercury in Fish Tissue **Source(s) of Impairment:** Atmospheric Deposition - Toxics, Source Unknown *Data Sources: 10*		
Primary Contact	**Support**	**Yes**
In 2008, MRWA collected E.coli samples at eight sites (49.6, 48.9, 47.3, 43.6, 43.4, 42.4, 41.1). The geometric means of the samples collected during the primary contact season at each site ranged from 16.2 CFU/100ml to 63.8 CFU/100ml. In 2003, CDM collected E. coli samples at two sites (M011, M012) (See Special Note 1). The geometric means of the samples collected during the primary contact season at each site were 93 and 72 CFU/100ml. Based on these results meeting the geometric mean criterion (126 CFU/100ml) for E. coli and the absence of frequent aesthetically objectionable conditions, the *Primary Contact Recreational Use* is assessed as support. CSO discharges in New Hampshire communities upstream from this segment influence water quality in this segment of the river. One Lowell Regional Wastewater Utilities CSO (Outfall 002 Walker Street) also discharges near the downstream end of this segment. This use is identified with an Alert Status due to these CSO discharges and spikes in E. coli concentrations during wet weather conditions. *Data Sources: 3, 25*		

Secondary Contact	Support	Yes
In 2008, MRWA collected E.coli samples at eight sites (49.6, 48.9, 47.3, 43.6, 43.4, 42.4, 41.1). The geometric means of the samples collected at each site ranged from 16.2 CFU/100ml to 63.8 CFU/100ml. In 2003, CDM collected E. coli samples at two sites (M011, M012) (See Special Note 1). The geometric means of the samples at each site were 93 and 72 CFU/100ml. Based on this result meeting the geometric mean criterion (630 CFU/100ml) for E. coli and the absence of frequent aesthetically objectionable conditions, the *Secondary Contact Recreational Use* is assessed as support. CSO discharges in New Hampshire communities upstream from this segment influence water quality in this segment of the river. One Lowell Regional Wastewater Utilities CSO (Outfall 002 Walker Street) also discharges near the downstream end of this segment. This use is identified with an Alert Status due to these CSO discharges and spikes in E. coli concentrations during wet weather conditions. *Data Sources: 3,25*		
Aesthetics	**Support**	**Yes**
MassDEP DWM field staff did not note any objectionable conditions (e.g., odors, oils, growths, scums, deposits or turbidity) in the Merrimack River at the Tyngsboro Bridge in the four sampling events conducted in June and August 2004 or June and September 2005. It should be noted however that the USACOE study included surveys by Normandeau Associates in November and December 2002 to identify areas of erosion along the Merrimack River greater than approximately 50-feet in length. Several problem areas were identified during this field reconnaissance effort in this segment of the river although many more locations were identified in the river upstream from the MA/NH state line. *Aesthetics Use* is assessed as support but is identified with an Alert Status based on identified erosional areas and turbidity. *Data Sources: 9, 23, 24*		
Monitoring Recommendations		
Conduct fish tissue toxics monitoring to evaluate the current fish consumption advisory. Conduct dissolved oxygen monitoring to evaluate diurnal variation by deploying multiprobes overnight.		

BRIDGE MEADOW BROOK (SEGMENT MA84A-34)

Segment Description: Headwaters, north of Chestnut Road, Tyngsborough to inlet Flint Pond, Tyngsborough.
Segment Length: 4.0 Miles
Segment Classification: B
2008 Integrated List of Waters: Not Listed
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Support**	**Yes**
In 2004, MassDEP DWM collected benthic macroinvertebrates at one site (B0522). The RBP III score in comparison to the "reference" site indicated that the benthic macroinvertebrate community was "slightly impacted". Habitat quality was limited mostly by low flow conditions, likely influenced by beaver dams and other small impoundments. Recent development (medium density residential housing) in the subwatershed area was also noted. MassDEP DWM biologists also estimated canopy cover (10 - 25% open) as well as micro and macroalgal cover at this site (0%, respectively) in the both the riffle and pool habitat. In 2004, MassDEP DWM collected fish at one site (BR01). All fish collected in the sample are classified as pollution tolerant or moderately pollution tolerant macrohabitat generalists although sampling efficiency was noted as 50% due to water color in the pool area where most fish were collected. MassDEP DWM conducted monthly in-situ water quality monitoring at one site (W1207) on three occasions during July, August and September 2004. Parameters measured include dissolved oxygen, percent saturation, temperature, pH, total dissolved solids and conductivity. Two of the three early morning DO measurements (between 3:40 and 4:36am, n=3) were low (3.1 and 3.9 mg/L) violating the water quality criterion of 5 mg/L and pH was also slightly low. Given the influence of wetlands and beaver activity in this subwatershed, however, these conditions are likely naturally occuring. The maximum water temperature was 21.8℃. The *Aquatic Life Use* is assessed as support based on the "slightly impacted" benthic macroinvertebrate community. An Alert Status is identified for this use due to low dissolved oxygen and the absence of fluvial fish. *Data Sources: 1, 2, 4, 19*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		
Primary Contact	**Support**	**Yes**
In 2004, MassDEP DWM collected five E. coli samples at one site (W1207) during the primary contact season. The geometric mean of the five samples was 51 CFU/100ml. Based on this result meeting the geometric mean criterion (126 CFU/100ml) for E. coli and the absence of frequent aesthetically objectionable conditions, the *Primary Contact Recreational Use* is assessed as support. An Alert Status is identified for this use due to one elevated E. coli count during a wet weather sampling event. *Data Sources: 2, 9, 17*		
Secondary Contact	**Support**	
In 2004, MassDEP DWM collected five E. coli samples at one site (W1207). The geometric mean of the five samples was 51 CFU/100ml. Based on this result meeting the geometric mean criterion (630 CFU/100ml) for E. coli and the absence of frequent aesthetically objectionable conditions, the *Secondary Contact Recreational Use* is assessed as support. *Data Sources: 2 9, 17*		

Aesthetics	Support	
In 2004, MassDEP DWM recorded field observations regarding aesthetics at one site (W1207). There were no field observations indicating prolonged or frequent occurences of objectionable deposits, odors, turbidity or color, floating scum, or overabundant growths of aquatic plants or algae. The *Aesthetics Use* is assessed as support. *Data Sources: 9, 17*		
Monitoring Recommendations		
None		

LAWRENCE BROOK (SEGMENT MA84A-20)

Segment Description: Headwaters, Tyngsborough (excluding intermittent portion) to confluence with Merrimack River, Tyngsborough.
Segment Length: 2.0 Miles
Segment Classification: B
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Support**	
MassDEP DWM conducted monthly in-situ water quality monitoring at one site (W1189) on three occasions during July, August and September 2004. Parameters measured include dissolved oxygen, percent saturation, temperature, pH, total dissolved solids and conductivity. Early morning DO measurements (between 3:16 and 4:07am, n=3) and other water quality physico-chemical monitoring data were indicative of good water quality conditions. The maximum water temperature was 24.7℃. The *Aquatic Life Use* is assessed as support based on the available water quality data. *Data Sources: 2*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		
Primary Contact	**Support**	
In 2004, MassDEP DWM collected five E. coli samples at one site (W1189) during the primary contact season. The geometric mean of the five samples was 100 CFU/100ml. Based on this result meeting the geometric mean criterion (126 CFU/100ml) for E. coli and the absence of frequent aesthetically objectionable conditions, the *Primary Contact Recreational Use* is assessed as support. *Data Sources: 2, 9*		
Secondary Contact	**Support**	
In 2004, MassDEP DWM collected five E. coli samples at one site (W1189). The geometric mean of the five samples was 100 CFU/100ml. Based on this result meeting the geometric mean criterion (630 CFU/100ml) for E. coli and the absence of frequent aesthetically objectionable conditions, the *Secondary Contact Recreational Use* is assessed as support. *Data Sources: 2, 9*		

Aesthetics	Support	
In 2004, MassDEP DWM recorded field observations regarding aesthetics at one site (W1189). There were no field observations indicating prolonged or frequent occurences of objectionable deposits, odors, turbidity or color, floating scum, or overabundant growths of aquatic plants or algae. The The *Aesthetics Use* is assessed as support. *Data Sources: 9*		
Monitoring Recommendations		
None		

DEEP BROOK (SEGMENT MA84A-21)

Segment Description: Headwaters east of Everett Turnpike, Tyngsborough to confluence with Merrimack River, Chelmsford.
Segment Length: 2.9 Miles
Segment Classification: B
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Unknown toxicity, Siltation, Organic enrichment/Low DO, Pathogens).
NPDES Permits: Allied Waste Services of Massachusetts, LLC (MA0030066)

Designated Use	Use Assessment	Alert
Aquatic Life	**Impaired**	
In August 2004, MassDEP DWM collected fish at one site (DRB05). Habitat quality was most noticeably limited by sediment deposition and substrate embeddedness resulting in marginal epifaunal substrate as well as low flow conditions. All fish collected in the sample are classified as macrohabitat generalists and either pollution tolerant or moderately pollution tolerant. MassDEP DWM biologists last sampled this same reach in Deep Brook in 1990 and collected 17 native eastern brook trout. The absence of eastern brook trout in the 2004 sample may indicate that the water and habitat quality has worsened over the last 15 years. DWM conducted monthly in-situ water quality monitoring at one site (W1190) on three occasions during July, August and September 2004. Parameters measured include dissolved oxygen, percent saturation, temperature, pH, total dissolved solids and conductivity. Early morning DO measurements (between 4:34 and 5:33am, n=3) and other water quality physico-chemical monitoring data were indicative of good water quality conditions. The maximum water temperature was 19.0℃. Highway construction runoff was identified as one source of the problem. The *Aquatic Life Use* is assessed as impaired based on the poor fish community. **Cause(s) of Impairment:** Fishes Bioassessment, Habitat Assessment, Sedimentation/Siltation **Source(s) of Impairment:** Highways, Roads, Bridges, Infrastructure (New Construction), Source Unknown *Data Sources: 2, 4*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		
Primary Contact	**Impaired**	
In 2004, MassDEP DWM collected five E. coli samples at one site (W1190) during the primary contact season. The geometric mean of the five samples was 365 CFU/100ml. Based on this result violating the geometric mean criterion (126 CFU/100ml) for E. coli, the *Primary Contact Recreational Use* is assessed as impaired. **Cause(s) of Impairment:** Escherichia coli **Source(s) of Impairment:** Unspecified Urban Stormwater, Source Unknown *Data Sources: 2, 9*		

Secondary Contact	Support	Yes
In 2004, MassDEP DWM collected five E. coli samples at one site (W1190). The geometric mean of the five samples was 365 CFU/100ml. Based on this result meeting the geometric mean criterion (630 CFU/100ml) for E. coli and the absence of frequent aesthetically objectionable conditions, the *Secondary Contact Recreational Use* is assessed as support. An Alert Status is identified for this use due to one elevated E. coli count during a wet weather sampling event. *Data Sources: 2, 9*		
Aesthetics	**Support**	
In 2004, MassDEP DWM recorded field observations regarding aesthetics at one site (W1190). There were no field observations indicating prolonged or frequent occurences of objectionable deposits, odors, turbidity or color, floating scum, or overabundant growths of aquatic plants or algae. The *Aesthetics Use* is assessed as support. *Data Sources: 9*		
Monitoring Recommendations		
Conduct additional bacteria monitoring to characterize the impairment and identify unknown sources. Conduct reconniasance fish surveys to determine if brook trout are present in the segment.		

UNNAMED TRIBUTARY "REEDY MEADOW BROOK" (SEGMENT MA84B-01)

Segment Description: (Locally known as Reedy Meadow Brook) Headwaters, outlet of small unnamed impoundment upstream of Bruce Street, Littleton to inlet Mill Pond, Littleton.
Segment Length: 1.5 Miles
Segment Classification: B
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Nutrients, pH, Organic enrichment/Low DO, Pathogens, Suspended solids).
NPDES Permits: Veryfine Products (Sunny Delight Beverages Co.) (MA0004936)

Designated Use	Use Assessment	Alert
Aquatic Life	**Not Assessed**	**Alert**
Water from Reedy Meadow Brook is collected upstream from the Veryfine Products Inc. outfall for use as a site control sample in the facility's whole effluent toxicity tests. Between January 2001 and April 2009 survival of P. promelas exposed (7days) to the brook ranged from 0 to 100% (n=34) and was less than 75% in 5 of the 34 test events (April 05, April 06, April 08, and January and April 2009 with survivals of 28, 58, 33, 58, and 0%, respectively) representing 15% of the test events. An Alert Status is identified for this use due to evidence of ambient toxicity. *Data Sources: 7*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		
Primary Contact	**Not Assessed**	
Insufficient data were available to assess the *Primary Contact Recreational Use*.		
Secondary Contact	**Not Assessed**	
Insufficient data were available to assess the *Secondary Contact Recreational Use*.		
Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		

Monitoring Recommendations
Conduct additional bacteria monitoring to confirm the 303(d) listing for pathogens.
Conduct dissolved oxygen monitoring to evaluate diurnal variation by deploying multiprobes overnight.
Conduct additional biological and water quality monitoring to evaluate designated uses.

TADMUCK BROOK (SEGMENT MA84B-07)

Segment Description: Headwaters south of Main Street, Westford to confluence with Stony Brook, Westford.
Segment Length: 1.4 Miles
Segment Classification: B
2008 Integrated List of Waters: Not Listed
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Support**	**Yes**
In 2004, MassDEP DWM collected benthic macroinvertebrates and periphyton at one site (B0523). The RBP III score in comparison to the "reference" site indicated that the benthic macroinvertebrate community is "non-impacted". Backpack electrofishing by DWM biologists in August 2004 only resulted in the capture of 6 fish at one site (TA01). Habitat quality was only limited by the low flow conditions encountered. MassDEP DWM conducted monthly in-situ water quality monitoring at one site (W1201) on three occasions during July, August and September 2004. Parameters measured include dissolved oxygen, percent saturation, temperature, pH, total dissolved solids and conductivity. Early morning DO measurements (between 4:06 and 5:05am, n=3) and other water quality physico-chemical monitoring data were indicative of good water quality conditions. The maximum water temperature was 21.0℃. The *Aquatic Life Use* is assessed as support based on the "non-impacted" benthic macroinvertebrate community. An Alert Status is identified for this use due to the low number of fish. *Data Sources: 1, 2, 4, 19*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		
Primary Contact	**Impaired**	
In 2004, MassDEP DWM collected five E. coli samples at one site (W1201) during the primary contact season. The geometric mean of the five samples was 534 CFU/100ml. Based on this result violating the geometric mean criterion (126 CFU/100ml) for E. coli, the *Primary Contact Recreational Use* is assessed as impaired. **Cause(s) of Impairment:** Escherichia coli **Source(s) of Impairment:** Unspecified Urban Stormwater, Source Unknown *Data Sources: 2, 9, 17*		
Secondary Contact	**Support**	**Yes**
In 2004, MassDEP DWM collected five E. coli samples at one site (W1201). The geometric mean of the five samples was 534 CFU/100ml. Based on this result meeting the geometric mean criterion (630 CFU/100ml) for E. coli and the absence of frequent aesthetically objectionable conditions, the *Secondary Contact Recreational Use* is assessed as support. An Alert Status is identified for this use due to elevated bacteria during a wet weather sampling event. *Data Sources: 2, 9, 17*		

Aesthetics	Support	
In 2004, MassDEP DWM recorded field observations regarding aesthetics at one site (W1201). There were no field observations indicating prolonged or frequent occurences of objectionable deposits, odors, turbidity or color, floating scum, or overabundant growths of aquatic plants or algae. The *Aesthetics Use* is assessed as support. *Data Sources: 9, 17*		
Monitoring Recommendations		
Conduct additional bacteria monitoring to characterize the impairment and identify unknown sources.		

BENNETTS BROOK (SEGMENT MA84B-06)

Segment Description: Headwaters, north of Route 2, Harvard to the inlet of Spectacle Pond, Ayer/Littleton.
Segment Length: 4.3 Miles
Segment Classification: B
2008 Integrated List of Waters: Not Listed
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Support**	**Yes**
In 2004, MassDEP DWM collected benthic macroinvertebrates at one site (B0525). The RBP III score in comparison to the "reference" site indicated that the benthic macroinvertebrate community was "non-impacted". MassDEP DWM biologists also estimated canopy cover (30% open) as well as micro and macroalgal cover at this site (30 and 0% for both). In 2006, MA DFG biologists conducted backpack electrofishing at two sites (1605, 1643). All fish collected in the sample are macrohabitat generalists and moderately pollution tolerant. MassDEP DWM conducted monthly in-situ water quality monitoring at one site (W1200) on three occasions during July, August and September 2004. Parameters measured include dissolved oxygen, percent saturation, temperature, pH, total dissolved solids and conductivity. Early morning DO measurements (between 1:14 and 1:48am, n=3) and other water quality physico-chemical monitoring data were indicative of good water quality conditions. The maximum water temperature was 21.2℃. None of the dissolved oxygen, temperature, or pH measurements violated water quality criteria. The *Aquatic Life Use* is assessed as support based on the "non-impacted" benthic macroinvertebrate community. An Alert Status is identified for this use due to the lack of any fluvial fish species. *Data Sources: 1, 2, 15, 19*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		
Primary Contact	**Impaired**	
In 2004, MassDEP DWM collected five E. coli samples at one site (W1200) during the primary contact season. The geometric mean of the five samples was 397 CFU/100ml. Based on this result violating the geometric mean criterion (126 CFU/100ml) for E. coli, the *Primary Contact Recreational Use* is assessed as impaired. **Cause(s) of Impairment:** Escherichia coli **Source(s) of Impairment:** Wet Weather Discharges (Non-point), Source Unknown *Data Sources: 2, 9, 17*		

Secondary Contact	Support	Yes
In 2004, MassDEP DWM collected five E. coli samples at one site (W1200). The geometric mean of the five samples was 397 CFU/100ml. Based on this result meeting the geometric mean criterion (630 CFU/100ml) for E. coli and the absence of frequent aesthetically objectionable conditions, the *Secondary Contact Recreational Use* is assessed as support. An Alert Status is identified for this use due to elevated bacteria during a wet weather sampling event. *Data Sources: 2, 9, 17*		
Aesthetics	**Support**	
In 2004, MassDEP DWM recorded field observations regarding aesthetics at one site (W1200). There were no field observations indicating prolonged or frequent occurences of objectionable deposits, odors, turbidity or color, floating scum, or overabundant growths of aquatic plants or algae. The *Aesthetics Use* is assessed as support. *Data Sources: 9, 17*		
Monitoring Recommendations		
Conduct additional bacteria monitoring to characterize the impairment and identify unknown sources.		

STONY BROOK (SEGMENT MA84B-04)

Segment Description: Brookside Road, Westford to confluence with Merrimack River, Chelmsford.
Segment Length: 3.4 Miles
Segment Classification: B, WWF
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Cause Unknown, Nutrients, pH, Organic enrichment/Low DO, Pathogens).
NPDES Permits: Fletcher Granite Company (MA0020231)

Designated Use	Use Assessment	Alert
Aquatic Life	**Not Assessed**	
USGS from 1999 through 2004 measured dissolved oxygen, temperature, and pH 12 times and collected 11 total phosphorus, 14 chlorophyll-a (periphyton) and 11 ammonia samples from Stony Brook at School Street bridge in Chelmsford. None of the dissolved oxygen, temperature, or pH measurements violated water quality criteria. The total phosphorus concentrations ranged from 0.014 mg/L to 0.049 mg/L and the chlorophyll-a concentrations ranged from 2.2 mg/m2 to 84.2 mg/m2. In 2003, CDM measured dissolved oxygen, temperature, and pH 13 times and collected five total phosphorus and three chlorophyll-a (phytoplankton) samples at one site (T006) (See Special Note 2). None of the dissolved oxygen, temperature, or pH measurements violated water quality criteria. The total phosphorus concentrations ranged from 0.023 mg/L to 0.045 mg/L and the chlorophyll-a concentrations ranged from 0.4 ug/L to 3.7 ug/L. While water quality data are indicative of generally good conditions, due to a lack of pre-dawn (worse-case) dissolved oxygen data, the *Aquatic Life Use* is not assessed. *Data Sources: 3, 5*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		

Primary Contact	Impaired	
In 2003, CDM collected E. coli samples at one site (T006) (See Special Note 1). The geometric mean of the samples collected during the primary contact season was 535 CFU/100ml. Based on this result violating the geometric mean criterion (126 CFU/100ml) for E. coli, the *Primary Contact Recreational Use* is assessed as impaired. **Cause(s) of Impairment:** Escherichia coli **Source(s) of Impairment:** Unspecified Urban Stormwater, Source Unknown *Data Sources: 3*		
Secondary Contact	**Support**	**Yes**
In 2003, CDM collected E. coli samples at one site (T006) (See Special Note 1). The geometric mean of the samples was 535 CFU/100ml. Based on this result meeting the geometric mean criterion (630 CFU/100ml) for E. coli., the *Secondary Contact Recreational Use* is assessed as support. An Alert Status is identified for this use due to occasional spikes in E. coli concentrations particularly during wet weather conditions. *Data Sources: 3*		
Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		
Monitoring Recommendations		
Conduct additional bacteria monitoring to characterize the impairment and identify unknown sources. Conduct dissolved oxygen monitoring to evaluate diurnal variation by deploying multiprobes overnight. Conduct additional biological and water quality monitoring to evaluate designated uses.		

REED BROOK (SEGMENT MA84B-08)

Segment Description: Headwaters, south of the West Street Cowdry Hill Road intersection, Westford to the confluence with Stony Brook, Westford.
Segment Length: 0.6 Miles
Segment Classification: B
2008 Integrated List of Waters: Not Listed
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Support**	
In 2006, MA DFG collected fish at one site (1644). The sample was dominated by eastern brook trout (Salvelinus fontinalis), a fluvial specialist, pollution intolerant species. Of the 42 individual fish collected 39 were identified as eastern brook trout of varying size classes. The dominance of a reproducing eastern brook trout population indicates excellent water quality. The fisheries data indicate that cold water fishery is an existing use for this segment. The *Aquatic Life Use* is assessed as support based on the good fish community. *Data Sources: 15*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		
Primary Contact	**Not Assessed**	
Insufficient data were available to assess the *Primary Contact Recreational Use*.		

Secondary Contact	**Not Assessed**	
Insufficient data were available to assess the *Secondary Contact Recreational Use*.		
Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		
Monitoring Recommendations		
None		

BLACK BROOK (SEGMENT MA84A-17)

Segment Description: Headwaters, Chelmsford to confluence with Merrimack River, Lowell.
Segment Length: 2.3 Miles
Segment Classification: B
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Unknown toxicity, Siltation, Pathogens, Turbidity).
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Impaired**	
In 2004, MassDEP DWM collected benthic macroinvertebrates at one site (B0521). Habitat quality degradation was observed (marginal instream cover and velocity/depth combinations, as well as sediment deposition and substrate embeddedness resulting in suboptimal epifaunal substrate). The RBP III score in comparison to the "reference" site indicated that the benthic macroinvertebrate community was "moderately impacted". MassDEP DWM in 2004 and MA DFG in 2001 collected fish at the same site (511, BB05). Both samples contained low total fish abundance. MassDEP DWM collected 24 fish and MA DFG collected just four fish and fluvial species were almost absent. MassDEP DWM conducted monthly in-situ water quality monitoring at one site (W1191) on three occasions during July, August and September 2004. Parameters measured include dissolved oxygen, percent saturation, temperature, pH, total dissolved solids and conductivity. Early morning DO measurements (between 5:01 and 5:59am, n=3) and other water quality physico-chemical monitoring data were indicative of good water quality conditions although conductivity was higher than most sites. The maximum water temperature was 19.7℃. The *Aquatic Life Use* is assessed as impaired based on the "moderately impacted" benthic macroinvertebrate community, the low fish abundance and absence of fluvial species, and the degraded habitat quality conditions. Sources are unknown but habitat modification, unspecified urban stormwater runoff, and loss of riparian habitat are suspected. **Cause(s) of Impairment:** Aquatic Macroinvertebrate Bioassessments, Fishes Bioassessment, Physical Substrate Habitat Alterations **Source(s) of Impairment:** Source Unknown *Data Sources: 1, 2, 4, 15*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		

Primary Contact	**Impaired**	
In 2004, MassDEP DWM collected five E. coli samples at one site (W1191) during the primary contact season. The geometric mean of the five samples was 302 CFU/100ml. Based on this result violating the geometric mean criterion (126 CFU/100ml) for E. coli and the frequent aesthetically objectionable conditions observed, the *Primary Contact Recreational Use* is assessed as impaired. **Cause(s) of Impairment:** Escherichia coli, Debris/Floatables/Trash, Turbidity **Source(s) of Impairment:** Unspecified Urban Stormwater, Inappropriate Waste Disposal, Source Unknown *Data Sources: 2, 9, 17*		
Secondary Contact	**Impaired**	
In 2004, MassDEP DWM collected five E. coli samples at one site (W1191). The geometric mean of the five samples was 302 CFU/100ml. This result does not violate the geometric mean criterion (630 CFU/100ml) for E. coli however frequent aesthetically objectionable conditions (e.g., trash, turbidity, occasional sheens) were observed so the *Secondary Contact Recreational Use* is assessed as impaired. It should be noted that elevated bacteria during storm events is also a concern. **Cause(s) of Impairment:** Debris/Floatables/Trash, Turbidity **Source(s) of Impairment:** Inappropriate Waste Disposal, Source Unknown *Data Sources: 2, 9, 17*		
Aesthetics	**Impaired**	
In 2004, MassDEP DWM recorded field observations regarding aesthetics at one site (W1191). There were frequent observations of aesthetically objectionable conditions (primarily trash, turbidity and occasional sheens) throughout the summer. The *Aesthetics Use* is assessed as impaired. **Cause(s) of Impairment:** Debris/Floatables/Trash, Turbidity **Source(s) of Impairment:** Inappropriate Waste Disposal, Source Unknown *Data Sources: 9, 17*		
Monitoring Recommendations		
Conduct additional biological and water quality monitoring to characterize any impairments and identify unknown sources.		

MERRIMACK RIVER (SEGMENT MA84A-02)

Segment Description: Pawtucket Dam, Lowell to Lowell Regional Wastewater Utilities outfall at Duck Island, Lowell.
Segment Length: 3.2 Miles
Segment Classification: B\TWS, WWF, CSO
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Metals, Nutrients, (Flow alteration*), Pathogens). * denotes a non-pollutant.
NPDES Permits: Boott Hydropower, Inc. (MAG250950), Boott Hydropower, Inc. (MAG250163), Lowell Regional Wastewater Utilities (MA0100633)

Designated Use	Use Assessment	Alert
Aquatic Life	**Impaired**	
In 2003, CDM collected five total phosphorus samples and three chlorophyll-a samples from two sites (MO14, M015) (See Special Note 2). The total phosphorus concentrations ranged from 0.044 to 0.140 mg/L and the chlorophyll-a concentrations ranged from 0.5 to 42 ug/L at these sites. Water from the river is collected at the Hunts Falls Bridge for use as a site control for the Lowell Regional Wastewater Utilities modified acute and chronic whole effluent toxicity tests. Survival of C. dubia exposed (7-days) to river water was >90% for the tests conducted between April 2008 and April 2009 (n=5). The bypass reach of the Merrimack River downstream from the Pawtucket Dam through Pawtucket Falls to the confluence with the Lowell Project tailrace (0.7 miles) is periodically dry (during low flow conditions). The riverbed along the Pawtucket Falls reach is exposed when the flow is diverted solely through the Northern canal system. The *Aquatic Life Use* is assessed as impaired because of the flow alterations associated with the hydropower project in the upper 0.7 mile reach of the segment results in a dry channel. **Cause(s) of Impairment:** Low Flow Alteration **Source(s) of Impairment:** Impacts from Hydrostructure Flow Regulation/Modification *Data Sources: 3, 6, 7,*		
Fish Consumption	**Impaired**	
MA DPH has issued a fish consumption advisory due to mercury contamination for this portion of the Merrimack River. Children younger than 12 years of age, pregnant women, women of childbearing age who may become pregnant, and nursing mothers should not eat White Sucker or Largemouth Bass fish from this water body. The general public should limit consumption of White Sucker and Largemouth Bass to two meals per month. **Cause(s) of Impairment:** Mercury in Fish Tissue **Source(s) of Impairment:** Atmospheric Deposition - Toxics, Source Unknown *Data Sources: 10*		
Primary Contact	**Impaired**	
In 2003, CDM collected E. coli samples at two sites (MO14, M015) (See Special Note 1). The geometric means of the samples collected during the primary recreation season at each site were 141 and 351 CFU/100ml. Based on these results violating the geometric mean criterion (126 CFU/100ml) for E. coli, the *Primary Contact Recreational Use* is assessed as impaired. Six Lowell Regional Wastewater Utilities CSOs (Outfall 027 Tilden Street, Outfall 008 West Street, Outfall 011 Read Street, Outfall 030 (1 & 2) Merrimack River and Barasford Ave, and Outfall 012 First Street) also discharge to this segment. **Cause(s) of Impairment:** Escherichia coli **Source(s) of Impairment:** Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO), Source Unknown *Data Sources: 3*		

Secondary Contact	**Support**	**Yes**
In 2003, CDM collected E. coli samples at two sites (MO14, M015) (See Special Note 1). The geometric means of the samples collected at each site were 141 and 351 CFU/100ml. Based on this result meeting the geometric mean criterion (630 CFU/100ml) for E. coli and the absence of frequent aesthetically objectionable conditions, the *Secondary Contact Recreational Use* is assessed as support. An Alert Status is identified for this use due to occasional spikes in E. coli concentrations and the presence of six Lowell Regional Wastewater Utilities CSOs (Outfall 027 Tilden Street, Outfall 008 West Street, Outfall 011 Read Street, Outfall 030 (1 & 2) Merrimack River and Barasford Ave, and Outfall 012 First Street) that also discharge to this segment. *Data Sources: 3*		
Aesthetics	**Support**	
MassDEP DWM field staff did not note any frequent or prolonged objectionable conditions (e.g., odors, oils, growths, scums, deposits or turbidity) at two sampling locations (Oulette Bridge and Hunts Falls Bridge in Lowell) in this segment of the Merrimack River during sampling events conducted between June 2004 and September 2005. A slight oil sheen and some trash/debris were noted at the Hunts Falls Bridge sampling location on one occasion. The The *Aesthetics Use* is assessed as support. *Data Sources: 9, 24*		
Monitoring Recommendations		
Conduct additional biological monitoring to evaluate the impact of the flow alteration on the lower reaches of the segment. Conduct fish tissue toxics monitoring to evaluate the current fish consumption advisory. Conduct dissolved oxygen monitoring to evaluate diurnal variation by deploying multiprobes overnight.		

PEPPERMINT BROOK (SEGMENT MA84A-35)

Segment Description: Headwaters, outlet of unnamed pond east of Route 38, Dracut to confluence with Beaver Brook, Dracut.
Segment Length: 2.7 Miles
Segment Classification: B
2008 Integrated List of Waters: Not Listed
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Support**	**Yes**
In 2004, MassDEP DWM collected benthic macroinvertebrates at one site (B0520). The RBP III score in comparison to the "reference" site indicated that the benthic macroinvertebrate community was "slightly-impacted". Habitat quality was limited primarily by low flow conditions and limited velocity/depth combinations as well as some sediment deposition and poor bank stability/riparian zone particularly on one bank. In 2004, MassDEP DWM collected fish at one site (PE01A). Backpack electrofishing resulted in capture of 8 species although sampling efficiency was poor due to poor visibility (fine sediment in pools got stirred up during sampling). Three fluvial species were collected although yellow bullhead, a tolerant macrohabitat generalist, dominated the sample. MassDEP DWM biologists also estimated canopy cover (100% open) as well as micro and macroalgal cover in cobble/riffle at this site (80 and 0%, respectively). MassDEP DWM conducted monthly in-situ water quality monitoring at one site (W1211) on three occasions during July, August and September 2004. Parameters measured include dissolved oxygen, percent saturation, temperature, pH, total dissolved solids and conductivity. Early morning DO measurements (between 1:45 and 2:28am, n=3) ranged from 4.1 to 6.5 mg/L and was <5.0 mg/L on one occasion. The other limited physico-chemical monitoring data were indicative of good conditions. The maximum water temperature was 21.2℃. The *Aquatic Life Use* is assessed as support based on the "slightly impacted" benthic macroinvertebrate community. An Alert Status is identified for this use due to low dissolved oxygen and habitat quality conditions. *Data Sources: 1, 2, 4, 19*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		
Primary Contact	**Impaired**	
In 2004, MassDEP DWM collected five E. coli samples at one site (W1211) during the primary contact season. The geometric mean of the five samples was 644 CFU/100ml. Based on this result violating the geometric mean criterion (126 CFU/100ml) for E. coli and the frequent aesthetically objectionable conditions observed, the *Primary Contact Recreational Use* is assessed as impaired. **Cause(s) of Impairment:** Escherichia coli, Debris/Floatables/Trash **Source(s) of Impairment:** Unspecified Urban Stormwater Inappropriate Waste Disposal, Source Unknown *Data Sources: 2, 9, 17, 4*		
Secondary Contact	**Impaired**	
In 2004, MassDEP DWM collected five E. coli samples at one site (W1211). The geometric mean of the five samples was 644 CFU/100ml. Based on this result violating the geometric mean criterion (630 CFU/100ml) for E. coli and the frequent aesthetically objectionable conditions observed, the *Secondary Contact Recreational Use* is assessed as impaired. **Cause(s) of Impairment:** Escherichia coli, Debris/Floatables/Trash **Source(s) of Impairment:** Unspecified Urban Stormwater, Inappropriate Waste Disposal, Source Unknown *Data Sources: 2, 9, 17, 4*		

Aesthetics	Impaired	
In 2004, MassDEP DWM recorded field observations regarding aesthetics at one site (W1211). There were no field observations indicating prolonged or frequent occurences of objectionable odors, turbidity or color, floating scum, or overabundant growths of aquatic plants or algae. There were observations of extensive objectionable deposits in the form of trash. The *Aesthetics Use* is assessed as impaired. **Cause(s) of Impairment:** Debris/Floatables/Trash **Source(s) of Impairment:** Inappropriate Waste Disposal *Data Sources: 9, 17, 4*		
Monitoring Recommendations		
Conduct additional bacteria monitoring to characterize the impairment and identify unknown sources.		

BEAVER BROOK (SEGMENT MA84A-11)

Segment Description: New Hampshire state line, Dracut to confluence with Merrimack River, Lowell.
Segment Length: 4.8 Miles
Segment Classification: B, CWF
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Cause Unknown, (Other habitat alterations*), Pathogens, Oil and grease, Turbidity, (Objectionable deposits*)). * denotes a non-pollutant.
NPDES Permits: Lowell Regional Wastewater Utilities (MA0100633)

Designated Use	Use Assessment	Alert
Aquatic Life	**Not Assessed**	**Yes**
In 2004, MA DMF evaluated fish passage in the Merrimack basin. Substantial potential riverine anadromous fish habitat was identified in Beaver Brook but the Beaver Brook Dam as well as other obstructions on the lower brook prevent fish passage into available habitats. In 2003, CDM measured dissolved oxygen, temperature, and pH a total of 13 times and collected five total phosphorus and three chlorophyll-a (phytoplankton) samples at one site (T007). Limited water quality data indicate generally good conditions although one slightly low DO (4.9 mg/L) and seven of 13 temperature measurements exceeded the cold water criterion (20°C). The total phosphorus concentrations ranged from 0.022 to 0.210 mg/L and chlorophyll-a concentrations ranged from 0.1 ug/L to 13.2 ug/L. An Alert Status is identified for this use due to fish migration barriers, elevated temperature, and elevated total phosphorus concentrations. *Data Sources: 3, 8*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		
Primary Contact	**Impaired**	
In 2003, CDM collected E. coli samples at one site (T007) during the primary contact season (See Special Note 1). The geometric mean of the samples was 317 CFU/100ml. Based on this result violating the geometric mean criterion (126 CFU/100ml) for E. coli, the *Primary Contact Recreational Use* is assessed as impaired. Elevated counts were only documented during wet weather conditions. One Lowell Regional Wastewater Utilities CSO (Outfall 007 Beaver Brook) also discharges near the downstream end of this segment. **Cause(s) of Impairment:** Escherichia coli **Source(s) of Impairment:** Unspecified Urban Stormwater, Source Unknown *Data Sources: 3*		

Secondary Contact	Support	Yes
In 2003, CDM collected E. coli samples at one site (T007) (See Special Note 1). The geometric mean of the samples was 317 CFU/100ml. Based on this result meeting the geometric mean criterion (630 CFU/100ml) for E. coli., the *Secondary Contact Recreational Use* is assessed as support. An Alert Status is identified for this use due to occasional spikes in E. coli concentrations. One Lowell Regional Wastewater Utilities CSO (Outfall 007 Beaver Brook) also discharges near the downstream end of this segment. *Data Sources: 3*		
Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		
Monitoring Recommendations		
Conduct additional bacteria monitoring to characterize the impairment and identify unknown sources. Conduct biological (macroinvertebrates) monitoring to evaluate the *Aquatic Life Use*. Conduct dissolved oxygen monitoring to evaluate diurnal variation by deploying multiprobes overnight.		

MERRIMACK RIVER (SEGMENT MA84A-03)

Segment Description: Lowell Regional Wastewater Utilities outfall at Duck Island, Lowell to Essex Dam, Lawrence.
Segment Length: 8.8 Miles
Segment Classification: B\TWS, WWF, CSO
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Priority organics, Metals, Nutrients, Pathogens).
NPDES Permits: Lowell Regional Wastewater Utilities (MA0100633), Brox Industries, Inc. (MA0040177)

Designated Use	Use Assessment	Alert
Aquatic Life	**Not Assessed**	**Yes**
In 2003, CDM collected five total phosphorus samples and three chlorophyll-a samples from three sites (M016, M017, M018) (See Special Note 2). The total phosphorus concentrations ranged from 0.056 to 0.180 mg/L and chlorophyll-a concentrations ranged from 2.6 to 23.2 µg/L at these sites. MassDEP DWM staff deployed a multiprobe meter in the river upstream from the Essex Dam for two days in August 2004. The DO and temperature measurements all met standards (DO ranged from 6.2 to 7.6 mg/L and the maximum temperature 24.5℃). Insuffic ient data were available to assess the Aquatic Life use. An Alert Status is identified for this use due to elevated total phosphorus and occasional elevated chlorohpyll-a concentrations. *Data Sources: 3*		
Fish Consumption	**Impaired**	
MA DPH has issued a fish consumption advisory due to mercury contamination for this portion of the Merrimack River. Children younger than 12 years of age, pregnant women, women of childbearing age who may become pregnant, and nursing mothers should not eat White Sucker or Largemouth Bass fish from this water body. The general public should limit consumption of White Sucker and Largemouth Bass to two meals per month. **Cause(s) of Impairment:** Mercury in Fish Tissue **Source(s) of Impairment:** Atmospheric Deposition - Toxics, Source Unknown *Data Sources: 10*		

Primary Contact	Impaired	
In 2008, MRWA collected E.coli samples at seven sites (37.9, 36.3, 35.1, 33.4, 32.2, 31.4, 29.6). The geometric means of the samples collected during the primary contact season at each site ranged from 20.2 CFU/100ml to 41.0 CFU/100ml. In 2003, CDM collected E. coli samples at three sites (M016, M017, M018) (See Special Note 1). Only one site (M017) had the minimum number of samples (5) required to determine compliance with the water quality criteria. The geometric mean of the samples collected during the primary contact season at this site was 721 CFU/100ml. Based on the CDM result violating the geometric mean criterion (126 CFU/100ml) for E. coli, the *Primary Contact Recreational* Use is assessed as impaired. **Cause(s) of Impairment:** Escherichia coli **Source(s) of Impairment:** Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO), Source Unknown *Data Sources: 3, 25*		
Secondary Contact	**Impaired**	
In 2008, MRWA collected E.coli samples at seven sites (37.9, 36.3, 35.1, 33.4, 32.2, 31.4, 29.6). The geometric means of the samples collected at each site ranged from 20.2 CFU/100ml to 41.0 CFU/100ml. In 2003, CDM collected E. coli samples at three sites (M016, M017, M018) (See Special Note 1). Only one site (M017) had the minimum number of samples (5) required to determine compliance with the water quality criteria. The geometric mean of the samples at this site was 721 CFU/100ml. Based on the CDM result violating the geometric mean criterion (630 CFU/100ml) for E. coli, the *Secondary Contact Recreational Use* is assessed as impaired. **Cause(s) of Impairment:** Escherichia coli **Source(s) of Impairment:** Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO), Source Unknown *Data Sources: 3, 25*		
Aesthetics	**Support**	**Yes**
MassDEP DWM field staff did not note any frequent or prolonged objectionable conditions (e.g., odors, oils, growths, scums, deposits or turbidity) in this segment of the Merrimack River (sites sampled more than once included River Road in Lowell, Haverhill Street in Dracut, above Pine Island in Methuen, between Route 93 and Methuen intake in Methuen, and between Lawrence and Methuen intake in Lawrence) during sampling events conducted between October 2004 and September 2005. Odors, slight oil sheens and some trash/debris were noted at the River Road in Lowell, Haverhill Street in Dracut sampling sites on occasion but none of these conditions were noted downstream. It should be noted however that the USACOE study included surveys by Normandeau Associates in November and December 2002 to identify areas of erosion along the Merrimack River greater than approximately 50-feet in length. Several problem areas were identified during this field reconnaissance effort in this segment of the river. The *Aesthetics Use* is assessed as support but is identified with an Alert Status based on the areas identified and concern regarding erosion/turbidity. *Data Sources: 9, 23, 24*		
Monitoring Recommendations		
Conduct fish tissue toxics monitoring to evaluate the current fish consumption advisory. Conduct dissolved oxygen monitoring to evaluate diurnal variation by deploying multiprobes overnight.		

RICHARDSON BROOK (SEGMENT MA84A-12)

Segment Description: Headwaters, Dracut (excluding intermittent portion) to confluence with Merrimack River, Dracut.
Segment Length: 1.9 Miles
Segment Classification: B
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant ((Other habitat alterations*)). * denotes a non-pollutant.
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Support**	**Yes**
In 2004, MassDEP DWM collected benthic macroinvertebrates at one site (B0306). The RBP III score in comparison to the "reference" site indicated that the benthic macroinvertebrate community was "slightly-impacted". Habitat quality was limited primarily by limited velocity/depth combinations and the poor riparian vegetative zone width along one bank near the sampling location. In 2004, MassDEP DWM collected fish at one site (RBR01A). During this sampling the channel flow status was limited. Only two species were collected in the sample . MassDEP DWM biologists also sampled both closed and open canopy cover sites (0 and 70% open, respectively) with microalgal cover estimated at 20 and 30% and macroalgal cover estimated at 0 and 10% in the closed and open cobble/riffle habitats, respectively. MassDEP DWM conducted monthly in-situ water quality monitoring at one site (W1192) on three occasions during July, August and September 2004. Parameters measured include dissolved oxygen, percent saturation, temperature, pH, total dissolved solids and conductivity. Early morning DO measurements (between 2:31 and 3:36am, n=3) ranged from 5.6 to 7.6 mg/L and the other limited physico-chemical monitoring data were indicative of good conditions. The maximum water temperature was 22.6℃. The *Aquatic Life Use* is assessed as support based on the "slightly impacted" benthic macroinvertebrate community. An Alert Status is identified for this use due to the lack of fluvial fish other than redfin pickerel as well as the low number of fish. *Data Sources: 1, 2, 4, 19*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		
Primary Contact	**Impaired**	
In 2004, MassDEP DWM collected five E. coli samples at one site (W1192) during the primary contact season. The geometric mean of the five samples was 162 CFU/100ml. Based on this result violating the geometric mean criterion (126 CFU/100ml) for E. coli, the *Primary Contact Recreational Use* is assessed as impaired. The high counts were collected during wet weather conditions. **Cause(s) of Impairment:** Escherichia coli **Source(s) of Impairment:** Unspecified Urban Stormwater, Source Unknown *Data Sources: 2, 9, 17*		
Secondary Contact	**Support**	**Yes**
In 2004, MassDEP DWM collected five E. coli samples at one site (W1192). The geometric mean of the five samples was 162 CFU/100ml. Based on this result meeting the geometric mean criterion (630 CFU/100ml) for E. coli and the absence of frequent aesthetically objectionable conditions, the *Secondary Contact Recreational Use* is assessed as support. An Alert Status is identified for this use due to elevated bacteria during a wet weather sampling event. *Data Sources: 2, 9, 17*		

Aesthetics	Support	
In 2004, MassDEP DWM staff recorded field observations regarding aesthetics at one site (W1192). There were no field observations indicating prolonged or frequent occurences of objectionable deposits, odors, turbidity or color, floating scum, or overabundant growths of aquatic plants or algae. The *Aesthetics Use* is assessed as support. *Data Sources: 9, 17*		
Monitoring Recommendations		
Conduct additional bacteria monitoring to characterize the impairment and identify unknown sources.		

TROUT BROOK (SEGMENT MA84A-13)

Segment Description: Headwaters, Dracut to confluence with Richardson Brook, Dracut.
Segment Length: 2.6 Miles
Segment Classification: B
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Not Assessed**	**Yes**
In 2004, MassDEP DWM collected fish at one site (TRB02). Habitat quality was noted to be limited most by sediment deposition, the marginal channel flow status which also limited velocity/depth combinations and the limited riparian vegetative zone width. The fish sample contained only 21 individuals and one species, redfin pickerel. In 2006 MA DFG collected fish at two sites (1607, 1608). Both samples had less than ten individuals and were dominated by macrohabitat generalists. It should be noted that during a survey conducted in the summer of 1990, MassDEP DWM collected multiple age classes of native brook trout from the brook near Kenwood Street. MassDEP DWM conducted monthly in-situ water quality monitoring at one site (W1193) on three occasions during July, August and September 2004. Parameters measured include dissolved oxygen, percent saturation, temperature, pH, total dissolved solids and conductivity. Early morning DO measurements (between 02:12 and 03:04am, n=3) ranged from 7.7 to 7.9 mg/L and the other limited physico-chemical monitoring data were indicative of excellent conditions. The maximum water temperature was 17.2℃. An Alert Status is identified for this use due to the low numbers and diversity of fish and the concerns related to habitat quality conditions (e.g., sediment deposition and limited flow regimes) and the absence of brook trout. *Data Sources: 2, 4, 15*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		
Primary Contact	**Impaired**	
In 2004, MassDEP DWM collected five E. coli samples at one site (W1193) during the primary contact season. The geometric mean of the five samples was 353 CFU/100ml. Based on this result violating the geometric mean criterion (126 CFU/100ml) for E. coli, the *Primary Contact Recreational Use* is assessed as impaired. **Cause(s) of Impairment:** Escherichia coli **Source(s) of Impairment:** Unspecified urban stormwater, Source Unknown *Data Sources: 2, 9*		

Secondary Contact	Support	Yes
In 2004, MassDEP DWM collected five E. coli samples at one site (W1193). The geometric mean of the five samples was 353 CFU/100ml. Based on this result meeting the geometric mean criterion (630 CFU/100ml) for E. coli and the absence of frequent aesthetically objectionable conditions, the *Secondary Contact Recreational Use* is assessed as support. An Alert Status is identified for this use due to elevated bacteria during a wet weather sampling event. *Data Sources: 2, 9*		
Aesthetics	**Support**	
In 2004, MassDEP DWM field crews recorded field observations regarding aesthetics at one site (W1193). There were no field observations indicating prolonged or frequent occurences of objectionable deposits, odors, turbidity or color, floating scum, or overabundant growths of aquatic plants or algae. The *Aesthetics Use* is assessed as support. *Data Sources: 9*		
Monitoring Recommendations		
Conduct additional bacteria monitoring to characterize the impairment and identify unknown sources.		

TRULL BROOK (SEGMENT MA84A-14)

Segment Description: Source, Tewksbury (excluding intermittent portion) to confluence with Merrimack River, Tewksbury.
Segment Length: 2.1 Miles
Segment Classification: B
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Support**	**Yes**
In 2004, MassDEP DWM collected benthic macroinvertebrates at one site (B0308) and fish at one site (TB02). The RBP III score in comparison to the "reference" site indicated that the benthic macroinvertebrate community was "slightly impacted". Habitat quality was generally good but was limited primarily by the marginal channel flow as well as some sediment deposition and marginal bank stability/riparian zone particularly on one bank. An erosion channel originating at a storm drain at River Road was noted as a concern. Backpack electrofishing resulted in the capture of four species and only 13 individuals but was dominated by fluvial dependants. DWM biologists also estimated canopy cover (35% open) as well as micro and macroalgal cover in cobble/riffle at this site (80 and 0%, respectively). In-situ water quality monitoring at one site (W1194) was conducted by MassDEP DWM in July, August, and September 2004. Multiprobe samplers deployed in the brook recorded temperature and DO. The minimum DO measurement was 6.6 mg/L (23 hours of deployment on 6/7 July and 43 hours 30 minutes of deployment 16 to 18 August) and the maximum temperature was 21.9℃ (23 hours of deployment on 6/7 July, 43 hours 30 minutes from 16 to 18 August, and 43 hours 15 minutes of deployment from 7 to 9 September). The *Aquatic Life Use* is assessed as support based on the "slightly impacted" benthic macroinvertebrate community. An Alert Status is identified for this use due to the low number of fish. *Data Sources: 1, 2, 4, 19*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		

Primary Contact	**Impaired**	
In 2004, MassDEP DWM collected five E. coli samples at one site (W1194) during the primary contact season. The geometric mean of the samples was 740 cfu/100 mL. Based on this result violating the geometric mean criterion (126 CFU/100ml) for E. coli, the *Primary Contact Recreational Use* is assessed as impaired. Although source(s) of bacteria are unknown, geese/droppings were identified in the vicinity of the sampling location. **Cause(s) of Impairment:** Escherichia coli **Source(s) of Impairment:** Unspecified urban stormwater, Source Unknown *Data Sources: 2, 9, 17*		
Secondary Contact	**Impaired**	
In 2004, MassDEP DWM collected five E. coli samples at one site (W1194). The geometric mean of the sample was 740 cfu/100 mL. Based on this result violating the geometric mean criterion (630 CFU/100ml) for E. coli, the *Secondary Contact Recreational Use* is assessed as impaired. It should also be noted that the extremely high count was associated with a storm event. Although source(s) of bacteria are unknown, geese/droppings were identified in the vicinity of the sampling location. **Cause(s) of Impairment:** Escherichia coli **Source(s) of Impairment:** Unspecified urban stormwater, Source Unknown *Data Sources: 2, 9, 17*		
Aesthetics	**Support**	
In 2004, MassDEP DWM recorded field observations in Trull Brook (W1194) downstream from River Road in Tewskbury. There were no field observations indicating prolonged or frequent occurences of objectionable deposits, odors, turbidity or color, floating scum, or overabundant growths of aquatic plants or algae. The *Aesthetics Use* is assessed as support. *Data Sources: 9, 17*		
Monitoring Recommendations		
Conduct additional bacteria monitoring to characterize the impairment and identify unknown sources.		

BARTLETT BROOK (SEGMENT MA84A-36)

Segment Description: New Hampshire state line, Dracut to inlet Mill Pond, Methuen.
Segment Length: 3.7 Miles
Segment Classification: B
2008 Integrated List of Waters: Not Listed
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Support**	**Yes**
In 2004, MassDEP DWM collected benthic macroinvertebrates at one site (B0519) and fish at one site (BA01A). Habitat quality was limited by the marginal channel flow status and lack of velocity/depth combinations, evidence of erosion and deposition, as well as a limited riparian vegetative zone width along one bank in the sampling reach. The RBP III score in comparison to the "reference" site indicated that the benthic macroinvertebrate community was "slightly/non-impacted". Six species of fish (28 individuals) were collected in the sample. Yellow bullhead, a pollution tolerant macrohabitat generalist, dominated the sample. MassDEP DWM biologists also estimated canopy cover (0% open) as well as micro and macroalgal cover in cobble/riffle at this site (~10 and 0%, respectively). MassDEP DWM conducted monthly in-situ water quality at one site (W1202) on three occasions during July, August and September 2004. Parameters measured include dissolved oxygen, percent saturation, temperature, pH, total dissolved solids and conductivity. Early morning DO measurements (between 03:01 and 03:55am, n=3) ranged from 6.8 to 7.9 mg/L and the other limited physico-chemical monitoring data were indicative of good conditions. The maximum water temperature was 20.9℃. The *Aquatic Life Use* is assessed as support based on the "slightly/non-impacted" benthic macroinvertebrate community. An Alert Status is identified for this use due the relatively low number of fluvial fish and habitat quality concerns related to flow and erosion/deposition problems. *Data Sources: 1, 2, 4, 19*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		
Primary Contact	**Impaired**	
In 2004, MassDEP DWM collected five E. coli samples at one site (W1202) during the primary contact season. The geometric mean of the five samples was 344 CFU/100ml . Based on this result violating the geometric mean criterion (126 CFU/100ml) for E. coli, the *Primary Contact Recreational Use* is assessed as impaired. **Cause(s) of Impairment:** Escherichia coli **Source(s) of Impairment:** Unspecified urban stormwater, Source Unknown *Data Sources: 2, 9, 17*		
Secondary Contact	**Support**	
In 2004, MassDEP DWM collected five E. coli samples at one site (W1202). The geometric mean of the five samples was 344 CFU/100ml. Based on this result meeting the geometric mean criterion (630 CFU/100ml) for E. coli and the absence of frequent aesthetically objectionable conditions, the *Secondary Contact Recreational Use* is assessed as support. *Data Sources: 2, 9, 17*		
Aesthetics	**Support**	
In 2004, MassDEP DWM recorded field observations regarding aesthetics at one site (W1202). There were no field observations indicating prolonged or frequent occurences of objectionable deposits, odors, turbidity or color, floating scum, or overabundant growths of aquatic plants or algae. The *Aesthetics Use* is assessed as support. *Data Sources: 9, 17*		

Monitoring Recommendations
Conduct additional bacteria monitoring to characterize the impairment and identify unknown sources.

FISH BROOK (SEGMENT MA84A-40)

Segment Description: Headwaters, east of Greenwood Road, Andover to confluence with Merrimack River at Fish Brook Dam, Andover.
Segment Length: 4.1 Miles
Segment Classification: A\PWS\ORW
2008 Integrated List of Waters: Not Listed
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Support**	**Yes**
In 2004, MassDEP DWM collected benthic macroinvertebrates at one site (B0517) and fish at two sites (FI01, FI01A). Habitat quality appeared to be most limited by the marginal channel flow status. The RBP III analysis in comparison to the "reference" site indicated that the benthic macroinvertebrate community was "non- impacted". The total number of fish collected was very low although high flows decreased sampling efficiency. Both fish samples were dominated by fluvial specialists. MassDEP DWM biologists also estimated canopy cover (0% open) as well as micro and macroalgal cover in a pool habitat at this site (90 and 0%, respectively). MassDEP DWM conducted monthly in-situ water quality monitoring at one site (W1206) on three occasions in July, August and September 2004. Parameters measured include dissolved oxygen, percent saturation, temperature, pH, total dissolved solids and conductivity. Early morning DO measurements (between 1:13 and 1:43am, n=3) were extremely low ranging from 1.2 to 1.9 mg/L although upstream wetlands likely contribute to these conditions. It should also be noted that conductivity was fairly high and is of concern particularly given the major highways/interchange and salt storage activities in this public water supply watershed area . The maximum water temperature was 22.7℃. and condu ctivity was fairly high. The *Aquatic Life Use* is assessed as support based on the "non-impacted" benthic macroinvertebrate community. An Alert Status is identified for this use due to low dissolved oxygen, elevated conductivity and the low number of fish despite excellent habitat quality. *Data Sources: 1, 2, 4, 19*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		
Primary Contact	**Impaired**	
In 2004, MassDEP DWM collected five E. coli samples at one site (W1206) during the primary contact season. The geometric mean of the five samples was 162 CFU/100ml. Based on this result violating the geometric mean criterion (126 CFU/100ml) for E. coli, the *Primary Contact Recreational Use* is assessed as impaired. **Cause(s) of Impairment:** Escherichia coli **Source(s) of Impairment:** Source Unknown *Data Sources: 2, 9, 17*		
Secondary Contact	**Support**	
In 2004, MassDEP DWM collected five E. coli samples at one site (W1206). The geometric mean of the five samples was 162 CFU/100ml. Based on this result meeting the geometric mean criterion (630 CFU/100ml) for E. coli and the absence of frequent aesthetically objectionable conditions, the *Secondary Contact Recreational Use* is assessed as support. *Data Sources: 2, 9, 17*		

Aesthetics	Support	
In 2004, MassDEP DWM recorded field observations regarding aesthetics at one site (W1206). There were no field observations indicating prolonged or frequent occurences of objectionable deposits, odors, turbidity or color, floating scum, or overabundant growths of aquatic plants or algae. The *Aesthetics Use* is assessed as support. *Data Sources: 9, 17*		
Monitoring Recommendations		
Conduct additional bacteria monitoring to characterize the impairment and identify unknown sources.		

MERRIMACK RIVER (SEGMENT MA84A-04)

Segment Description: Essex Dam, Lawrence to confluence with Little River, Haverhill.
Segment Length: 10.0 Miles
Segment Classification: B, CSO
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Priority organics, Nutrients, Pathogens).
NPDES Permits: Boott Hydropower, Inc. (MAG250948), Greater Lawrence Sanitary District (MA0100447), City of Haverhill Wastewater Division (MA0101621), Lucent Technologies, Inc. (MA0001261)

Designated Use	Use Assessment	Alert
Aquatic Life	**Support**	**Yes**
In 2003, CDM measured dissolved oxygen, temperature, and pH a total of 26 times and collected ten total phosphorus and six chlorophyll-a (phytoplankton) samples at three sites in (M019, M021, M022) (See Special Note 2). None of the dissolved oxygen, temperature, or pH measurements violated water quality criteria. The total phosphorus concentrations ranged from 0.071 to 0.150 mg/L and the chlorophyll-a concentrations ranged from 2.3 to 23.0 ug/L. Water from the Merrimack River was collected at the Route 495 (O'Reilly Bridge) in Lawrence for use as dilution water in the Greater Lawrence Sanitary District's whole effluent toxicity tests. Survival of C. dubia exposed (7-day) to the river water was > 80% with the exception of the August 2002 test event when survival was 60% (n=37). The *Aquatic Life Use* is assessed as support for this segment of the river based primarily on the good survival of test organisms. An Alert Status is identified for this use due to elevated total phosphorus and occasionally chlorophyll-a concentrations. *Data Sources: 3, 7*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4). *Data Sources: 10*		

Primary Contact	**Impaired**	
In 2008, MRWA collected E.coli samples at five sites (29.1, 28.2, 26.9, 25.6, 22.3). The geometric means of the samples collected during the primary contact season at each site ranged from 93.3 CFU/100ml to 151.9 CFU/100ml. In 2003, CDM collected E. coli samples at three sites (M019, M021, M022) (See Special Note 1). Only two of the sites (M019 and M022) had the minimum number of samples (5) required to determine compliance with the water quality criteria. The geometric means of the samples collected during the primary contact season at these sites were 666 CFU/100ml (M019) and 215 CFU/100ml (M022). Based on the CDM and MRWA results violating the geometric mean criterion (126 CFU/100ml) for E. coli, the *Primary Contact Recreational Use* is assessed as impaired. Highest counts were representative of wet weather sampling conditions. **Cause(s) of Impairment:** Escherichia coli **Source(s) of Impairment:** Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO), Source Unknown *Data Sources: 3, 25*		
Secondary Contact	**Impaired**	
In 2008, MRWA collected E.coli samples at five sites (29.1, 28.2, 26.9, 25.6, 22.3). The geometric means of the samples collected during at each site ranged from 93.3 CFU/100ml to 151.9 CFU/100ml. In 2003, CDM collected E. coli samples at three sites (M019, M021, M022) (See Special Note 1). Only two of the sites (M019 and M022) had the minimum number of samples (5) required to determine compliance with the water quality criteria. The geometric means of the samples collected during the primary contact season at these sites were 666 CFU/100ml (M019) and 215 CFU/100ml (M022). Based on the CDM results violating the geometric mean criterion (630 CFU/100ml) for E. coli, the *Secondary Contact Recreational Use* is assessed as impaired. Highest counts were representative of wet weather sampling conditions. **Cause(s) of Impairment:** Escherichia coli **Source(s) of Impairment:** Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO), Source Unknown *Data Sources: 3, 25*		
Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		
Monitoring Recommendations		
None		

SPICKET RIVER (SEGMENT MA84A-10)

Segment Description: New Hampshire state line, Methuen to confluence with Merrimack River, Lawrence.
Segment Length: 5.8 Miles
Segment Classification: B, WWF
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Cause Unknown, Metals, Nutrients, (Other habitat alterations*), Pathogens, (Objectionable deposits*)). * denotes a non-pollutant.
NPDES Permits: GenCorp, Inc. (MAG910424), Greater Lawrence Sanitary District (MA0100447)

Designated Use	Use Assessment	Alert
Aquatic Life	**Not Assessed**	**Yes**
In 2004, MA DMF evaluted fish passage in the Merrimack River basin. American Shad has been observed at the mouth of the Spicket River but the Spicket River Dam obstructs the passage of anadromous fish upstream. In 2003, CDM measured dissolved oxygen, temperature, and pH a total of 12 times and collected five total phosphorus and three chlorophyll-a (phytoplankton) samples at one site (T009) (See Special Note 2). Dissolved oxygen and pH measurements were slightly low on one occasion each. The total phosphorus concentrations ranged from 0.049 to 0.360 mg/L and the chlorophyll-a concentrations ranged from 0.7 to 7.4 ug/L. The *Aquatic Life Use* is not assessed (too limited data). An Alert Status is identified for this use due to elevated total phosphorus concentrations and the barrier to fish migration. *Data Sources: 3, 8*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		
Primary Contact	**Impaired**	
In 2003, CDM collected E. coli samples at one site (T009) (See Special Note 1). The geometric mean of the samples collected during the primary contact season was 9404 CFU/100ml. Based on this result violating the geometric mean criterion (126 CFU/100ml) for E. coli, the *Primary Contact Recreational Use* is assessed as impaired. **Cause(s) of Impairment:** Escherichia coli **Source(s) of Impairment:** Unspecified urban stormwater, Source Unknown *Data Sources: 3*		
Secondary Contact	**Impaired**	
In 2003, CDM collected E. coli samples at one site (T009) (See Special Note 1). The geometric mean of the samples was 9404 CFU/100ml. Based on this result violating the geometric mean criterion (630 CFU/100ml) for E. coli, the *Secondary Contact Recreational Use* is assessed as impaired. **Cause(s) of Impairment:** Escherichia coli **Source(s) of Impairment:** Unspecified urban stormwater, Source Unknown *Data Sources: 3*		
Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		
Monitoring Recommendations		
Conduct additional bacteria monitoring to characterize the impairment and identify unknown sources. Conduct biological (macroinvertebrates) monitoring to evaluate the *Aquatic Life Use*. Conduct dissolved oxygen monitoring to evaluate diurnal variation by deploying multiprobes overnight.		

BARE MEADOW BROOK (SEGMENT MA84A-18)

Segment Description: Headwaters, Methuen to confluence with Merrimack River, Methuen.
Segment Length: 3.0 Miles
Segment Classification: B
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Siltation, Organic enrichment/Low DO, Pathogens, Turbidity).
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Support**	
In 2004, MassDEP DWM collected fish at one site (BMB01A). The sample was dominated by moderately pollution tolerant fluvial species. DWM conducted monthly in-situ water quality monitoring at one site (W1195) on three occasions during July, August and September 2004. Parameters measured include dissolved oxygen, percent saturation, temperature, pH, total dissolved solids and conductivity . Early morning DO measurements (between 3:36 and 4:33am, n=3) and other water quality physico-chemical monitoring data were indicative of good water quality conditions. The maximum water temperature was 23.5℃ . The *Aquatic Life Use* is assessed as support based on the available water quality data. *Data Sources: 2, 4*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		
Primary Contact	**Impaired**	
In 2004, MassDEP DWM collected five E. coli samples at one site (W1195) during the primary contact season. The geometric mean of the five samples was 323 CFU/100ml. Based on this result violating the geometric mean criterion (126 CFU/100ml) for E. coli, the *Primary Contact Recreational Use* is assessed as impaired. **Cause(s) of Impairment:** Escherichia coli **Source(s) of Impairment:** Unspecified urban stormwater, Source Unknown *Data Sources: 2, 9*		
Secondary Contact	**Support**	**Yes**
In 2004, MassDEP DWM collected five E. coli samples at one site (W1195). The geometric mean of the five samples was 323 CFU/100ml. Based on this result meeting the geometric mean criterion (630 CFU/100ml) for E. coli and the absence of frequent aesthetically objectionable conditions, the *Secondary Contact Recreational Use* is assessed as support. An Alert Status is identified for this use due to an elevated E. coli count during a wet weather sampling event. *Data Sources: 2, 9*		
Aesthetics	**Support**	
In 2004, MassDEP DWM recorded field observations regarding aesthetics at one site (W1195). There were no field observations indicating prolonged or frequent occurences of objectionable deposits, odors, turbidity or color, floating scum, or overabundant growths of aquatic plants or algae. The *Aesthetics Use* is assessed as support. *Data Sources: 9*		
Monitoring Recommendations		
Conduct additional bacteria monitoring to characterize the impairment and identify unknown sources.		

CREEK BROOK (SEGMENT MA84A-37)

Segment Description: Headwaters, outlet Crystal Lake, Haverhill to confluence with Merrimack River, Haverhill.
Segment Length: 2.3 Miles
Segment Classification: B
2008 Integrated List of Waters: Not Listed
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Support**	
In 2004, MassDEP DWM collected benthic macroinvertebrates at one site (B0518) and fish at one site (CR01). The RBP III score in comparison to the "reference" site indicated that the benthic macroinvertebrate community was "slightly-impacted". Habitat quality during the benthic survey was limited primarily by low flow conditions which affected instream cover, velocity-depth combinations, and channel flow status. Flow conditions were not low during the fish population survey (14 August). Backpack electrofishing resulted in capture of 7 species (44 individuals); and three most dominant species are considered to be tolerant to moderately tolerant "fluvial" species. MassDEP DWM biologists also estimated canopy cover (0% open) as well as micro and macroalgal cover in cobble/riffle at this site (25 and 0%, respectively). MassDEP DWM conducted monthly in-situ water quality at one site (W1203) on three occasions during July, August and September 2004. Parameters measured include dissolved oxygen, percent saturation, temperature, pH, total dissolved solids and conductivity. Early morning DO measurements (between 3:57 and 4:52am, n=3) ranged from 7.8 to 8.7 mg/L . The other limited physico-chemical monitoring data were indicative of good conditions. The maximum water temperature was 19.6℃. The *Aquatic Life Use* is assessed as support based on the "slightly impacted" benthic macroinvertebrate community. *Data Sources: 1, 2, 4, 19*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		
Primary Contact	**Impaired**	
In 2004, MassDEP DWM collected five E. coli samples at one site (W1203) during the primary contact season. The geometric mean of the five samples was 331 CFU/100ml. Based on this result violating the geometric mean criterion (126 CFU/100ml) for E. coli, the *Primary Contact Recreational Use* is assessed as impaired. **Cause(s) of Impairment:** Escherichia coli **Source(s) of Impairment:** Unspecified urban stormwater, Source Unknown *Data Sources: 2, 9, 17*		
Secondary Contact	**Support**	**Yes**
In 2004, MassDEP DWM collected five E. coli samples at one site (W1203). The geometric mean of the five samples was 331 CFU/100ml. Based on this result meeting the geometric mean criterion (630 CFU/100ml) for E. coli and the absence of frequent aesthetically objectionable conditions, the *Secondary Contact Recreational Use* is assessed as support. An Alert Status is identified for this use due to elevated bacteria during a wet weather sampling event. *Data Sources: 2, 9, 17*		

Aesthetics	Support	
In 2004, MassDEP DWM recorded field observations regarding aesthetics at one site (W1203). There were no field observations indicating prolonged or frequent occurences of objectionable deposits, odors, turbidity or color, floating scum, or overabundant growths of aquatic plants or algae. The *Aesthetics Use* is assessed as support. *Data Sources: 9, 17*		
Monitoring Recommendations		
Conduct additional bacteria monitoring to characterize the impairment and identify unknown sources.		

MERRIMACK RIVER (SEGMENT MA84A-05)

Segment Description: Confluence Little River, Haverhill to confluence Indian River, West Newbury/Amesbury.
Segment Length: 1.8 Square Miles
Segment Classification: SB, CSO, Shellfishing
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Priority organics, Pathogens).
NPDES Permits: City of Haverhill Wastewater Division (MA0101621), Haverhill Paperboard Corp. (MAG250961), Town of Merrimac (MA0101150)

Designated Use	Use Assessment	Alert
Aquatic Life	**Support**	**Yes**
In 2003, CDM collected eight total phosphorus and six chlorophyll-a (phytoplankton) samples at two sites (M024, M025) (See Special Note 2). The total phosphorus concentrations ranged from 0.062 to 0.095 mg/L and the chlorophyll-a concentrations ranged from 2.2 to 28.6 µg/L. Water from the Merrimack River was collected from the Route 125 bridge (Basiliere Bridge) in Haverhill for use as dilution water in the Haverhill WPAF whole effluent toxicity tests. Between June 2001 and April 2009 survival of P. promelas exposed (48 hours) to the river was > 95% (n=31 test events). Water from the Merrimack River just upstream from its confluence with Cobbler Brook in Merrimac was also collected for use as dilution water in the Merrimac WWTP's whole effluent toxicity tests. Between November 2001 and July 2008 survival of M. bahia and M. beryllina exposed (48-hours) to the river water was > 93% (n= 14 and 12 test events, respectively). The *Aquatic Life Use* is assessed as support based primarily on the good survival of test organisms exposed to river water samples in this segment of the river. An Alert Status is identified for this use due to occasionally elevated chlorophyll-a concentrations. *Data Sources: 3, 7*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		
Shellfishing	**Not Assessed**	
DMF does not classify any shellfishing areas in this segment so the Shellfishing Use is not assessed.		

Primary Contact	Impaired	
In 2008, MRWA collected E.coli samples at three sites (19.1, 17.8, 16.8) and Enterococcus at two sites (14.1, 10.6). The geometric means of the samples collected at each site during the primary contact season ranged from 107.2 CFU/100ml to 124.3 CFU/100ml for the E. coli sites and 31.8CFU/100ml to 39.2 CFU/100ml for the Enterococcus sites. In 2003, CDM collected Enterococcus samples at two sites (M024, M025) (See Special Note 1). Neither site had the minimum number of samples (5) required to determine compliance with the Enterococcus geometric mean criterion, however five out of eight counts at the two sites exceeded 104 colonies/100ml. Based on the CDM and MRWA results violating the Enterococcus geometric mean criterion (35 CFU/100ml), the *Primary Contact Recreational Use* is assessed as impaired. Bacteria was elevated during both dry and wet weather conditions and the highest counts represented wet weather sampling. NOTE: Between June 2000 and July 2006 $20.1 Million has been invested to increase capacity at the Haverhill WWTP to capture over 97% of all combined flows including modifications at the WWTP and design and construction of miscellaneous improvements at CSO structures. **Cause(s) of Impairment:** Enterococcus **Source(s) of Impairment:** Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO), Source Unknown *Data Sources: 3, 25*		
Secondary Contact	**Impaired**	
In 2008, MRWA collected E.coli samples at three sites (19.1, 17.8, 16.8) and Enterococcus at two sites (14.1, 10.6). The geometric means of the samples collected at each site ranged from 107.2 CFU/100ml to 124.3 CFU/100ml for the E. coli sites and 31.8CFU/100ml to 39.2 CFU/100ml for the Enterococcus sites. In 2003, CDM collected Enterococcus samples at two sites (M024, M025) (See Special Note 1). Neither CDM site had the minimum number of samples (5) required to determine compliance with the Enterococcus geometric mean criterion 175 colonies/100ml), however four out of eight counts at the two sites exceeded 350 colonies/100ml so the *Secondary Contact Recreational Use* is assessed as impaired. Bacteria was elevated during both dry and wet weather conditions and the highest counts represented wet weather sampling and were more frequently detected at the upstream sampling location. NOTE: Between June 2000 and July 2006 $20.1 Million has been invested to increase capacity at the Haverhill WWTP to capture over 97% of all combined flows including modifications at the WWTP and design and construction of miscellaneous improvements at CSO structures. **Cause(s) of Impairment:** Enterococcus **Source(s) of Impairment:** Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO), Source Unknown *Data Sources: 3, 25*		
Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		
Monitoring Recommendations		
Conduct bacteria monitoring to evaluate if recent upgrades to the Haverhill WWTP and CSO structures have improved water quality.		

LITTLE RIVER (SEGMENT MA84A-09)

Segment Description: New Hampshire state line, Haverhill to confluence with Merrimack River, Haverhill.
Segment Length: 4.6 Miles
Segment Classification: B, WWF
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL ((Other habitat alterations*), Pathogens). * denotes a non-pollutant.
NPDES Permits: City of Haverhill Wastewater Division (MA0101621)

Designated Use	Use Assessment	Alert
Aquatic Life	**Impaired**	
In 2006, MA DFG collected fish at one site (1651). The sample was comprised of a total of 31 fish representing 7 species. Fluvial specialists/dependants comprised 35% of the sample. DWM conducted monthly in-situ water quality monitoring at one site (W1210) on three occasions during July, August and September 2004. Parameters measured include dissolved oxygen, percent saturation, temperature, pH, total dissolved solids and conductivity. Early morning DO measurements (between 4:21 and 5:13 am, n=3) and other water quality physico-chemical monitoring data were indicative of good water quality conditions. The maximum water temperature was 21.3℃. The lower 0.4 miles of this segement is culverted underground impairing *Aquatic Life Use* due to habitat modification. The limited water quality and fish population information indicates that conditions in the upper 4.2 miles of the segment may support *Aquatic Life Use*. **Cause(s) of Impairment:** Habitat Assessments **Source(s) of Impairment:** Habitat Modification - other than Hydromodification *Data Sources: 2*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		
Primary Contact	**Impaired**	
In 2004, MassDEP DWM collected five E. coli samples at one site (W1210) during the primary contact season. The geometric mean of the five samples was 429 CFU/100ml. Based on this result violating the geometric mean criterion (126 CFU/100ml) for E. coli and the frequent aesthetically objectionable conditions observed, the *Primary Contact Recreational Use* is assessed as impaired. The lower reach of the Little River also receives flow from 4 of Haverhill WPCF CSOs. **Cause(s) of Impairment:** Escherichia coli, Debris/Floatables/Trash **Source(s) of Impairment:** Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO), Inappropriate Waste Disposal, Source Unknown *Data Sources: 2, 9*		
Secondary Contact	**Impaired**	
In 2004, MassDEP DWM collected five E. coli samples at one site (W1210). The geometric mean of the E. coli counts was 429 CFU/100ml. This result does not violate the geometric mean criterion (630 CFU/100ml) for E. coli however frequent aesthetically objectionable conditions (e.g., trash, turbidity, occasional sheens) were observed so the *Secondary Contact Recreational Use* is assessed as impaired. Elevated bacteria during storm events is also a concern as well as flow from 4 of Haverhill WPCF CSOs. **Cause(s) of Impairment:** Debris/Floatables/Trash **Source(s) of Impairment:** Inappropriate Waste Disposal *Data Sources: 2, 9*		

Aesthetics	Impaired	
In 2004, MassDEP DWM staff recorded field observations regarding aesthetics at one site (W1210). Objectionable deposits of trash and debris blanketed the streambed. The *Aesthetics Use* is assessed as impaired. Occasionally objectionable odors (e.g., sewage, chlorine, chemical) were noted although not consistently so this is identified as a concern. This lower reach of the Little River also receives flow from 4 of Haverhill WPCF CSOs. **Cause(s) of Impairment:** Debris/Floatables/Trash **Source(s) of Impairment:** Inappropriate Waste Disposal *Data Sources: 9*		
Monitoring Recommendations		
Conduct additional bacteria monitoring to characterize the impairment and identify unknown sources.		

JOHNSON CREEK (SEGMENT MA84A-15)

Segment Description: Headwaters, Groveland (excluding intermittent portion) to confluence with Merrimack River, Groveland/Haverhill.
Segment Length: 1.1 Miles
Segment Classification: B
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed
NPDES Permits: Town of Groveland (MA0102661)

Designated Use	Use Assessment	Alert
Aquatic Life	**Support**	
In 2004, MassDEP DWM collected fish at one site (JC03). Habitat quality at this sampling location was limited by sediment deposition and embeddedness. Bank stability was also marginal. The fish sample was comprised of three species, and while containing low numbers of fish (n=11), was dominated by eastern brook trout (n=9) of varying size classes. Eastern brook trout are a cold water species classified as a fluvial specialist and pollution intolerant and the presence of a reproducing eastern brook trout population is indicative of excellent water quality. In 2002, MA DFG also collected fish in Johnson Creek further downstream near Main Street (736). A total of 12 species (118 fish) were collected. The sample was dominated by a pollution tolerant, fluvial dependant species (white sucker). Approximately half of the individuals collected are classified as fluvial specialists or dependents. MassDEP DWM conducted monthly in-situ water quality monitoring at one site (W1197) on three occasions during July, August and September 2004. Parameters measured include dissolved oxygen, percent saturation, temperature, pH, total dissolved solids and conductivity. Early morning DO measurements (between 4:25 and 5:18am, n=3) and other water quality physico-chemical monitoring data were indicative of excellent water quality conditions. The maximum water temperature was 17.3℃. The *Aquatic Life Use* is assessed as support based on the fish community and available water quality data. *Data Sources: 2, 4, 15*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		

Primary Contact	**Impaired**	
In 2004, MassDEP DWM collected five E. coli samples at one site (W1197) during the primary contact season. The geometric mean of the five samples was 310 CFU/100ml. Based on this result violating the geometric mean criterion (126 CFU/100ml) for E. coli, the *Primary Contact Recreational Use* is assessed as impaired. The elevated counts represented wet weather conditions. **Cause(s) of Impairment:** Escherichia coli **Source(s) of Impairment:** Unspecified urban stormwater, Source Unknown *Data Sources: 2, 9*		
Secondary Contact	**Support**	**Yes**
In 2004, MassDEP DWM collected five E. coli samples at one site (W1197). The geometric mean of the five samples was 309 CFU/100ml. Based on this result meeting the geometric mean criterion (630 CFU/100ml) for E. coli and the absence of frequent aesthetically objectionable conditions, the *Secondary Contact Recreational Use* is assessed as support. An Alert Status is identified for this use due to elevated bacteria during wet weather sampling events. *Data Sources: 2, 9*		
Aesthetics	**Support**	
Between June and September 2004, MassDEP DWM recorded field observations regarding aesthetics at one site (W1197). There were no field observations indicating prolonged or frequent occurences of any objectionable deposits, odors, turbidity or color, floating scum, or overabundant growths of aquatic plants or algae. The *Aesthetics Use* is assessed as support. *Data Sources: 9*		
Monitoring Recommendations		
Conduct additional bacteria monitoring to characterize the impairment and identify unknown sources.		

UNNAMED TRIBUTARY (AKA ARGILLA BROOK) (SEGMENT MA84A-38)

Segment Description: (Locally known as Argilla Brook) Unnamed tributary to Johnson Creek (excluding intermittent portion) from Center Street, Groveland to confluence with Johnson Creek, Groveland.
Segment Length: 1.3 Miles
Segment Classification: B
2008 Integrated List of Waters: Not Listed
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Support**	**Yes**
In 2004, MassDEP DWM collected fish at one site (AR01A). They noted habitat quality was limited most by sediment deposition/embeddedness and channel alteration as well as some bank instability and limited bank vegetative protection. A total of 11 species (86 individuals) were collected in the sample. Although the fish population included a number of golden shiner, a macrohabitat generalist, the majority of fish collected are classified as fluvial specialists/dependants. It should also be noted that in 2000, MA DFG biologists collected 21 eastern brook trout of varying size classes from a site (1456) downstream of the MassDEP DWM sample. Eastern brook trout are a cold water species classified as a fluvial specialist and are pollution intolerant. The presence of a reproducing eastern brook trout population was indicative of excellent water quality. In 2004, MassDEP DWM measured dissolved oxygen, temperature, and pH at one site (W1209) on three occasions during July, August and September 2004. Early morning DO measurements (between 4:03 and 4:49am, n=3) ranged from 6.9 to 8.1 mg/L. The other limited physico-chemical monitoring data were also indicative of good conditions. The maximum water temperature was 21.8℃. he *Aquatic Life Use* is assessed as support based on the fish community and available water quality data. This use is identified with an Alert Status because no trout were collected by MassDEP DWM during the most recent survey in this stream. *Data Sources: 2, 4, 15, 16*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		
Primary Contact	**Support**	**Yes**
In 2004, MassDEP DWM collected five E. coli at one site (W1209) during the primary contact season. The geometric mean of the five samples was 119 CFU/100ml. Based on this result meeting the geometric mean criterion (126 CFU/100ml) for E. coli and the absence of frequent aesthetically objectionable conditions, the *Primary Contact Recreational Use* is assessed as support. An Alert Status is identified for this use due to elevated bacteria during a wet weather sampling event. *Data Sources: 2, 9*		
Secondary Contact	**Support**	**Yes**
In 2004, MassDEP DWM collected five E. coli samples at one site (W1209). The geometric mean of the five samples was 119 CFU/100ml. Based on this result meeting the geometric mean criterion (630 CFU/100ml) for E. coli and the absence of frequent aesthetically objectionable conditions, the *Secondary Contact Recreational Use* is assessed as support. An Alert Status is identified for this use due to elevated bacteria during a wet weather sampling event. *Data Sources: 2, 9*		

Aesthetics	Support	
In 2004, MassDEP DWM recorded field observations regarding aesthetics at one site (W1209). There were no field observations indicating prolonged or frequent occurences of objectionable deposits, odors, turbidity or color, floating scum, or overabundant growths of aquatic plants or algae. The *Aesthetics Use* is assessed as support. *Data Sources: 9*		
Monitoring Recommendations		
None		

EAST MEADOW RIVER (SEGMENT MA84A-39)

Segment Description: Headwaters, outlet Neal Pond, Haverhill to inlet Millvale Reservoir, Haverhill.
Segment Length: 3.0 Miles
Segment Classification: A\PWS\ORW
2008 Integrated List of Waters: Not Listed
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Support**	**Yes**
In 2004, MassDEP DWM collected fish at one site (EA01). Habitat quality scored well. Backpack electrofishing resulted in the capture of five species (n=73 fish including young-of-year). The fish sample was comprised of both fluvial (American eel and redfin pickerel) and macrohabitat generalist species and all species are classified as tolerant or moderately tolerant of pollution. MassDEP DWM conducted monthly in-situ water quality monitoring at one site (W1213) on three occasions during July, August and September 2004. Parameters measured include dissolved oxygen, percent saturation, temperature, pH, total dissolved solids and conductivity. Early morning DO measurements (between 3:30 and 3:59am, n=3) were extremely low (maximum of 1.8 mg/L). The maximum water temperature was 20.7℃. The *Aquatic Life Use* is assessed as support primarily based on best professional judgement of MassDEP DWM fishery biologists but is identified with an Alert Status because of the extremely low DO although these conditions are considered to be naturally occuring given the influence of the wetlands and beaver activity. *Data Sources: 2, 4*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		
Primary Contact	**Impaired**	
In 2004, MassDEP DWM collected five E. coli samples at one site (W1213) during the primary contact season. The geometric mean of the five samples was 128 CFU/100ml. Based on this result violating the geometric mean criterion (126 CFU/100ml) for E. coli, the *Primary Contact Recreational Use* is assessed as impaired. **Cause(s) of Impairment:** Escherichia coli **Source(s) of Impairment:** Source Unknown *Data Sources: 2, 9*		

Secondary Contact	Support	
In 2004, MassDEP DWM collected five E. coli samples at one site (W1213). The geometric mean of the five samples was 128 CFU/100ml. Based on this result meeting the geometric mean criterion (630 CFU/100ml) for E. coli and the absence of frequent aesthetically objectionable conditions, the *Secondary Contact Recreational Use* is assessed as support. *Data Sources: 2, 9*		
Aesthetics	**Support**	
In 2004, MassDEP DWM recorded field observations regarding aesthetics at one site (W1213). There were no field observations indicating prolonged or frequent occurences of objectionable deposits, odors, turbidity or color, floating scum, or overabundant growths of aquatic plants or algae. The *Aesthetics Use* is assessed as support. *Data Sources: 9*		
Monitoring Recommendations		
Conduct additional bacteria monitoring to characterize the impairment and identify unknown sources.		

COBBLER BROOK (SEGMENT MA84A-22)

Segment Description: Headwaters, Merrimac to confluence with Merrimack River, Merrimac.
Segment Length: 4.4 Miles
Segment Classification: B, CWF
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Cause Unknown, Unknown toxicity).
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Support**	**Yes**
In 2006, MA DFG biologists collected fish at two sites (1649, 1650). At the upstream sampling location the majority of the streambed was exposed due to very low flows while the downstream sampling reach was noted to have shallow pools and undercut banks that provided fish habitat. Both sampling sites were dominated by fluvial specialists and the downstream reach was dominated by multiple age classes of eastern brook trout. Of the 40 individual fish collected 31 (69%) in this reach were identified as eastern brook trout of varying size classes. Eastern brook trout are a cold water species classified as fluvial specialist and pollution intolerant. The second sample did not include any species classified as cold water. The *Aquatic Life Use* is assessed as support based on the good fish community. An Alert Status is identified for this use due to the absence of cold water fish species at the second site. *Data Sources: 15, 16*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		
Primary Contact	**Not Assessed**	
Insufficient data were available to assess the *Primary Contact Recreational Use*.		
Secondary Contact	**Not Assessed**	
Insufficient data were available to assess the *Secondary Contact Recreational Use*.		
Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		

Monitoring Recommendations
Conduct biological (macroinvertebrates) monitoring to evaluate the *Aquatic Life Use*.

POWWOW RIVER (SEGMENT MA84A-25)

Segment Description: Outlet of Lake Gardner, Amesbury to tidal portion, just downstream of Main Street, Amesbury.
Segment Length: 0.6 Miles
Segment Classification: B, WWF
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Pathogens, Suspended solids, Noxious aquatic plants, Turbidity).
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Support**	**Yes**
In 2004, MassDEP DWM biologists collected benthic macroinvertebrates at one site (B0516). Habitat quality was degraded by channel alteration, poor bank stability and little to no riparian vegetative zone. The channel flow status was marginal and instream cover was also limited. The RBP III score in comparison to the "reference" site indicated that the benthic macroinvertebrate community was "slightly-impacted". MassDEP DWM biologists also estimated canopy cover (100% open) as well as micro and macroalgal cover in cobble/riffle at this site (0 and 100%, respectively) and in cobble/run (0 and 0%, respectively). MassDEP DWM conducted monthly in-situ water quality monitoring at one site (W1198) on three occasions during July, August and September 2004. Parameters measured include dissolved oxygen, percent saturation, temperature, pH, total dissolved solids and conductivity. Early morning DO measurements (between 1:49 and 1:57am, n=3) ranged from 8.3 to 8.5 mg/L and the other limited physico-chemical monitoring data were indicative of good conditions. The maximum water temperature was 22.9℃. MA DMF evaluted fish passage in the Merrimack River basin. Bluebacks are known to enter the Powwow River in small numbers but the Mill Street Dam near the downstream end of this segment presently obstructs the passage of anadromous fish upstream. Because this particular dam presents a very difficult passage problem and, when combined with the cost of providing passage at the large dam at Lake Gardner, eliminates any development potential here. The *Aquatic Life Use* is assessed as support based on the "slightly impacted" benthic macroinvertebrate community. This use is identified with an Alert Status because of the habitat quality issues, barriers to fish migration, and concerns regarding enriched conditions (i.e., algal biomoass).		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		
Primary Contact	**Impaired**	
In 2004, MassDEP DWM collected five E. coli samples at one site (W1198) during the primary contact season. The geometric mean of the five samples was 531 CFU/100ml. Based on this result violating the geometric mean criterion (126 CFU/100ml) for E. coli, the *Primary Contact Recreational Use* is assessed as impaired. Field crews also sampled a pipe discharging to the river just downstream from the water quality sampling location. Elevated bacteria counts were documented during both dry and wet weather sampling events and sewage odors were noted on occasion eminating from the pipe. Elevated counts were representative of both dry and wet weather sampling events. **Cause(s) of Impairment:** Escherichia coli **Source(s) of Impairment:** Unspecified urban stormwater, Source Unknown *Data Sources: 2, 9, 17, 19*		

Secondary Contact	Support	Yes
In 2004, MassDEP DWM collected five E. coli samples at one site (W1198). The geometric mean of the five samples was 531 CFU/100ml. Based on this result meeting the geometric mean criterion (630 CFU/100ml) for E. coli and the absence of frequent aesthetically objectionable conditions, the *Secondary Contact Recreational Use* is assessed as support. Field crews also sampled the pipe discharging to the river just downstream from the water quality sampling location and noted sewage odors eminating from the pipe on occasion. Elevated bacteria counts were documented during both dry and wet weather sampling events. Some green filamentous algae was observed in the open riffle areas at the lower end of the sampling reach which is of concern. An Alert Status is identified for this use due to elevated bacteria during both dry and wet weather sampling events, the pipe discharge and occasional sewage odors, and the growth of filamentous green algae in the open riffle habitat. *Data Sources: 2, 9, 17, 19*		
Aesthetics	**Support**	**Yes**
In 2004, MassDEP DWM recorded field observations regarding aesthetics at one site (W1198). There were no field observations of prolonged or frequent occurences of objectionable deposits, odors, turbidity or color, floating scum, or overabundant growths of aquatic plants or algae but there was an observation of sewage odors eminating from a pipe just downstream from the sampling. The MassDEP DWM biologists did observe some green filamentous algae in the open riffle areas at the lower end of the sampling reach (% of macroalgal cover estimated at 80%) which is of concern. The *Aesthetics Use* is assessed as support but is identified with an Alert Status due to the pipe discharge and occasional sewage odors and the growth of filamentous green algae in the open riffle habitat. *Data Sources: 9, 17, 19*		
Monitoring Recommendations		
Conduct additional bacteria monitoring to characterize the impairment and identify unknown sources.		

UNNAMED TRIBUTARY (SEGMENT MA84A-30)

Segment Description: Unnamed tributary to Powwow River locally considered portion of Back River from outlet of Clarks Pond, Amesbury to confluence with Powwow River, Amesbury (formerly portion of segment MA84A-16).
Segment Length: 0.003 Square Miles
Segment Classification: SA
2008 Integrated List of Waters: Not Listed
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Support**	
MassDEP DWM conducted monthly in-situ water quality monitoring at one site (W1106) on three occasions during July, August and September 2004. Parameters measured include dissolved oxygen, percent saturation, temperature, pH, total dissolved solids and conductivity . Early morning DO measurements (between 2:13 and 2:27am, n=3) ranged from 6.9 to 7.9 mg/L and the other limited physico-chemical monitoring data were indicative of good conditions. The maximum water temperature was 22.8℃ . Small numbers of river herring have b een observed in the stream and a fishway could be installed at a reasonable cost. The *Aquatic Life Use* is assessed as support based on available water quality data. *Data Sources: 2, 8*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		

Shellfishing	**Not Assessed**	
DMF does not classify shellfishing beds in this segment area so the Shellfishing Use is not assessed.		
Primary Contact	**Impaired**	
In 2004, MassDEP DWM collected five E. coli samples at one site (W1106) during the primary contact season. The geometric mean of the five samples was 236 CFU/100ml. Based on this result violating the geometric mean criterion (126 CFU/100ml) for E. coli, the *Primary Contact Recreational Use* is assessed as impaired. Elevated bacteria counts were documented during both dry and wet weather sampling conditions but the extremely high count represented wet weather. **Cause(s) of Impairment:** Escherichia coli **Source(s) of Impairment:** Unspecified urban stormwater, Source Unknown *Data Sources: 2, 9*		
Secondary Contact	**Support**	**Yes**
In 2004, MassDEP DWM collected five E. coli samples at one site (W1106). The geometric mean of the five samples was 236 CFU/100ml. Based on this result meeting the geometric mean criterion (630 CFU/100ml) for E. coli and the absence of frequent aesthetically objectionable conditions, the *Secondary Contact Recreational Use* is assessed as support. An Alert Status is identified for this use due to presence of trash/debris in the stream. *Data Sources: 2, 9*		
Aesthetics	**Support**	**Yes**
In 2004, MassDEP DWM recorded field observations regarding aesthetics at one site (W1106). There were no field observations indicating prolonged or frequent occurences of objectionable odors, turbidity or color, floating scum, or overabundant growths of aquatic plants or algae but trash/debris were noted at this sampling location. The Aestheticsl Use is assessed as support but is identified with an Alert Status because of the trash/debris at the sampling location. *Data Sources: 9*		
Monitoring Recommendations		
None		

BACK RIVER (SEGMENT MA84A-16)

Segment Description: New Hampshire state line, Amesbury to inlet Clarks Pond, Amesbury.
Segment Length: 2.7 Miles
Segment Classification: B
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Siltation, Pathogens, Turbidity).
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Support**	**Yes**
In 2002 MA DFG biologists collected fish at one site (738). The fish sample contained 46 individuals representing eight species. Although white sucker, a fluvial dependant species, co-dominated the sample, the other species were all macrohabitat generalists. MassDEP DWM conducted monthly in-situ water quality monitoring at one site (W1212) on three occasions during July, August and September 2004. Parameters measured include dissolved oxygen, percent saturation, temperature, pH, total dissolved solids and conductivity. Early morning DO measurements (between 02:35 and 02:56am, n=3) ranged from 6.2 to 7.6 mg/L and the other limited physico-chemical monitoring data were indicative of excellent conditions. The maximum water temperature was 20.2℃. In 2004, MA DMF evaluted anadromous fish passage in the Merrimack River Basin. There is a relatively low head dam at the outlet of Clarks Pond that obstructs the passage of anadromous fish upstream. The *Aquatic Life Use* is assessed as support based on available water quality data. An Alert Status is identified for this use due to fish migration barriers.		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		
Primary Contact	**Impaired**	
In 2004, MassDEP DWM collected five E. coli samples at one site (W1212) during the primary contact season. The geometric mean of the five samples was 862 CFU/100ml. Based on this result violating the geometric mean criterion (126 CFU/100ml) for E. coli, the *Primary Contact Recreational Use* is assessed as impaired. The elevated counts represent both dry and wet weather conditions although the highest counts represented wet weather sampling conditions. **Cause(s) of Impairment:** Escherichia coli **Source(s) of Impairment:** Unspecified urban stormwater, Source Unknown *Data Sources: 2, 9*		
Secondary Contact	**Impaired**	
In 2004, MassDEP DWM collected five E. coli samples at one site (W1212). The geometric mean of the five samples was 862 CFU/100ml. Based on this result violating the geometric mean criterion (630 CFU/100ml) for E. coli, the *Secondary Contact Recreational Use* is assessed as impaired. **Cause(s) of Impairment:** Escherichia coli **Source(s) of Impairment:** Unspecified urban stormwater, Source Unknown *Data Sources: 2, 9*		
Aesthetics	**Support**	**Yes**
In 2004, MassDEP DWM recorded field observations regarding aesthetics at one site (W1212). There were no field observations indicating prolonged or frequent occurences of objectionable deposits, odors, turbidity or color, floating scum, or overabundant growths of aquatic plants or algae. The *Aesthetics Use* is assessed as support but an Alert Status is identified for this use due to consistent observations of moderate turbidity. *Data Sources: 9*		

Monitoring Recommendations
Conduct additional bacteria monitoring to characterize the impairment and identify unknown sources.

POWWOW RIVER (SEGMENT MA84A-08)

Segment Description: Tidal portion, just downstream of Main Street, Amesbury to confluence with Merrimack River, Amesbury.
Segment Length: 0.1 Square Miles
Segment Classification: SB, Shellfishing
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Pathogens).
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Not Assessed**	**Yes**
In 2003, CDM collected five total phosphorus and chloropyll-a samples at one site (T011) (See Special Note 2). The total phosphorus concentrations at this sampling site ranged from 0.076 mg/L to 0.110 mg/L and the chlorophyll-a concentrations ranged from 3.8 ug/L to 29.9 ug/L. Insufficient quality assured data were available to assess the Aquatic Life use. An Alert Status is identified for this use due to elevated total phosphorus and chlorophyll-a concentrations. *Data Sources: 3*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		
Shellfishing	**Not Assessed**	
DMF does not classify shellfishing beds in this segment area so the Shellfishing Use is not assessed.		
Primary Contact	**Impaired**	
In 2003, CDM collected E. coli samples at one site (T011) (See Special Note 1). The geometric mean of the samples collected at this site during the primary contact season was 566 CFU/100ml. Based on this result violating the geometric mean criterion (126 CFU/100ml) for E. coli, the *Primary Contact Recreational Use* is assessed as impaired. **Cause(s) of Impairment:** Escherichia coli **Source(s) of Impairment:** Unspecified urban stormwater, Source Unknown *Data Sources: 3*		
Secondary Contact	**Support**	**Yes**
In 2003, CDM collected E. coli samples at one site (T011) (See Special Note 1). The geometric mean of the samples was 566 CFU/100ml. Based on this result meeting the geometric mean criterion (630 CFU/100ml) for E. coli., the *Secondary Contact Recreational Use* is assessed as support. An Alert Status is identified for this use due to occasional spikes in E. coli concentrations. *Data Sources: 3*		
Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		
Monitoring Recommendations		
Conduct additional bacteria monitoring to characterize the impairment and identify unknown sources.		

MERRIMACK RIVER (SEGMENT MA84A-06)

Segment Description: Confluence Indian River, West Newbury/Amesbury to mouth at Atlantic Ocean, Newburyport/Salisbury (includes Back River, Salisbury).
Segment Length: 4.5 Square Miles
Segment Classification: SB, CSO, Shellfishing
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Priority organics, Pathogens).
NPDES Permits: Town of Amesbury (MA0101745), Ferraz Shawmut, Inc. (MA0000281), Newburyport Water Department (MAG640018), City of Newburyport (MA0101427), Salisbury Sewer Commission (MA0102873)

Designated Use	Use Assessment	Alert
Aquatic Life	**Support**	**Yes**
In 2003, CDM measured dissolved oxygen, temperature, and pH a total of 42 times and collected 26 total phosphorus and 15 chlorophyll-a (phytoplankton) samples at five sites (M26, M28, M29, M27, M30) (See Special Note 2). None of the dissolved oxygen and temperature measurements and only two of the pH measurements violated water quality standards. The total phosphorus concentrations ranged from 0.023 to 0.130 mg/L and the chlorophyll-a concentrations ranged from 1.1 to 35.2 ug/L. Water from the Merrimack River was collected from the shore at the Amesbury WPAF for use as dilution water in the facility's whole effluent toxicity tests. Between April 2002 and October 2008 (n=15) survival of M. bahia exposed to river water (48 hours) was > 80%. Between April 2002 and August 2003 survival of M. beryllina exposed (48 hours) to river water >90% (n=5). Water from the Merrimack River was collected at Deer Island in Amesbury, usually on an outgoing tide, for use as dilution water in the Salisbury WWTPs whole effluent toxicity tests. Between May 2001 and March 2009 survival of M. beryllina (48 hour to 7-day exposure) was >88% (n=32). Survival of M. bahia (48 hour exposure) was > 98% (n=4 test events). Water from the Merrimack River was collected off of the southern shoreline opposite Carr Island in Newburyport for use as dilution water in the Ferraz Shawmut, Inc. whole effluent toxicity tests. Between May 2001 and April 2005 (n=12) survival of M. bahia and M. beryllina exposed (48-hours) to the river water was > 88% in all tests conducted. Water from the Merrimack River was collected slightly east of the Route 1 bridge in Newburyport for use in the Newburyport WPCF acute whole effluent toxicity tests. Between June 2001 and May 2009 (n=34 test events) survival of M. bahia was > 90% with the exception of the May 2006 test event (survival =40%) and survival of M. beryllina was > 75% with the exception of the May 2003 test event (survival =65%). The *Aquatic Life Use* is assessed as support based primarily on the good survival of test organisms exposed to river water samples in this segment of the river. An Alert Status is identified for this use due to occasionally elevated chlorophyll-a concentrations. *Data Sources: 3, 7*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		
Shellfishing	**Impaired**	
A large portion of this segment (east of Route 95 bridge) was part of the MA DMF's Designated Shellfish Growing Area referred to as Merrimack River N2.0 which was classified as Prohibited prior to 2006. This area has recently been further partitioned by DMF into smaller areas. The large area N2.0 is still classified as Prohibited. This segment also contains portions of Growing Areas N2.1 and N2.3 both of which are classified as Conditionally Restricted). **Cause(s) of Impairment:** Fecal Coliform **Source(s) of Impairment:** Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO), Source Unknown *Data Sources: 11*		

Primary Contact	Impaired	
In 2008, MRWA collected Enterococcus samples at six sites (9.4, 8.3, 6.8, 4.4, 3.8, 2.7). The geometric means of the samples collected during the primary contact season at each site ranged from 16.9 CFU/100ml to 42.1 CFU/100ml. In 2003, CDM collected Enterococcus and E. coli samples at five sites (M26, M28, M29, M27, M30) (See Special Note 1). Only one CDM site (M27) had the minimum number of samples (5) required to determine compliance with the Enterococcus geometric mean criterion (35 colonies/100ml) and the geometric mean at this site was 43 CFU/100ml. Three of the other four sampling sites also had more than one Enterococcus bacteria count greater than 104 CFU/100ml. Bacteria was elevated during both dry and wet weather conditions and the highest counts almost always represented wet weather sampling. Plum Island Beach in Newburyport lines the shoreline along the southeastern edge of this segment. Between 2002 and 2007 the beach was only closed in the 2006 season for a total of eight days (8% of the season) and was not closed at all during any other year. The *Primary Contact Recreational Use* is assessed as impaired based on elevated Enterococci bacteria. **Cause(s) of Impairment:** Enterococcus **Source(s) of Impairment:** Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO), Source Unknown *Data Sources: 3, 12, 25*		
Secondary Contact	**Support**	
In 2008, MRWA collected Enterococcus samples at six sites (9.4, 8.3, 6.8, 4.4, 3.8, 2.7). The geometric means of the samples collected at each site ranged from 16.9 CFU/100ml to 42.1 CFU/100ml. In 2003, CDM collected Enterococcus and E. coli samples at five sites (M26, M28, M29, M27, M30) (See Special Note 1). Only one site (M27) had the minimum number of samples (5) required to determine compliance with the Enterococcus geometric mean criterion for secondary contact recreation (175 CFU/100ml). The geometric mean of the samples collected at M27 was 43 CFU/100ml. Based these results meeting the criterion for Enterococcus and the absence of aesthetically objectionable conditions, the *Secondary Contact Recreational Use* is assessed as support. *Data Sources: 3, 25*		
Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		
Monitoring Recommendations		
None		

MERRIMACK RIVER (SEGMENT MA84A-26)

Segment Description: The Basin in the Merrimack River Estuary, Newbury/Newburyport.
Segment Length: 0.2 Square Miles
Segment Classification: SA, Shellfishing
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Pathogens).
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Not Assessed**	
Insufficient data were available to assess the *Aquatic Life Use*.		

Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		
Shellfishing	**Impaired**	
This segment was formerly part of the MA DMF's Designated Shellfish Growing Area referred to as Merrimack River N2.0 which was classified as Prohibited prior to 2006. Growing Area N2.0 has recently been further partitioned by DMF into smaller areas. This segment now contains portions of Growing Areas N2.1 and N2.4 which are both classified by DMF as Conditionally Restricted. **Cause(s) of Impairment:** Fecal Coliform **Source(s) of Impairment:** On-site Treatment Systems (Septic Systems and Similar Decencentralized Systems), Source Unknown *Data Sources: 11*		
Primary Contact	**Not Assessed**	
Insufficient data were available to assess the Primary Contact.		
Secondary Contact	**Not Assessed**	
Insufficient data were available to assess the Secondary Contact.		
Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		
Monitoring Recommendations		
Conduct bacteria monitoring to evaluate/document improvements in water quality conditions as a result of improvements a the Newburyport WPCF and the sewering of Plum Island.		

PLUM ISLAND RIVER (SEGMENT MA84A-27)

Segment Description: From Chaces Island, Merimack River Estuary, to the "high sandy" sand bar just north of the confluence with Pine Island Creek, Newbury (formerly encompassed in MA84A-23).
Segment Length: 0.1 Square Miles
Segment Classification: SA
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Pathogens).
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Not Assessed**	
Insufficient data were available to assess the *Aquatic Life Use*.		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		

Shellfishing	Impaired	
This segment was formerly part of the MA DMF's Designated Shellfish Growing Area referred to as Merrimack River N2.0 which was classified as Prohibited prior to 2006. Growing Area N2.0 has recently been further partitioned by DMF into smaller areas. This segment now contains portions of Growing Areas N2.3 and N2.4 which are both classified by DMF as Conditionally Restricted. **Cause(s) of Impairment:** Fecal Coliform **Source(s) of Impairment:** Source Unknown *Data Sources: 11*		
Primary Contact	**Not Assessed**	
Insufficient data were available to assess the *Primary Contact Recreational Use*.		
Secondary Contact	**Not Assessed**	
Insufficient data were available to assess the *Secondary Contact Recreational Use*.		
Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		
Monitoring Recommendations		
Conduct bacteria monitoring to evaluate/document improvements in water quality conditions as a result of improvements a the Newburyport WPCF and the sewering of Plum Island.		

LOWELL CANALS (SEGMENT MA84A-29)

Segment Description: Canal system near Pawtucket Falls, Lowell.
Segment Length: 4.9 Miles
Segment Classification: B\TWS
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Pesticides, Priority organics, Metals).
NPDES Permits: Boott Hydropower, Inc. (MAG250949), Lowell Cogeneration Company (MA0031071), Lowell National Historical Park (MAG250732)

Designated Use	Use Assessment	Alert
Aquatic Life	**Not Assessed**	
Insufficient data were available to assess the *Aquatic Life Use*.		
Fish Consumption	**Impaired**	
Fish toxics monitoring was conducted by MassDEP DWM biologists and/or Menzie-Cura Inc. in the Lowell Canal system in June 2004. MA DPH has issued a fish consumption advisory due to mercury, lead, PCBs, and DDT contamination for Lowell Canals. Children younger than 12 years or age, pregnant women, women of childbearing age who may become pregnant, and nursing mothers should not eat any fish from this water body. The general public should not consume any of the affected fish species (American Eel) from this water body. The general public should limit consumption of non-affected fish from this water body to two meals per month. **Cause(s) of Impairment:** Mercury in Fish Tissue, PCB in Fish Tissue, DDT, Lead **Source(s) of Impairment:** Atmospheric Deposition - Toxics, Source Unknown *Data Sources: 10, 21*		
Primary Contact	**Not Assessed**	
Insufficient data were available to assess the *Primary Contact Recreational Use*.		

Secondary Contact	**Not Assessed**	
Insufficient data were available to assess the *Secondary Contact Recreational Use*.		
Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		
Monitoring Recommendations		
None		

LAKE ATTITASH (SEGMENT MA84002)

Segment Description: Amesbury/Merrimac
Segment Area: 369 Acres
Segment Classification: A\PWS\ORW
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Metals).
NPDES Permits: Merrimack Water Department (MAG640030)

Designated Use	Use Assessment	Alert
Aquatic Life	**Not Assessed**	
Insufficient data were available to assess the *Aquatic Life Use*.		
Fish Consumption	**Impaired**	
MA DPH has issued a fish consumption advisory due to mercury contamination for Lake Attitash. Children younger than 12 years of age, pregnant women, women of childbearing age who may become pregnant, and nursing mothers should not eat any fish from this water body. The general public should not consume Largemouth Bass from this water body. **Cause(s) of Impairment:** Mercury in Fish Tissue **Source(s) of Impairment:** Atmospheric Deposition - Toxics, Source Unknown *Data Sources: 10*		
Primary Contact	**Not Assessed**	
Insufficient data were available to assess the *Primary Contact Recreational Use*.		
Secondary Contact	**Not Assessed**	
Insufficient data were available to assess the *Secondary Contact Recreational Use*.		
Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		
Monitoring Recommendations		
Conduct monitoring to confirm the presence of non-native aquatic plants.		

CHADWICKS POND (SEGMENT MA84006)

Segment Description: Haverhill/Boxford
Segment Area: 173 Acres
Segment Classification: A\PWS\ORW
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Metals).
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Not Assessed**	
Insufficient data were available to assess the *Aquatic Life Use*.		
Fish Consumption	**Impaired**	
MA DPH has issued a fish consumption advisory due to mercury contamination for Chadwicks Pond. The general public should not consume any fish from this water body. **Cause(s) of Impairment:** Mercury in Fish Tissue **Source(s) of Impairment:** Atmospheric Deposition - Toxics, Source Unknown *Data Sources: 10*		
Primary Contact	**Not Assessed**	
Insufficient data were available to assess the *Primary Contact Recreational Use*.		
Secondary Contact	**Not Assessed**	
Insufficient data were available to assess the *Secondary Contact Recreational Use*.		
Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		
Monitoring Recommendations		
None		

LAKE COCHICHEWICK (SEGMENT MA84008)

Segment Description: North Andover
Segment Area: 575 Acres
Segment Classification: A\PWS\ORW
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Metals).
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Not Assessed**	
Insufficient data were available to assess the *Aquatic Life Use*.		
Fish Consumption	**Impaired**	
MA DPH has issued a fish consumption advisory due to mercury contamination for Lake Cochichewick. Children younger than 12 years of age, pregnant women, women of childbearing age who may become pregnant, and nursing mothers should not eat any Largemouth Bass fish from this water body. The general public should limit consumption of Largemouth Bass fish to two meals per month. **Cause(s) of Impairment:** Mercury in Fish Tissue **Source(s) of Impairment:** Atmospheric Deposition - Toxics, Source Unknown *Data Sources: 10*		

Primary Contact	**Not Assessed**	
Insufficient data were available to assess the *Primary Contact Recreational Use*.		
Secondary Contact	**Not Assessed**	
Insufficient data were available to assess the *Secondary Contact Recreational Use*.		
Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		
Monitoring Recommendations		
None		

CRYSTAL LAKE (SEGMENT MA84010)

Segment Description: Haverhill
Segment Area: 161 Acres
Segment Classification: A\PWS\ORW
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Metals).
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Not Assessed**	
Insufficient data were available to assess the *Aquatic Life Use*.		
Fish Consumption	**Impaired**	
MA DPH has issued a fish consumption advisory due to mercury contamination for Crystal Lake. Children younger than 12 years of age, pregnant women, women of childbearing age who may become pregnant, and nursing mothers should not eat any fish from this water body. The general public should not consume Largemouth Bass from this water body. The general public should limit consumption of non-affected fish from this waterbody to two meals per month. **Cause(s) of Impairment:** Mercury in Fish Tissue **Source(s) of Impairment:** Atmospheric Deposition - Toxics, Source Unknown *Data Sources: 10*		
Primary Contact	**Not Assessed**	
Insufficient data were available to assess the *Primary Contact Recreational Use*.		
Secondary Contact	**Not Assessed**	
Insufficient data were available to assess the *Secondary Contact Recreational Use*.		
Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		
Monitoring Recommendations		
None		

FLINT POND (SEGMENT MA84012)

Segment Description: Tyngsborough
Segment Area: 72 Acres
Segment Classification: B
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Metals [12/20/2007NEHgTMDL], Noxious aquatic plants, (Exotic species*)).
* denotes a non-pollutant.
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Impaired**	
Two non-native aquatic plant species (*Myriophyllum heterophyllum, Najas minor*) were documented in Flint Pond. The *Aquatic Life Use* is assessed as impaired based on the presence of non-native aquatic plants. **Cause(s) of Impairment:** Non-Native Aquatic Plants **Source(s) of Impairment:** Introduction of Non-Native Organisms *Data Sources: 13*		
Fish Consumption	**Impaired**	
MA DPH has issued a fish consumption advisory due to mercury contamination for Flint Pond. Children younger than 12 years of age, pregnant women, women of childbearing age who may become pregnant, and nursing mothers should not eat any fish from this water body. The general public should not consume Largemouth Bass from this water body. The general public should limit consumption of non-affected fish from this waterbody to two meals per month. **Cause(s) of Impairment:** Mercury in Fish Tissue **Source(s) of Impairment:** Atmospheric Deposition - Toxics, Source Unknown *Data Sources: 10*		
Primary Contact	**Not Assessed**	
Insufficient data were available to assess the *Primary Contact Recreational Use*.		
Secondary Contact	**Not Assessed**	
Insufficient data were available to assess the *Secondary Contact Recreational Use*.		
Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		
Monitoring Recommendations		
None		

FOREST LAKE (SEGMENT MA84014)

Segment Description: Methuen
Segment Area: 48 Acres
Segment Classification: B
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Metals, Noxious aquatic plants).
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Not Assessed**	
Insufficient data were available to assess the *Aquatic Life Use*.		

Fish Consumption	Impaired	
MA DPH has issued a fish consumption advisory due to mercury contamination for Forest Lake. Children younger than 12 years of age, pregnant women, women of childbearing age who may become pregnant, and nursing mothers should not eat any Largemouth Bass fish from this water body. The general public should limit consumption of Largemouth Bass fish to two meals per month. **Cause(s) of Impairment:** Mercury in Fish Tissue **Source(s) of Impairment:** Atmospheric Deposition - Toxics, Source Unknown *Data Sources: 10*		
Primary Contact	**Not Assessed**	
Insufficient data were available to assess the *Primary Contact Recreational Use*.		
Secondary Contact	**Not Assessed**	
Insufficient data were available to assess the *Secondary Contact Recreational Use*.		
Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		
Monitoring Recommendations		
None		

FORGE POND (SEGMENT MA84015)

Segment Description: Westford/Littleton
Segment Area: 203 Acres
Segment Classification: B
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 4a-TMDL is Completed (Metals [12/20/2007NEHgTMDL]).
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Impaired**	
Non-native aquatic plant species (recent documentation of *Trapa natans*, and historical observations of *Cabomba caroliniana, Potamogeton crispus*) infest Forge Pond. The *Aquatic Life Use* is assessed as impaired based on the presence of non-native aquatic plants. **Cause(s) of Impairment:** Non-Native Aquatic Plants **Source(s) of Impairment:** Introduction of Non-Native Organisms *Data Sources: 13, 18*		
Fish Consumption	**Impaired**	
MassDEP DWM biologists collected fish from the pond in May 2004 and composite samples of edible fillets were analyzed for As, Cd, Hg, Pb, Se, PCBs and organochlorine pesticides. MA DPH has issued a fish consumption advisory due to mercury contamination for Forge Pond. Children younger than 12 years of age, pregnant women, women of childbearing age who may become pregnant, and nursing mothers should not eat any Largemouth Bass fish from this water body. The general public should limit consumption of Largemouth Bass fish to two meals per month. **Cause(s) of Impairment:** Mercury in Fish Tissue **Source(s) of Impairment:** Atmospheric Deposition - Toxics, Source Unknown *Data Sources: 10, 21*		
Primary Contact	**Not Assessed**	
Insufficient data were available to assess the *Primary Contact Recreational Use*.		

Secondary Contact	**Not Assessed**	
Insufficient data were available to assess the *Secondary Contact Recreational Use*.		
Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		
Monitoring Recommendations		
Conduct monitoring to confirm the presence of non-native aquatic plants.		

HAGGETTS POND (SEGMENT MA84022)

Segment Description: Andover
Segment Area: 211 Acres
Segment Classification: A\PWS\ORW
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Metals).
NPDES Permits: Town of Andover (MAG640058)

Designated Use	Use Assessment	Alert
Aquatic Life	**Not Assessed**	
Insufficient data were available to assess the *Aquatic Life Use*.		
Fish Consumption	**Impaired**	
MA DPH has issued a fish consumption advisory due to mercury contamination for Haggetts Pond. Children younger than 12 years of age, pregnant women, women of childbearing age who may become pregnant, and nursing mothers should not eat any fish from this water body. The general public should not consume any of the affected fish species (Largemouth Bass) from this water body. The general public should limit consumption of non-affected fish from this water body to two meals per month. **Cause(s) of Impairment:** Mercury in Fish Tissue **Source(s) of Impairment:** Atmospheric Deposition - Toxics, Source Unknown *Data Sources: 10*		
Primary Contact	**Not Assessed**	
Insufficient data were available to assess the *Primary Contact Recreational Use*.		
Secondary Contact	**Not Assessed**	
Insufficient data were available to assess the *Secondary Contact Recreational Use*.		
Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		
Monitoring Recommendations		
None		

HOVEYS POND (SEGMENT MA84025)

Segment Description: Boxford
Segment Area: 36 Acres
Segment Classification: A\PWS\ORW
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Metals).
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Not Assessed**	
Insufficient data were available to assess the *Aquatic Life Use*.		
Fish Consumption	**Impaired**	
MA DPH has issued a fish consumption advisory due to mercury contamination for Hoveys Pond. Children younger than 12 years of age, pregnant women, women of childbearing age who may become pregnant, and nursing mothers should not eat any fish from this water body. The general public should limit consumption of all fish from this water body to two meals per month. **Cause(s) of Impairment:** Mercury in Fish Tissue **Source(s) of Impairment:** Atmospheric Deposition - Toxics, Source Unknown *Data Sources: 10*		
Primary Contact	**Not Assessed**	
Insufficient data were available to assess the *Primary Contact Recreational Use*.		
Secondary Contact	**Not Assessed**	
Insufficient data were available to assess the *Secondary Contact Recreational Use*.		
Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		
Monitoring Recommendations		
None		

JOHNSONS POND (SEGMENT MA84027)

Segment Description: Groveland/Boxford
Segment Area: 194 Acres
Segment Classification: A\PWS\ORW
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Metals, Organic enrichment/Low DO).
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Not Assessed**	
Insufficient data were available to assess the *Aquatic Life Use*.		

Fish Consumption	Impaired	
MA DPH has issued a fish consumption advisory due to mercury contamination for Johnsons Pond. Children younger than 12 years of age, pregnant women, women of childbearing age who may become pregnant, and nursing mothers should not eat Largemouth Bass fish from this water body. The general public should limit consumption of Largemouth Bass fish to two meals per month. **Cause(s) of Impairment:** Mercury in Fish Tissue **Source(s) of Impairment:** Atmospheric Deposition - Toxics, Source Unknown *Data Sources: 10*		
Primary Contact	**Not Assessed**	
Insufficient data were available to assess the *Primary Contact Recreational Use*.		
Secondary Contact	**Not Assessed**	
Insufficient data were available to assess the *Secondary Contact Recreational Use*.		
Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		
Monitoring Recommendations		
None		

KENOZA LAKE (SEGMENT MA84028)

Segment Description: Haverhill
Segment Area: 240 Acres
Segment Classification: A\PWS\ORW
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Metals).
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Not Assessed**	
Insufficient data were available to assess the *Aquatic Life Use*.		
Fish Consumption	**Impaired**	
MA DPH has issued a fish consumption advisory due to mercury contamination for Kenoza Lake. The general public should not consume any fish from this water body. **Cause(s) of Impairment:** Mercury in Fish Tissue **Source(s) of Impairment:** Atmospheric Deposition - Toxics, Source Unknown *Data Sources: 10*		
Primary Contact	**Not Assessed**	
Insufficient data were available to assess the *Primary Contact Recreational Use*.		
Secondary Contact	**Not Assessed**	
Insufficient data were available to assess the *Secondary Contact Recreational Use*.		
Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		
Monitoring Recommendations		

None

KNOPS POND/LOST LAKE (SEGMENT MA84084)

Segment Description: Groton
Segment Area: 187 Acres
Segment Classification: B
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Metals [12/20/2007NEHgTMDL], (Exotic species*)). * denotes a non-pollutant.
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Impaired**	
Four non-native aquatic plant species (*Trapa natans, Myriophyllum spicatum, Cabomba caroliniana, Potamogeton crispus*) have been reported in Knops Pond/Lost Lake. The *Aquatic Life Use* is assessed as impaired based on the presence of non-native aquatic plants. **Cause(s) of Impairment:** Non-Native Aquatic Plants, Eurasian Water Milfoil (*Myriophyllum spicatum*) **Source(s) of Impairment:** Introduction of Non-Native Organisms *Data Sources: 13, 14, 18*		
Fish Consumption	**Impaired**	
MassDEP DWM biologists collected fish from the pond in May 2004 and composite samples of edible fillets were analyzed for As, Cd, Hg, Pb, Se, PCBs and organochlorine pesticides. MA DPH has issued a fish consumption advisory due to mercury contamination for Knops Pond/Lost Lake. Children younger than 12 years of age, pregnant women, women of childbearing age who may become pregnant, and nursing mothers should not eat any Largemouth Bass fish from this water body. The general public should limit consumption of Largemouth Bass fish to two meals per month. **Cause(s) of Impairment:** Mercury in Fish Tissue **Source(s) of Impairment:** Atmospheric Deposition - Toxics, Source Unknown *Data Sources: 10, 21*		
Primary Contact	**Not Assessed**	
Insufficient data were available to assess the *Primary Contact Recreational Use*.		
Secondary Contact	**Not Assessed**	
Insufficient data were available to assess the *Secondary Contact Recreational Use*.		
Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		
Monitoring Recommendations		
Conduct monitoring to confirm the presence of non-native aquatic plants.		

LONG POND (SEGMENT MA84032)

Segment Description: Dracut/Tyngsborough (size indicates portion in Massachusetts)
Segment Area: 137 Acres
Segment Classification: B
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Metals [12/20/2007NEHgTMDL], Noxious aquatic plants).
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Impaired**	
One non-native aquatic macrophyte (*Potamogeton crispus*) has been documented in Long Pond. The *Aquatic Life Use* is assessed as impaired based on the presence of non-native aquatic plants. **Cause(s) of Impairment:** Non-Native Aquatic Plants **Source(s) of Impairment:** Introduction of Non-Native Organisms *Data Sources: 13, 14*		
Fish Consumption	**Impaired**	
MA DPH has issued a fish consumption advisory due to mercury contamination for Long Pond. Children younger than 12 years of age, pregnant women, women of childbearing age who may become pregnant, and nursing mothers should not eat any fish from this water body. The general public should limit consumption of all fish from this water body to two meals per month. **Cause(s) of Impairment:** Mercury in Fish Tissue **Source(s) of Impairment:** Atmospheric Deposition - Toxics, Source Unknown *Data Sources: 10*		
Primary Contact	**Not Assessed**	
Insufficient data were available to assess the *Primary Contact Recreational Use*.		
Secondary Contact	**Not Assessed**	
Insufficient data were available to assess the *Secondary Contact Recreational Use*.		
Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		
Monitoring Recommendations		
Conduct monitoring to confirm the presence of non-native aquatic plants.		

LAKE MASCUPPIC (SEGMENT MA84037)

Segment Description: Tyngsborough/Dracut
Segment Area: 210 Acres
Segment Classification: B
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Impaired**	
Two non-native aquatic macrophytes (*Potamogeton crispus and Cabomba caroliniana*) have been documented in Lake Mascuppic. The *Aquatic Life Use* is assessed as impaired based on the presence of non-native aquatic plants. **Cause(s) of Impairment:** Non-Native Aquatic Plants **Source(s) of Impairment:** Introduction of Non-Native Organisms *Data Sources: 13, 14*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		
Primary Contact	**Not Assessed**	
Insufficient data were available to assess the *Primary Contact Recreational Use*.		
Secondary Contact	**Not Assessed**	
Insufficient data were available to assess the *Secondary Contact Recreational Use*.		
Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		
Monitoring Recommendations		
Conduct monitoring to confirm the presence of non-native aquatic plants.		

MASSAPOAG POND (SEGMENT MA84087)

Segment Description: Dunstable/Groton/Tyngsborough
Segment Area: 111 Acres
Segment Classification: B
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Metals [12/20/2007NEHgTMDL], Organic enrichment/Low DO, Noxious aquatic plants, (Exotic species*)). * denotes a non-pollutant.
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Impaired**	
Two non-native aquatic plant species (*Myriophyllum heterophyllum, Potamogeton crispus*) have been observed in Massapoag Pond. In 2003, MassDEP measured dissolved oxygen, temperature, and pH profiles on one occassion near the maximum lake depth (11.2 meters). Oxygen depletion occured at depths of approximately 3.5 m (approximately 25% of the lake surface area). The *Aquatic Life Use* is assessed as impaired based on the presence of non-native aquatic plants and low dissolved oxygen. **Cause(s) of Impairment:** Non-Native Aquatic Plants, Oxygen, Dissolved (Low) **Source(s) of Impairment:** Introduction of Non-Native Organisms, Source Unknown *Data Sources: 13, 22*		
Fish Consumption	**Impaired**	
MA DPH has issued a fish consumption advisory due to mercury contamination for Massapoag Pond. Children younger than 12 years of age, pregnant women, women of childbearing age who may become pregnant, and nursing mothers should not eat any fish from this water body. The general public should limit consumption of all fish from this water body to two meals per month. **Cause(s) of Impairment:** Mercury in Fish Tissue **Source(s) of Impairment:** Atmospheric Deposition - Toxics, Source Unknown *Data Sources: 10*		
Primary Contact	**Not Assessed**	
Insufficient data were available to assess the *Primary Contact Recreational Use*.		
Secondary Contact	**Not Assessed**	
Insufficient data were available to assess the *Secondary Contact Recreational Use*.		
Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		
Monitoring Recommendations		
Conduct monitoring to confirm the presence of non-native aquatic plants.		

MILLVALE RESERVOIR (SEGMENT MA84041)

Segment Description: Haverhill
Segment Area: 44 Acres
Segment Classification: A\PWS\ORW
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Metals).
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Not Assessed**	
Insufficient data were available to assess the *Aquatic Life Use*.		
Fish Consumption	**Impaired**	
MA DPH has issued a fish consumption advisory due to mercury contamination for Millvale Reservoir. Children younger than 12 years of age, pregnant women, women of childbearing age who may become pregnant, and nursing mothers should not eat any fish from this water body. The general public should not consume Largemouth Bass from this water body. **Cause(s) of Impairment:** Mercury in Fish Tissue **Source(s) of Impairment:** Atmospheric Deposition - Toxics, Source Unknown *Data Sources: 10*		
Primary Contact	**Not Assessed**	
Insufficient data were available to assess the *Primary Contact Recreational Use*.		
Secondary Contact	**Not Assessed**	
Insufficient data were available to assess the *Secondary Contact Recreational Use*.		
Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		
Monitoring Recommendations		
None		

NEWFIELD POND (SEGMENT MA84046)

Segment Description: Chelmsford
Segment Area: 77 Acres
Segment Classification: B
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Metals [12/20/2007NEHgTMDL], Organic enrichment/Low DO, Noxious aquatic plants, (Exotic species*)). * denotes a non-pollutant.
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Impaired**	
Three non-native aquatic plant species (*Cabomba caroliniana, Potamogeton crispus, Myriophyllum spicatum*) have been observed in Newfield Pond. In 2003, MassDEP measured dissolved oxygen, temperature, and pH (depth profile) on one occassion at the deep hole (5.0 meters). Oxygen depletion occured at depths greater than 4m representing approximately 10% of the area of the waterbody. The *Aquatic Life Use* is assessed as impaired based on the presence of non-native aquatic plants and low dissolved oxygen. **Cause(s) of Impairment:** Non-Native Aquatic Plants, Oxygen, Dissolved (Low) **Source(s) of Impairment:** Introduction of Non-Native Organisms, Source Unknown *Data Sources: 13, 22*		
Fish Consumption	**Impaired**	
Fish toxics monitoring in Newfield Pond was conducted in 1999 as part of the DEP ORS mercury study. MA DPH has issued a fish consumption advisory due to mercury contamination for Newfield Pond. Children younger than 12 years of age, pregnant women, women of childbearing age who may become pregnant, and nursing mothers should not eat Largemouth Bass fish from this water body. The general public should limit consumption of Largemouth Bass fish to two meals per month. **Cause(s) of Impairment:** Mercury in Fish Tissue **Source(s) of Impairment:** Atmospheric Deposition - Toxics, Source Unknown *Data Sources: 10, 13*		
Primary Contact	**Not Assessed**	
Insufficient data were available to assess the *Primary Contact Recreational Use*.		
Secondary Contact	**Not Assessed**	
Insufficient data were available to assess the *Secondary Contact Recreational Use*.		
Aesthetics	**Not Assessed**	
While no aesthetically objectionable conditions were noted during the DWM survey of the pond in August 2003, insufficient data were available to assess the *Aesthetics Use*. *Data Sources: 9*		
Monitoring Recommendations		
Conduct monitoring to confirm the presence of non-native aquatic plants.		

LAKE PENTUCKET (SEGMENT MA84051)

Segment Description: Haverhill
Segment Area: 38 Acres
Segment Classification: A\PWS\ORW
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Metals).
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Not Assessed**	
Insufficient data were available to assess the *Aquatic Life Use*.		
Fish Consumption	**Impaired**	
MA DPH has issued a fish consumption advisory due to mercury contamination for Lake Pentucket. The general public should not consume any fish from this water body. **Cause(s) of Impairment:** Mercury in Fish Tissue **Source(s) of Impairment:** Atmospheric Deposition - Toxics, Source Unknown *Data Sources: 10*		
Primary Contact	**Not Assessed**	
Insufficient data were available to assess the *Primary Contact Recreational Use*.		
Secondary Contact	**Not Assessed**	
Insufficient data were available to assess the *Secondary Contact Recreational Use*.		
Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		
Monitoring Recommendations		
None		

LAKE SALTONSTALL (SEGMENT MA84059)

Segment Description: Haverhill
Segment Area: 44 Acres
Segment Classification: B
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Metals).
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Not Assessed**	
Insufficient data were available to assess the *Aquatic Life Use*.		
Fish Consumption	**Impaired**	
MA DPH has issued a fish consumption advisory due to mercury contamination for Lake Saltonstall. Children younger than 12 years of age, pregnant women, women of childbearing age who may become pregnant, and nursing mothers should not eat any Largemouth Bass fish from this water body. The general public should limit consumption of Largemouth Bass fish to two meals per month. **Cause(s) of Impairment:** Mercury in Fish Tissue **Source(s) of Impairment:** Atmospheric Deposition - Toxics, Source Unknown *Data Sources: 10*		

Primary Contact	**Not Assessed**	
Insufficient data were available to assess the *Primary Contact Recreational Use*.		
Secondary Contact	**Not Assessed**	
Insufficient data were available to assess the *Secondary Contact Recreational Use*.		
Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		
Monitoring Recommendations		
None		

SPECTACLE POND (SEGMENT MA84089)

Segment Description: Littleton/Ayer
Segment Area: 79 Acres
Segment Classification: B
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Organic enrichment/Low DO, Noxious aquatic plants, (Exotic species*)). * denotes a non-pollutant.
NPDES Permits: Littleton Water Department (MAG640002)

Designated Use	Use Assessment	Alert
Aquatic Life	**Impaired**	
Three non-native aquatic plant species (*Cabomba caroliniana, Potamogeton crispus, Myriophyllum heterophyllum*) were documented in Spectacle Pond. The *Aquatic Life Use* is assessed as impaired based on the presence of non-native aquatic plants. **Cause(s) of Impairment:** Non-Native Aquatic Plants **Source(s) of Impairment:** Introduction of Non-Native Organisms *Data Sources: 13, 14*		
Fish Consumption	**Not Assessed**	
This waterbody does not have a site-specific fish consumption advisory. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody (See Special Note 4).		
Primary Contact	**Not Assessed**	
Insufficient data were available to assess the *Primary Contact Recreational Use*.		
Secondary Contact	**Not Assessed**	
Insufficient data were available to assess the *Secondary Contact Recreational Use*.		
Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		
Monitoring Recommendations		
Conduct monitoring to confirm the presence of non-native aquatic plants.		

STEVENS POND (SEGMENT MA84064)

Segment Description: North Andover
Segment Area: 23 Acres
Segment Classification: B
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Metals).
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Not Assessed**	
Insufficient data were available to assess the *Aquatic Life Use*.		
Fish Consumption	**Impaired**	
MA DPH has issued a fish consumption advisory due to mercury contamination for Stevens Pond. Children younger than 12 years of age, pregnant women, women of childbearing age who may become pregnant, and nursing mothers should not eat any Largemouth Bass fish from this water body. The general public should limit consumption of Largemouth Bass fish to two meals per month. **Cause(s) of Impairment:** Mercury in Fish Tissue **Source(s) of Impairment:** Atmospheric Deposition - Toxics, Source Unknown *Data Sources: 10*		
Primary Contact	**Not Assessed**	
Insufficient data were available to assess the *Primary Contact Recreational Use*.		
Secondary Contact	**Not Assessed**	
Insufficient data were available to assess the *Secondary Contact Recreational Use*.		
Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		
Monitoring Recommendations		
None		

NABNASSET POND (SEGMENT MA84044)

Segment Description: Westford
Segment Area: 134 Acres
Segment Classification: B
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 4a-TMDL is Completed (Metals [12/20/2007NEHgTMDL]).
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Impaired**	
Two non-native aquatic plant species (*Myriophyllum heterophyllum, Potamogeton crispus*) in Nabnasset Pond were documented by ACT as part of herbicide treatment applications. The *Aquatic Life Use* is assessed as impaired based on the presence of non-native aquatic plants. **Cause(s) of Impairment:** Non-Native Aquatic Plants **Source(s) of Impairment:** Introduction of Non-Native Organisms *Data Sources: 14, 18*		

Fish Consumption	Impaired	
MassDEP DWM biologists collected fish from the pond in May 2004 and composite samples of edible fillets were analyzed for As, Cd, Hg, Pb, Se, PCBs and organochlorine pesticides. MA DPH reviewed the data and issued a fish consumption advisory due to mercury contamination for Nebnasset Pond. Children younger than 12 years of age, pregnant women, women of childbearing age who may become pregnant, and nursing mothers should not eat any Largemouth Bass fish from this water body. The general public should limit consumption of Largemouth Bass fish to two meals per month. **Cause(s) of Impairment:** Mercury in Fish Tissue **Source(s) of Impairment:** Atmospheric Deposition - Toxics, Source Unknown *Data Sources: 10, 21*		
Primary Contact	**Not Assessed**	
Insufficient data were available to assess the *Primary Contact Recreational Use*.		
Secondary Contact	**Not Assessed**	
Insufficient data were available to assess the *Secondary Contact Recreational Use*.		
Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		
Monitoring Recommendations		
Conduct monitoring to confirm the presence of non-native aquatic plants.		

LOCUST POND (SEGMENT MA84031)

Segment Description: Tyngsborough
Segment Area: 16 Acres
Segment Classification: B
2008 Integrated List of Waters: This segment is on the 2008 Integrated List of Waters in Category 4a-TMDL is Completed (Metals [12/20/2007NEHgTMDL]).
NPDES Permits: None

Designated Use	Use Assessment	Alert
Aquatic Life	**Not Assessed**	
Insufficient data were available to assess the *Aquatic Life Use*.		
Fish Consumption	**Impaired**	
MA DPH has issued a fish consumption advisory due to mercury contamination for Locust Pond. Children younger than 12 years of age, pregnant women, women of childbearing age who may become pregnant, and nursing mothers should not eat any fish from this water body. The general public should limit consumption of all fish from this water body to two meals per month. **Cause(s) of Impairment:** Mercury in Fish Tissue **Source(s) of Impairment:** Atmospheric Deposition - Toxics, Source Unknown *Data Sources: 10*		
Primary Contact	**Not Assessed**	
Insufficient data were available to assess the *Primary Contact Recreational Use*.		
Secondary Contact	**Not Assessed**	
Insufficient data were available to assess the *Secondary Contact Recreational Use*.		

Aesthetics	**Not Assessed**	
Insufficient data were available to assess the *Aesthetics Use*.		
Monitoring Recommendations		
None		

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APPENDIX A - ASSESSMENT METHODOLOGY
GUIDELINES FOR EVALUATING DESIGNATED USE STATUS OF MASSACHUSETTS SURFACE WATERS - 2009

WATER QUALITY CLASSIFICATION

The Massachusetts Surface Water Quality Standards (SWQS) designate the most sensitive uses for which the surface waters of the Commonwealth shall be enhanced, maintained and protected; prescribe minimum water quality criteria required to sustain the designated uses; and include provisions for the prohibition of discharges (MassDEP 2006). These regulations should undergo public review every three years. The surface waters are segmented and each segment is assigned to one of the six classes described below. Each class is identified by the most sensitive and, therefore, governing water uses to be achieved and protected. Surface waters may be suitable for other beneficial uses, but shall be regulated by the Department of Environmental Protection to protect and enhance the designated uses.

Inland Water Classes

- *CLASS A* - These waters include waters designated as a source of public water supply and their tributaries. They are designated as excellent habitat for fish, other aquatic life and wildlife, including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation, even if not allowed. These waters shall have excellent aesthetic value. These waters are protected as Outstanding Resource Waters.
- *CLASS B* - These waters are designated as a habitat for fish, other aquatic life, and wildlife, including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation. Where designated in 314 CMR 4.06, they shall be suitable as a source of public water supply with appropriate treatment ("Treated Water Supply"). Class B waters shall be suitable for irrigation and other agricultural uses and for compatible industrial cooling and process uses. These waters shall have consistently good aesthetic value.
- *CLASS C* - These waters are designated as a habitat for fish, other aquatic life and wildlife, including for their reproduction, migration, growth and other critical functions, and for secondary contact recreation. These waters shall be suitable for the irrigation of crops used for consumption after cooking and for compatible industrial cooling and process uses. These waters shall have good aesthetic value.

Coastal And Marine Classes

- *CLASS SA* - These waters are designated as an excellent habitat for fish, other aquatic life and wildlife, including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation. In certain waters, excellent habitat for fish, other aquatic life and wildlife may include, but is not limited to, sea grass. Where designated in the tables to 314 CMR 4.00 for shellfishing, these waters shall be suitable for shellfish harvesting without depuration (Approved and Conditionally Approved Shellfish Areas). These waters shall have excellent aesthetic value.
- *CLASS SB* - These waters are designated as a habitat for fish, other aquatic life and wildlife, including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation. In certain waters, habitat for fish, other aquatic life and wildlife may include, but is not limited to, seagrass. Where designated in the tables to 314 CMR 4.00 for shellfishing, these waters shall be suitable for shellfish harvesting with depuration (Restricted and Conditionally Restricted Shellfish Areas). These waters shall have consistently good aesthetic value.
- *CLASS SC* - These waters are designated as a habitat for fish, other aquatic life and wildlife, including for their reproduction, migration, growth and other critical functions, and for secondary contact recreation. They shall also be suitable for certain industrial cooling and process uses. These waters shall have good aesthetic value.

The Clean Water Act (CWA), Section 305(b), water quality reporting process is an essential aspect of the Nation's water pollution control effort. It is the principal means by which EPA, Congress, and the public evaluate existing water quality, assess progress made in maintaining and restoring water quality, and determine the extent of remaining problems. By this process, states report on waterbodies within the context of meeting their designated uses. These uses include: *Aquatic Life, Fish Consumption, Drinking Water, Primary Contact Recreation, Secondary Contact Recreation, Shellfish Harvesting* and *Aesthetics*. Two subclasses of Aquatic Life are also designated in the Massachusetts Surface Water Quality Standards (SWQS): Cold Water Fishery – waters capable of sustaining a year-round population of cold water aquatic life, such as trout – and Warm Water Fishery – waters that are not capable of sustaining a year-round population of cold water aquatic life (MassDEP 2006).

The SWQS, summarized in Table A1, prescribe minimum water quality criteria to sustain the designated uses. Furthermore, these standards describe the hydrological conditions at which water quality criteria must be applied (MassDEP 2006). In rivers the lowest flow conditions at and above which aquatic life criteria must be applied are the lowest mean flow for seven consecutive days to be expected once in ten years (7Q10). In waters where flows are regulated by dams or similar structures the lowest flow conditions at which aquatic life criteria must be applied are the flows equal to or exceeded 99% of the time on a yearly basis or another equivalent flow that has been agreed upon (see Mass DEP 2006 for more detail). In coastal and marine waters and for lakes the Massachusetts Department of Environmental Protection (MassDEP) will determine on a case-by-case basis the most severe hydrological condition for which the aquatic life criteria must be applied.

The availability of appropriate and reliable scientific data and technical information is fundamental to the 305(b) reporting process. It is EPA policy (EPA Order 5360.1 CHG 1) that any individual or group performing work for or on behalf of EPA establish a quality system to support the development, review, approval, implementation, and assessment of data collection operations. To this end MassDEP describes its Quality System in an EPA-approved Quality Management Plan to ensure that environmental data collected or compiled by the MassDEP are of known and documented quality and are suitable for their intended use. For external sources of information, MassDEP requires the following: 1) an appropriate Quality Assurance Project Plan (QAPP) including a laboratory Quality Assurance /Quality Control (QA/QC) plan; 2) use of a state certified lab (or as otherwise approved by DEP for a particular analysis); and 3) sample data, QA/QC and other pertinent sample handling information documented in a citable report. This information will be reviewed by MassDEP to determine its validity and usability to assess water use support. Data use could be modified or rejected due to poor or undocumented QAPP implementation, lack of project documentation, incomplete reporting of data or information, and/or project monitoring objectives unsuitable for MassDEP assessment purposes.

EPA provides guidelines to states for making their use support determinations (EPA 1997 and 2002, Grubbs and Wayland III 2000 and Wayland III 2001). The determination of whether or not a waterbody supports each of its designated uses is a function of the type(s), quality and quantity of available current information. Although data/information older than five years are usually considered “historical” and used for descriptive purposes they can be utilized in the use support determination provided they are known to reflect the current conditions. While the water quality standards (Table A1) prescribe minimum water quality criteria to sustain the designated uses, numerical criteria are not available for every indicator of pollution. Best available guidance from available literature may be applied in lieu of actual numerical criteria (e.g., freshwater sediment data may be compared to *Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario* 1993 by D. Persaud, R. Jaagumagi and A. Hayton). Excursions from criteria due solely to “naturally occurring” conditions (e.g., low pH in some areas) do not constitute violations of the SWQS.

Each designated use within a given segment is individually assessed as ***support*** or ***impaired***. When too little current data/information exist or no reliable data are available, the use is ***not assessed***. In this report, however, if there is some indication that water quality impairment may exist, and it is not “naturally occurring”, the use is identified with an “Alert Status”. It is important to note that not all waters are assessed. Some ponds, rivers, and estuaries have never been assessed; the status of their designated uses has never been reported to EPA in the Commonwealth’s 305(b) Report or the Integrated List of Waters nor is information on these waters maintained in the waterbody system database (WBS) or the new assessment database (ADB). These waterbodies are considered ***not assessed other waters.***

Table A1. Summary of Massachusetts Surface Water Quality Standards (MassDEP 2006, MA DPH 2002, FDA 2003).

Dissolved Oxygen	Class A and Class B Cold Water Fishery (BCWF) and Class SA: ≥6.0 mg/L Class A and Class B Warm Water Fishery (BWWF) and Class SB: ≥5.0 mg/L Class C: Not <5.0 mg/L at least 16 hours of any 24-hour period and not <3.0 mg/L at any time. Class SC: Not <5.0 mg/L at least 16 hours of any 24-hour period and not <4.0 mg/L anytime. For all classes, where natural background conditions are lower than the criteria stated for each class, DO shall not be less than natural background conditions. Natural seasonal and daily variations that are necessary to protect existing and designated uses shall also be maintained.
Temperature	Class A CWF: ≤68°F (20°C) based on the mean of the daily maximum temperature over a seven day period in cold water fisheries, unless naturally occurring and ΔT due to a discharge ≤1.5°F (0.8°C). Class A WWF: ≤83°F (28.3°C) and ΔT due to a discharge ≤1.5°F (0.8°C). Class BCWF: ≤68°F (20°C) based on the mean of the daily maximum temperature over a seven day period in all cold water fisheries, unless naturally occurring, and ΔT due to a discharge ≤Δ3°F (1.7°C)

Table A1. Summary of Massachusetts Surface Water Quality Standards (MassDEP 2006, MA DPH 2002, FDA 2003).

	Class BWWF: ≤83°F (28.3°C) and ΔT due to a discharge ≤5°F (2.8°C) in rivers (based on the minimum expected flow for the month) and ΔT due to a discharge ≤3°F (1.7°C) in the epilimnion (based on the monthly average of maximum daily temperatures) in lakes, Class C and Class SC: ≤85°F (29.4°C) and ΔT due to a discharge ≤5°F (2.8°C) Class SA: ≤85°F (29.4°C) nor a maximum daily mean of 80°F (26. 7°C) and ΔT due to a discharge ≤1.5°F (0.8°C) Class SB: ≤85°F (29.4°C) nor a maximum daily mean of 80°F (26. 7°C) and Δ T due to a discharge ≤1.5°F (0.8°C) between July and September and ≤ 4.0°F (2.2°C) between October and June. *For all classes, natural seasonal and daily variations that are necessary to protect existing and designated uses shall be maintained. There shall be no changes from natural background conditions that would impair any uses assigned to each class, including those conditions necessary to protect normal species diversity, successful migration, reproductive functions or growth of aquatic organisms.* For CWF waters, where a reproducing cold water aquatic community exists at a naturally higher temperature, the temperature necessary to protect the community shall not be exceeded and natural daily and seasonal temperature fluctuations necessary to protect the community shall be maintained. Class B, C, SA, SB, and SC: See MassDEP 2006 for language specific to alternative effluent limitations relating to thermal discharges and cooling water intake structures.
pH	Class A, Class BCWF and Class BWWF: 6.5 - 8.3 SU and Δ0.5 outside the natural background range. Class C: 6.5 - 9.0 SU and Δ1.0 outside the natural background range. Class SA and Class SB: 6.5 - 8.5 SU and Δ0.2 SU outside the natural background range. Class SC: 6.5 - 9.0 SU and Δ0.5 SU outside the natural background range. There shall be no change from natural background conditions that would impair any use assigned to each class.
Solids	All Classes: *These waters shall be free from floating, suspended, and settleable solids in concentrations or combinations that would impair any use assigned to each class, that would cause aesthetically objectionable conditions, or that would impair the benthic biota or degrade the chemical composition of the bottom.*
Color and Turbidity	All Classes: *These waters shall be free from color and turbidity in concentrations or combinations that are aesthetically objectionable or would impair any use.*
Oil and Grease	Class A and Class SA: *Waters shall be free from oil and grease, petrochemicals and other volatile or synthetic organic pollutants.* Class SA: *Waters shall be free from oil and grease and petrochemicals.* Class B, Class C, Class SB and Class SC: *Waters shall be free from oil, grease, and petrochemicals that produce a visible film on the surface of the water, impart an oily taste to the water or an oily or other undesirable taste to the edible portions of aquatic life, coat the banks or bottom of the water course, or are deleterious or become toxic to aquatic life.*
Taste and Odor	Class A and Class SA: *None other than of natural origin.* Class B, Class C, Class SB and Class SC: *None in such concentrations or combinations that are aesthetically objectionable, that would impair any use assigned to each class, or that would cause tainting or undesirable flavors in the edible portions of aquatic life.*
Aesthetics	All Classes: *All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.*
Toxic Pollutants	All Classes: *All surface waters shall be free from pollutants in concentrations or combinations that are toxic to humans, aquatic life or wildlife. For pollutants not otherwise listed in 314 CMR 4.00, the National Recommended Water Quality Criteria: 2002, EPA 822-R-02-047, November 2002 published by EPA pursuant to Section 304(a) of the Federal Water Pollution Control Act, are the allowable receiving water concentrations for the affected waters, unless the Department either establishes a site specific criterion or determines that naturally occurring background concentrations are higher. The Department shall use the water quality criteria for the protection of aquatic life expressed in terms of the dissolved fraction of metals when EPA's 304(a) recommended criteria provide for use of the dissolved fraction* (see Mass DEP 2006 for more detail regarding permit limits, conversion factors, site specific criteria).
Nutrients	*Unless naturally occurring, all surface waters shall be free from nutrients in concentrations that would cause or contribute to impairment of existing or designated uses and shall not exceed the site specific criteria developed in a TMDL or as otherwise established by the Department pursuant to these Standards.*
Bacteria (MassDEP 2006	Class A: *At water supply intakes in unfiltered public water supplies:* either fecal coliform shall not exceed 20

Table A1. Summary of Massachusetts Surface Water Quality Standards (MassDEP 2006, MA DPH 2002, FDA 2003).

and MA DPH 2002) Class A criteria apply to the *Drinking Water Use*. Class B and SB criteria apply to *Primary Contact Recreation Use* while Class C and SC criteria apply to *Secondary Contact Recreation Use*.	organisms/100 ml in all samples taken in any six month period, or total coliform shall not exceed 100 organisms/ 100 ml in 90% of the samples taken in any six month period. If both total and fecal coliform are measured, then only the fecal coliform criterion must be met. Class A other waters, Class B: Where *E.* coli is the chosen indicator at public bathing beaches as defined by MA DPH: The geometric mean of the five most recent *E. coli* samples taken within during the same bathing season shall not exceed 126 colonies/ 100 ml and no single sample taken during the bathing season shall exceed 235 colonies/ 100 ml (these criteria may be applied on a seasonal basis at the Department's discretion). Where Enterococci are the chosen indicators at public bathing beaches*:* The geometric mean of the five most recent samples taken during the same bathing season shall not exceed 33 colonies /100 ml and no single *Enterococci* sample taken during the bathing season shall exceed 61 colonies /100 ml. For other waters and, during the non bathing season, for waters at public bathing beaches: The geometric mean of all *E. coli* samples taken within the most recent six months shall not exceed 126 colonies/ 100 ml typically based on a minimum of five samples and no single sample shall exceed 235 colonies/ 100 ml. These criteria may be applied on a seasonal basis at the Department's discretion. The geometric mean of all *Enterococci* samples taken within the most recent six months shall not exceed 33 colonies/ 100 ml typically based on a minimum of five samples and no single sample shall exceed 61 colonies/ 100 ml. These criteria may be applied on a seasonal basis at the Department's discretion. Class C: *The geometric mean of all E. coli samples taken within the most recent six months shall not exceed 630 E. coli/ 100 ml, typically based on a minimum of five samples and 10% of such samples shall not exceed 1260 E. coli/ 100 ml.* This criterion may be applied on a seasonal basis at the discretion of the Department. Class SA: Waters designated for shellfishing: *Fecal coliform bacteria shall not exceed a geometric mean (Most Probable Number (MPN) method) of 14 organisms/100 ml, nor shall more than 10% of the samples exceed an MPN of 28 organisms/100 ml, or other values of equivalent protection based on sampling and analytical methods used by the Massachusetts Division of Marine Fisheries and approved by the National Shellfish Sanitation Program in the latest revision of the Guide for the Control of Molluscan Shellfish Areas (more stringent regulations may apply, see 314 CMR 4.06(1)(d)(5)).* Class SB: Waters designated for shellfishing: *Fecal coliform median or geometric mean MPN shall not exceed 88 organisms/100 ml, nor shall more than 10% of the samples exceed an MPN of 260 organisms/100 ml or other values of equivalent protection based on sampling and analytical methods used by the Massachusetts Division of Marine Fisheries and approved by the National Shellfish Sanitation Program in the latest revision of the Guide for the Control of Molluscan Shellfish Areas (more stringent regulations may apply, see 314 CMR 4.06(1)(d)(5)).* Class SA and Class SB: At public bathing beaches, as defined by MA DPH: No single *Enterococci* sample taken during the bathing season shall exceed 104 colonies /100 ml and the geometric mean of the five most recent *Enterococci* samples taken within the same bathing season shall not exceed 35 colonies /100 ml. At public bathing beaches during the non-bathing season and in non bathing beach waters: No single *Enterococci* sample shall exceed 104 colonies/ 100 ml and the geometric mean of all samples taken within the most recent six months, typically a minimum of five samples, shall not exceed 35 colonies/ 100 ml. These criteria may be applied on a seasonal basis at the discretion of the Department). Class SC: *The geometric mean of all Enterococci samples taken within the most recent six months shall not exceed 175 colonies/ 100 ml, typically based on the five most recent samples, and 10% of such samples shall not exceed 350 colonies/ 100 ml. This criterion may be applied on a seasonal basis at the discretion of the Department.*

Note: *Italics are direct quotations.* Δ criterion (referring to a change from natural background conditions) is applied to the effects of a permitted discharge.

DESIGNATED USES

The Massachusetts Surface Water Quality Standards designate the most sensitive uses for which the surface waters of the Commonwealth shall be enhanced, maintained and protected. Each of these uses is briefly described below (MassDEP 2006):

- *AQUATIC LIFE* - suitable habitat for sustaining a native, naturally diverse, community of aquatic flora and fauna, including, but not limited to, wildlife and threatened and endangered species and for their reproduction, migration, growth and other critical functions. Two subclasses of aquatic life are also designated in the standards for freshwater bodies: *Cold Water Fishery* - capable of sustaining a year-round population of cold water aquatic life, such as trout; *Warm Water Fishery* - waters that are not capable of sustaining a year-round population of cold water aquatic life. In certain waters, excellent habitat for fish, other aquatic life and wildlife may include, but is not limited to, seagrass.
- *FISH CONSUMPTION* - pollutants shall not result in unacceptable concentrations in edible portions of marketable fish or for the recreational use of fish, other aquatic life or wildlife for human consumption.
- *DRINKING WATER* - used to denote those waters used as a source of public drinking water. They may be subject to more stringent regulation in accordance with the Massachusetts Drinking Water Regulations (310 CMR 22.00). These waters are designated for protection as Outstanding Resource Waters under 314 CMR 4.04(3).
- *SHELLFISH HARVESTING* (in SA and SB segments) – Class SA waters where designated shall be suitable for shellfish harvesting without depuration (Approved and Conditionally Approved Shellfish Areas); Class SB waters where designated shall be suitable for shellfish harvesting with depuration (Restricted and Conditionally Restricted Shellfish Areas).
- *PRIMARY CONTACT RECREATION* - suitable for any recreation or other water use in which there is prolonged and intimate contact with the water with a significant risk of ingestion of water. These include, but are not limited to, wading, swimming, diving, surfing and water skiing.
- *SECONDARY CONTACT RECREATION* - suitable for any recreation or other water use in which contact with the water is either incidental or accidental. These include, but are not limited to, fishing, including human consumption of fish, boating and limited contact incident to shoreline activities. Where designated, secondary contact recreation also includes shellfishing, including human consumption of shellfish. Human consumption of fish and shellfish are assessed as the *Fish Consumption* and *Shellfish Harvesting* uses, respectively.
- *AESTHETICS* - all surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.
- *AGRICULTURAL AND INDUSTRIAL* - suitable for irrigation or other agricultural process water and for compatible industrial cooling and process water.

The guidance used to assess the *Aquatic Life, Fish Consumption, Drinking Water, Shellfish Harvesting, Primary* and *Secondary Contact Recreation* and *Aesthetics* uses follows.

Note: Waterbodies affected by Combined Sewer Overflow (CSO) discharges are qualified in the standards, however, unless a variance has been granted and states otherwise, excursions from criteria are not allowed during storm events (designated uses are still applicable).

AQUATIC LIFE USE

This use is suitable for sustaining a native, naturally diverse, community of aquatic flora and fauna, including, but not limited to, wildlife and threatened and endangered species and for their reproduction, migration, growth and other critical functions. The results of biological (and habitat), toxicological, and chemical data are integrated to assess this use. The nature, frequency, and precision of the MassDEP's data collection techniques dictate that a weight of evidence be used to make the assessment, with biosurvey results used as the final arbiter of borderline cases. The following chart provides an overview of the guidance used to assess the status (support or impaired) of the *Aquatic Life Use.*

Variable	***Support*** Data available clearly indicates support or minor modification of the biological community. Excursions from chemical criteria (Table A1) not frequent or prolonged and may be tolerated if the biosurvey results demonstrate support.	***Impaired*** There are frequent or severe violations of chemical criteria, presence of acute toxicity, or a moderate or severe modification of the biological community.
BIOLOGY		
Rapid Bioassessment Protocol (RBP) III*	Non/Slightly impacted	Moderately or Severely Impacted
Fish Community	Best Professional Judgment (BPJ)	BPJ
Habitat and Flow	BPJ	Dewatered streambed due to artificial regulation or channel alteration, BPJ
Eelgrass Bed Habitat (Howes *et al.* 2003, Costello 2003)	Stable (No/minimal loss), BPJ	Loss/decline, BPJ
Non-native species	BPJ	Non-native species present, BPJ
Plankton/Periphyton	No/infrequent algal blooms	Frequent and/or prolonged algal blooms
TOXICITY TESTS**		
Water Column/Ambient	≥75% survival either 48 hr or 7-day exposure	<75% survival either 48 hr or 7-day exposure
Sediment	≥75% survival	<75% survival
CHEMISTRY-WATER**		
Dissolved oxygen (DO) (MassDEP 2006, EPA 1997)	Infrequent excursion from criteria (Table A1), BPJ (minimum of three samples representing critical period)	Frequent and/or prolonged or severe excursion from criteria [river and shallow lakes - exceedances >10% of representative measurements; deep lakes (with hypolimnion) - exceedances in the hypolimnetic area >10% of the surface area during maximum oxygen depletion].
pH (MassDEP 2006, EPA 1999a)	Infrequent excursion from criteria (Table A1)	Criteria exceeded >10% of measurements.
Temperature (MassDEP 2006,EPA 1997) [Note: typically the analysis of this variable is applicable to a summer index period ranging anywhere from mid-June through early September.]	Infrequent excursion from criteria (Table A1)	Small datasets: Criteria exceeded >10% of measurements. Deployed probe (long term) datasets: CWF: excursion based on mean of the daily maximum temperatures over a 7-day period. WWF: BPJ (e.g., >10% days in a 30 day period or three consecutive days in a 30 day period exceed 28.3℃, or 7-day average of daily maximum temperatures exceeds 28.3℃)
Toxic Pollutants (MassDEP 2006, EPA 1999a) Ammonia-N (MassDEP 2006, EPA 1999b) Chlorine (MassDEP 2006, EPA 1999a)	Infrequent excursion from criteria (Table A1) Ammonia is pH and temperature dependent[1] 0.011 mg/L (freshwater) or 0.0075 mg/L (saltwater) total residual chlorine (TRC)[2]	Frequent and/or prolonged excursion from criteria (exceeded >10% of measurements).

AQUATIC LIFE USE (CONTINUED)

CHEMISTRY-SEDIMENT**		
Toxic Pollutants (Persaud *et al.* 1993)	Concentrations ≤ Low Effect Level (L-EL), BPJ	Concentrations ≥ Severe Effect Level (S-EL)[3], BPJ
CHEMISTRY-TISSUE		
PCB – whole fish (Coles 1998)	≤500 µg/kg wet weight	BPJ
DDT (Environment Canada 1999)	≤14.0 µg/kg wet weight	BPJ
PCB in aquatic tissue (Environment Canada 1999)	≤0.79 ng TEQ/kg wet weight	BPJ

*RBP II analysis may be considered for assessment decision on a case-by-case basis, **For identification of impairment, one or more of the following variables may be used to identify possible causes/sources of impairment: NPDES facility compliance with whole effluent toxicity test and other limits, turbidity and suspended solids data, nutrient (nitrogen and phosphorus) data for water column/sediments. [1] Saltwater is temperature dependent only. [2] The minimum quantification level for TRC is 0.05 mg/L. [3]For the purpose of this report, the S-EL for total polychlorinated biphenyl compounds (PCB) in sediment (which varies with total organic carbon (TOC) content) with 1% TOC is 5.3 ppm while a sediment sample with 10% TOC is 53 ppm.

Note: National Academy of Sciences/National Academy of Engineering (NAS/NAE) guideline for maximum organochlorine concentrations (i.e., total PCB) in fish tissue for the protection of fish-eating wildlife is 500µg/kg wet weight (ppb, not lipid-normalized). PCB data (tissue) in this report are presented in µg/kg wet weight (ppb) and are not lipid-normalized to allow for direct comparison to the NAS/NAE guideline.

FISH CONSUMPTION USE

Pollutants shall not result in unacceptable concentrations in edible portions of marketable fish or for the recreational use of fish, other aquatic life or wildlife for human consumption. The assessment of this use is made using the most recent list of Fish Consumption Advisories issued by the Massachusetts Executive Office of Health and Human Services, Department of Public Health (MA DPH), Bureau of Environmental Health Assessment (MA DPH 2008). The MA DPH list identifies waterbodies where elevated levels of a specified contaminant in edible portions of freshwater species pose a health risk for human consumption. Hence, the *Fish Consumption Use* is assessed as impaired in these waters.

In July 2001 MA DPH issued new consumer advisories on fish consumption and mercury contamination (MA DPH 2001).

1. The MA DPH "…is advising pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age to refrain from eating the following marine fish; shark, swordfish, king mackerel, tuna steak and tilefish. In addition, MA DPH is expanding its previously issued statewide fish consumption advisory which cautioned pregnant women to avoid eating fish from all freshwater bodies due to concerns about mercury contamination, to now include women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age (MA DPH 2001)."
2. Additionally, MA DPH "…is recommending that pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age limit their consumption of fish not covered by existing advisories to no more than 12 ounces (or about 2 meals) of cooked or uncooked fish per week. This recommendation includes canned tuna, the consumption of which should be limited to 2 cans per week. Very small children, including toddlers, should eat less. Consumers may wish to choose to eat light tuna rather than white or chunk white tuna, the latter of which may have higher levels of mercury (MA DPH 2001)."

Other statewide advisories that MA DPH has previously issued and are still in effect are as follows (MA DPH 2001):

1. Due to concerns about chemical contamination, primarily from polychlorinated biphenyl compounds (PCB) and other contaminants, no individual should consume lobster tomalley from any source. Lobster tomalley is the soft green substance found in the tail and body section of the lobster.
2. Pregnant and breastfeeding women and those who are considering becoming pregnant should not eat bluefish due to concerns about PCB contamination in this species.

The following is an overview of EPA's guidance used to assess the status (support or impaired) of the *Fish Consumption Use*. Because of the statewide advisory no waters can be assessed as support for the *Fish Consumption Use*. Therefore, if no site-specific advisory is in place, the *Fish Consumption Use* is not assessed.

Variable	***Support*** No restrictions or bans in effect	***Impaired*** There is a "no consumption" advisory or ban in effect for the general population or a sub-population for one or more fish species or there is a commercial fishing ban in effect.
MA DPH Fish Consumption Advisory List	Not applicable, precluded by statewide advisory (Hg)	Waterbody on MA DPH Fish Consumption Advisory List

Note: MA DPH's statewide advisory does not include fish stocked by the state Division of Fisheries and Wildlife or farm-raised fish sold commercially.

Northeast Regional Mercury TMDL: On 20 December 2007 the U.S. EPA approved the Northeast Regional Mercury Total Maximum Daily Load (TMDL). This TMDL is a Federal Clean Water Act mandated document that identifies pollutant load reductions necessary for regional waterbodies to meet and maintain compliance with state and federal water quality standards. It was prepared by the New England Interstate Water Pollution Control Commission (NEIWPCC) in cooperation with the states of Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont. The TMDL covers inland waterbodies that are impaired primarily due to atmospheric deposition of mercury (Northeast States 2007). The TMDL target for Massachusetts is 0.3 ppm or less of mercury in fish tissue. The plan calls for a 75% reduction of in-region and out of region atmospheric sources by 2010 and a 90% or greater reduction in the future (NEIWPCC 2007). The TMDL will be reassessed in

2010 based on an evaluation of new on-going monitoring and air deposition data. Final targets will be determined at that time.

DRINKING WATER USE

The term *Drinking Water Use* denotes those waters used as a source of public drinking water. These waters may be subject to more stringent regulation in accordance with the Massachusetts Drinking Water Regulations (310 CMR 22.00). They are designated for protection as Outstanding Resource Waters in 314 CMR 4.04(3). MassDEP's Drinking Water Program (DWP) has primacy for implementing the provisions of the federal Safe Drinking Water Act (SDWA). Except for suppliers with surface water sources for which a waiver from filtration has been granted (these systems also monitor surface water quality) all public drinking water supplies are monitored as finished water (tap water). Monitoring includes the major categories of contaminants established in the SDWA: bacteria, volatile and synthetic organic compounds, inorganic compounds and radionuclides. The DWP maintains current drinking supply monitoring data. The suppliers currently report to MassDEP and EPA the status of the supplies on an annual basis in the form of a consumer confidence report (http://yosemite.epa.gov/ogwdw/ccr.nsf/Massachusetts). Below is EPA's guidance to assess the status (support or impaired) of the drinking water use.

Variable	***Support*** No closures or advisories (no contaminants with confirmed exceedances of maximum contaminant levels, conventional treatment is adequate to maintain the supply).	***Impaired*** Has one or more advisories or more than conventional treatment is required or has a contamination-based closure of the water supply.
Drinking Water Program (DWP) Evaluation	See note below	See note below

Note: While this use is not assessed in this report, information on drinking water source protection and finish water quality is available at http://www.mass.gov/dep/water/drinking.htm and from local public water suppliers.

SHELLFISHING USE

This use is assessed using information from the Department of Fish and Game's Division of Marine Fisheries (DMF). A designated shellfish growing area is an area of potential shellfish habitat. Growing areas are managed with respect to shellfish harvest for direct human consumption, and comprise at least one or more classification areas. The classification areas are the management units, and range from being approved to prohibited (described below) with respect to shellfish harvest. Shellfish areas under management closures are *not assessed.* Not enough testing has been done in these areas to determine whether or not they are fit for shellfish harvest, therefore, they are closed for the harvest of shellfish.

Variable	***Support*** SA Waters: Approved[1] SB Waters: Approved[1], Conditionally Approved[2], or Restricted[3]	***Impaired*** SA Waters: Conditionally Approved[2], Restricted[3], Conditionally Restricted[4], or Prohibited[5] SB Waters: Conditionally Restricted[4] or Prohibited[5]
DMF Shellfish Project Classification Area Information (MA DFG 2000)	Reported by DMF	Reported by DMF

NOTE: Designated shellfish growing areas may be viewed using the MassGIS datalayer available from MassGIS at http://www.mass.gov/mgis/dsga.htm. This coverage currently reflects classification areas as of July 1, 2000.

[1] **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.

[2] **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.

[3] **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.

[4] **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).

[5] **Prohibited -** Closed for harvest of shellfish.

PRIMARY CONTACT RECREATION USE

This use is suitable for any recreational or other water use in which there is prolonged and intimate contact with the water with a significant risk of ingestion of water during the primary contact recreation season (1 April to 15 October). These include, but are not limited to, wading, swimming, diving, surfing and water skiing. The chart below provides an overview of the guidance used to assess the status (support or impaired) of the *Primary Contact Recreation Use*. Excursions from criteria due to natural conditions are not considered impairment of use.

Variable	***Support*** Criteria are met, no aesthetic conditions that preclude the use	***Impaired*** Frequent or prolonged violations of criteria and/or formal bathing area closures, or severe aesthetic conditions that preclude the use
Bacteria (105 CMR 445.000) Minimum Standards for Bathing Beaches State Sanitary Code) (MassDEP 2006)	At "public bathing beach" areas: Formal beach postings/advisories neither frequent nor prolonged during the swimming season (the number of days posted or closed cannot exceed 10% during the locally operated swimming season). Collected samples* meet the geometric mean criteria (Table A1). Shellfish Growing Area classified as "Approved by DMF.	At "public bathing beach" areas: Formal beach closures/postings >10% of time during swimming season (the number of days posted or closed exceeds 10% during the locally operated swimming season). Collected samples* do not meet the geometric mean criteria (Table A1).
Aesthetics (MassDEP 1996) - *All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance* [growth or amount] *species of aquatic life*		
Odor, oil and grease, color and turbidity, floating matter	Narrative "free from" criteria met or excursions neither frequent nor prolonged, BPJ.	Narrative "free from" criteria not met - objectionable conditions either frequent and/or prolonged, BPJ.
Transparency (MA DPH 1969)	Public bathing beach and lakes – Secchi disk depth ≥1.2 meters (≥ 4') (minimum of three samples representing critical period).	Public bathing beach and lakes - Secchi disk depth <1.2 meters (< 4') (minimum of three samples representing critical period).
Nuisance organisms	No overabundant growths (i.e., blooms) that render the water aesthetically objectionable or unusable, BPJ.	Overabundant growths (i.e., blooms and/or non-native macrophyte growth dominating the biovolume) rendering the water aesthetically objectionable and/or unusable, BPJ.

* Data sets to be evaluated for assessment purposes must be representative of a sampling location (at least five samples per station recommended) and the season being analyzed, as described in the SWQS (see Table 1). Samples collected on one date from multiple stations on a river are not considered adequate to assess this designated use. Because of low sample frequency (i.e., less than ten samples per station) an impairment decision will not be based on a single sample exceedance (i.e., the geometric mean of five samples is < 126 *E. coli* colonies/100 ml but one of the five sample exceeds 235 *E. coli* colonies/100 ml). The method detection limit (MDL) will be used in the calculation of the geometric mean when data are reported as less than the MDL (e.g., use 20 cfu/100 ml if the result is reported as <20 cfu/100 ml). Those data reported as too numerous to count (TNTC) will not be used in the geometric mean calculation; however frequency of TNTC sample results should be presented.

SECONDARY CONTACT RECREATION USE

This use is suitable for any recreation or other water use in which contact with the water is either incidental or accidental. These include, but are not limited to, fishing, boating and limited contact incident to shoreline activities. Following is an overview of the guidance used to assess the status (support or impaired) of the *Secondary Contact Use*. Excursions from criteria due to natural conditions are not considered impairment of use.

Variable	***Support*** Criteria are met, no aesthetic conditions that preclude the use	***Impaired*** Frequent or prolonged violations of criteria, or severe aesthetic conditions that preclude the use
Bacteria (MassDEP 2006)	Collected samples* meet the Class C or SC geometric mean criteria (see Table A1). Shellfish Growing Area classified as "Approved" by DMF.	Collected samples* do not meet the Class C or SC geometric mean criteria (see Table A1).
Aesthetics (MassDEP 2006) - *All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance* [growth or amount] *species of aquatic life*		
Odor, oil and grease, color and turbidity, floating matter	Narrative "free from" criteria met or excursions neither frequent nor prolonged, BPJ.	Narrative "free from" criteria not met - objectionable conditions either frequent and/or prolonged, BPJ.
Transparency (MA DPH 1969)	Public bathing beach and lakes – Secchi disk depth ≥1.2 meters (≥ 4') (minimum of three samples representing critical period).	Public bathing beach and lakes - Secchi disk depth <1.2 meters (< 4') (minimum of three samples representing critical period).
Nuisance organisms	No overabundant growths (i.e., blooms) that render the water aesthetically objectionable or unusable, BPJ.	Overabundant growths (i.e., blooms and/or non-native macrophyte growth dominating the biovolume) rendering the water aesthetically objectionable and/or unusable, BPJ.

*Data sets to be evaluated for assessment purposes must be representative of a sampling location (at least five samples per station recommended) over time. Because of low sample frequency (i.e., less than ten samples per station) an impairment decision will not be based on a single sample exceedance. Samples collected on one date from multiple stations on a river are not considered adequate to assess this designated use.

AESTHETICS USE

All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life. The aesthetic use is closely tied to the public health aspects of the recreational uses (swimming and boating). Below is an overview of the guidance used to assess the status (support or impaired) of the *Aesthetics Use*.

Variable	***Support*** Narrative "free from" criteria met	***Impaired*** Objectionable conditions frequent and/or prolonged
Odor, oil and grease, color and turbidity, floating matter	Narrative "free from" criteria met or excursions neither frequent nor prolonged, BPJ.	Narrative "free from" criteria not met - objectionable conditions either frequent and/or prolonged, BPJ.
Transparency (MA DPH 1969)	Public bathing beach and lakes – Secchi disk depth ≥1.2 meters (≥ 4') (minimum of three samples representing critical period).	Public bathing beach and lakes - Secchi disk depth <1.2 meters (< 4') (minimum of three samples representing critical period).
Nuisance organisms	No overabundant growths (i.e., blooms) that render the water aesthetically objectionable or unusable, BPJ.	Overabundant growths (i.e., blooms and/or non-native macrophyte growth dominating the biovolume) rendering the water aesthetically objectionable and/or unusable, BPJ.

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APPENDIX B – SUMMARY OF NPDES PERMITTING INFORMATION
MERRIMACK RIVER WATERSHED

Table 1. NPDES discharges in the Merrimack River Watershed (excluding permits for construction/dewatering) including a summary of whole effluent toxicity results if available.

Permittee	NPDES #	Segment	Description
Allied Waste Services of Massachusetts, LLC	MA0030066	MA84A-21	Allied Waste Services of Massachusetts, LLC is authorized (MA0030066 issued March 2003) (transfer of ownership from Browning-Ferris Industries, Inc.) to discharge treated stormwater runoff through four outfalls from a truck refueling, washing and maintenance facility on Dunstable Road in Tyngsborough, MA. The outfalls 001, 003, 004, and 007 discharge into "Bridge Meadows" which flows into Deep Brook (MA84A-21).
Town of Amesbury	MAG640065	MA84A-28	The Town of Amesbury is authorized (MAG640065 issued May 2004) to discharge a maximum daily flow of 0.485 MGD from the Amesbury Water Treatment Plan on Newton Rd. into the Powwow River via outfalls #001 and #002.
Town of Amesbury	MA0101745	MA84A-06	The Town of Amesbury is authorized (MA0101745 issued February 2004 and modified in May 2007) to discharge 2.4 MGD of treated sanitary and industrial wastewater from the Amesbury Water Pollution Abatement Facility via outfall #001 to the Merrimack River. The maximum daily TRC limit is 1.0 mg/L. Acute whole effluent toxicity test are required twice a year using M. bahia with an LC50 limit ≥50% effluent. (Note: the permit required testing with M. beryllina as well but EPA approved request to reduce to M. bahia only in May 2004 letter to town). Between April 2002 and October 2008, no acute whole effluent toxicity was detected in the Amesbury WPAF discharge during the test events (i.e., all LC50s were >100% effluent in the valid tests conducted).
Town of Andover	MAG640058	MA84022	The Town of Andover is authorized (MAG640058 issued August 2001) to discharge a maximum daily flow of 0.97 MGD of backwash water processing wastewater from the Andover Water Treatment Plant into Haggetts Pond via 1 outfall.
Boott Hydropower, Inc.	MAG250949	MA84A-29	Boott Hydropower, Inc. is authorized (MAG250949 issued September 2000) to discharge 0.00144 MGD of non-contact cooling water from the Hamilton Power Station on Jackson St. in Lowell into the Merrimack River via the Hamilton Canal.
Boott Hydropower, Inc.	MAG250950	MA84A-02	Boott Hydropower, Inc. is authorized (MAG250950 issued September 2000) to discharge 0.006 MGD of non-contact cooling water from the John Street Power Station to the Merrimack River.
Boott Hydropower, Inc.	MAG250163	MA84A-02	Boott Hydropower, Inc. is authorized (MAG250163 issued September 2000) to discharge 0.6 MGD of non-contact cooling water from Eldred L. Field Hydroelectric Project on Pawtucket St. in Lowell to the Merrimack River.
Boott Hydropower, Inc.	MAG250948	MA84A-04	Boott Hydropower, Inc. is authorized (MAG250948 issued September 2000) to discharge 0.9 MGD of non-contact cooling water from the Lawrence Hydroelectric Project on South Broadway St. to the Merrimack River.
Brox Industries, Inc.	MA0040177	Not a Segment (MA84A-03 subwatershed)	Brox Industries, Inc. is authorized (MA0040177 issued in March 2007) to discharge a maximum daily flow of 1.58 MGD treated storm water and process generated wastewater from the quarry and crushing/washing operations at its facility on Methuen St. in Dracut into the receiving wetland system adjacent to the Merrimack River via outfall #003. The facility conducted one modified acute and chronic whole effluent toxicity test in October 2003. No acute or chronic toxicity was detected by either C. dubia or P. promelas.

Permittee	NPDES #	Segment	Description
Ferraz Shawmut, Inc.	MA0000281	MA84A-06	Ferraz Shawmut, Inc. (formerly Gould, Inc.) was authorized (MA0000281 issued in September 2002) to discharge an average monthly flow of 0.04 MGD of treated process wastewater from its facility on Merrimac St. in Newburyport, into the receiving waters of the Merrimack River via outfall #001. Whole effluent toxicity testing in May and November each year was required using both Mysidopsis bahia and Menidia beryllina. The LC50 limit was ≥50% effluent. Whole effluent toxicity tests from May 2001 to April 2005 (n=12) showed the effluent was acutely toxic to M. bahia (consistently the more sensitive test organism) in all 12 test events with LC50s ranging from 21.1 to 82.6% effluent. The LC50 permit limit of 50% was not met in half of the tests conducted. The facility tied into the Newburyport WPCF in August 2005 and the NPDES permit was terminated by EPA in November 2005.
Fletcher Granite Company	MA0020231	Not a Segment (MA84B-04 subwatershed)	Fletcher Granite Company is authorized (MA0020231 issued April 2003) to discharge via outfall 001 and process water discharge from the cutting mill via outfall #003 to Gilson Brook, a tributary to Stony Brook.
GenCorp, Inc.	MAG910424	MA84A-10	GenCorp, Inc. was authorized (MA0003824 issued July 1992) to discharge from its facility on General St. in Lawrence to the Spicket River. The company applied for coverage under a Remedial General Permit (RGP) MAG910424 for ongoing remedial activities at the site (removal of contaminated sediment and residue from subsurface interior raceways and an exterior, at grade, raceway) and plugging of interior raceways to permanently isolate them from surface water except during a 100 year frequency flood event. Installation of a permanent groundwater treatment system, using the plugged raceways as the groundwater collection system will be applied for as a separate RGP. The RGP was issued to the facility in July 2009.
Greater Lawrence Sanitary District	MA0100447	MA84A-04 MA84A-10	Greater Lawrence Sanitary District is authorized (MA0100447 issued in August 2005) to discharge (via outfall #001) treated effluent to the Merrimack River from the facility on Charles St. in North Andover. The monthly average flow is 52MGD. The TRC limit is 0.15 mg/L average monthly with a daily maximum concentration of 0.26 mg/L. The facility is also required to monitor and report quarterly total ammonia nitrogen, Kjeldahl nitrogen, nitrite and nitrate concentrations as well as monthly total phosphorus concentrations. The facility is also required to conduct quarterly chronic and modified acute whole effluent toxicity tests using Ceriodaphnia dubia. The LC50 limit is ≥100% and the C-NOEC must be reported. February 2001 and April 2009 modified acute and chronic whole effluent toxicity tests were conducted on Greater Lawrence Sanitary District's treated effluent using C. dubia (n=39). The facility met the LC50 limit of ≥100% effluent with three exceptions (February, May, and August 2002 when LC50s were 71, 71, and 65.98% effluent, respectively). CNOEC test results ranged from <6.25 to 100% effluent (n=33 valid tests). CSO Discharges (upstream to downstream): Outfall 003 South Bank secondary overflow just downstream O'Leary Bridge to Merrimack River, Outfall 005 North Bank secondary overflow just downstream Casey Bridge to Merrimack River, Outfall 002 South Bank main overflow to Merrimack River, Outfall 006 Spicket River secondary overflow to Spicket River, Outfall 004 North Bank main overflow at mouth of Spicket River

Permittee	NPDES #	Segment	Description
Town of Groveland	MA0102661	MA84A-15	The Town of Groveland (Mill Pond GW Intercept System) was authorized (MA0102661 issued April 1983) to discharge from test well site #4 and test well site #14 to Johnson Creek and Brindle Brook via outfall #001 and #002 respectively. The average flow was 0.5 MGD and 0.35 respectively. In November 2001 EPA terminated the permit because the site was determined to be a Superfund Site. *EPA Status of Site: Completion of construction for the 150 gallons per minute groundwater extraction, treatment and discharge facility was achieved in Spring 2000. The groundwater treatment plant began treating contaminated groundwater in April of 2000. Treatment will continue until such time that the groundwater clean up goals have been met throughout the site. The first year of operation and maintenance (O&M) is being provided by the current construction contractor. Funding is provided through a Superfund State Contract with the MassDEP. Under the contract, EPA is funding the O & M for the groundwater treatment system until the end of June 2011. Beginning July 2011, MassDEP will be responsible for funding the continued operation and maintenance of the treatment system until the residual site risk(s) are within an acceptable (protective) range. EPA completed the first five-year review of the remedy in 2005 and determined that the clean up actions at the site are still currently protective of human health and the environment.. In September of 2007, EPA in consultation with MassDEP issued an Explanation of Significant Differences (ESD) to document the clean-up levels and also document that Electrical Resistive Heating (ERH) will be the treatment method used to clean-up TCE contaminated soils on the southern portion of the property. In September of 2008, EPA authorized funding for our oversight contractor implement the ERH remedy. EPA, expects to complete procurement and implement the ERH design in the summer of 2009. See above section entitled "source control". As of October 2006, the treatment system has extracted and treated over 388 million gallons of contaminated groundwater and has removed approximately 1,093 pounds of contamination (Total VOCs). URL: http://www.epa.gov/region1/superfund/sites/groveland Last updated on Thursday, June 18th, 2009*
City of Haverhill Wastewater Division	MA0101621	MA84A-04 MA84A-05 MA84A-09	The City of Haverhill is authorized (MA0101621) issued in December 2007to discharge an average monthly flow of 18.1 MGD treated of treated industrial and sanitary wastewater and storm water from the Haverhill Wastewater Treatment Facility via outfall #046 to the Merrimack River. The average monthly and daily maximum TRC limits are 0.40 and 0.70 mg/L, respectively. The facility is also required to conduct quarterly acute whole effluent toxicity tests with Pimephales promelas with an LC50 limit ≥100% effluent. Monitoring and reporting of monthly total ammonia nitrogen, Kjeldahl nitrogen, nitrite and nitrate concentrations is required. Between June 2001 and April 2009, no acute whole effluent toxicity was detected in the Haverhill WPAF discharge during the test events (i.e., all LC50s were >100% effluent). The facility's 20 CSOs discharge as follows: Merrimack River (MA84A-04) - Outfall #025 (Beach St.), Outfall #031 (Front St.), Outfall #024 (Upper Siphon), Outfall #023 (266 River St.), Outfall #022 (Railroad Bridge), Outfall #032 (Bradford Ave) Outfall #033 (South Prospect St.), Outfall #021A (Middle Siphon) Merrimack River (MA84A-05) - Outfall #034 (Middlesex St.), Outfall #019 (Main St. North), Outfall #035 (South Main St.), Outfall #016 (Fire Station), Outfall #036 (Ferry St.), Outfall #013 (Lower Siphon), Outfall #010 (Boardman St.), Outfall #001 (Bates Bridge) Little River (MA84A-09) - Outfall #021H (Winter and Hale (near Lafayette Square)), Outfall #038 (High St. Diversion), Outfall #021D (Locke St. North), Outfall #021E (Locke St. South)
Haverhill Paperboard Corp.	MAG250961	MA84A-05	The Haverhill Paperboard Corp. is authorized (MAG250961 issued April 2009) to discharge 0.02 MGD of non-contact cooling water via Outfall 003 to the Merrimack River. This facility, which began operation in 1902, ceased operation in August 2008 and is in the process of complete closure. The source of water for cooling was the Merrimack River. Little information is available for the cooling water intake structure except that it is gravity fed.

Permittee	NPDES #	Segment	Description
Littleton Water Department	MAG640002	MA84089	The Littleton Water Department is authorized (MAG6400002 issued March 2002) to discharge an average monthly flow of 0.02 MGD (0.03 MGD maximum daily) from Spectacle Pond Water Production Facility near Rt. 119 to Spectacle Pond.
Lowell Cogeneration Company	MA0031071	MA84A-29	The Lowell Cogeneration Company, L.P. is authorized (MA0031071 issued December 2008) to discharge a monthly average flow of 0.0865 MGD (0.115 MGD maximum daily) of cooling tower blowdown, boiler blowdown, demineralizer wastewater and water softener regeneration wastewater from its facility on Western Ave. via outfall #001 to the Pawtucket Canal to the Merrimack River. The Total Residual Chlorine limit is 0.1 mg/l. Acute whole effluent toxicity testing with both Ceriodaphnia dubia and Pimephales promelas is required once during the first year of the permit (sometime between July and September) and then once every other year thereafter with an LC50 limit of ≥50%effluent. The daily maximum temperature limit is 105℉.
Lowell National Historical Park	MAG250732	MA84A-29	The Lowell National Historical Park is authorized (MAG250732 issued November 2000) to discharge an average monthly flow of 0.360 MGD (0.4 MGD daily maximum) of non-contact cooling water from the Boott Cotton Mills Museum to the Eastern Canal of the Merrimack River.
Lowell Regional Wastewater Utilities	MA0100633	MA84A-01 MA84A-02 MA84A-03 MA84A-11	Lowell Regional Wastewater Utilities is authorized (MA0100633 issued September 2005) to discharge an average monthly flow of 32 MGD of treated effluent from its facility on Rt.110 via Outfall #035) to the Merrimack River (MA84A-03). Total Residual Chlorine limit is 0.21 mg/L average monthly (0.37mg/l daily maximum). Quarterly modified acute and chronic whole effluent toxicity testing is required using Ceriodaphnia dubia with an LC50 limit of ≥ 100% and C-NOEC report only. Two additional acute tests are required each year when secondary treatment is bypassed. Between February 2001 and April 2009 acute and/or modified acute and chronic whole effluent toxicity tests using C. dubia were conducted on Lowell Regional Wastewater Utilities treated effluent using C. dubia (n=38). No acute whole effluent toxicity was detected in any of the test events (LC50s were all >100% effluent). The CNOEC test results ranged from <6.25 to 100% effluent (n=14) and although two tests (July 2006 and July 2007 had CNOECs of <6.25 and 6.25% effluent, respectively) were of concern, no chronic whole effluent toxicity at levels of concern has been detected since October 2007. The permit also authorizes the discharge from 9 CSOs (see below) to the receiving waters of the Merrimack River, Concord River and Beaver Brook. Chelmsford Sewer Commission, Dracut Sewer Commission, Tewksbury DPW and Tynsborough Town Hall are all co- permittees for specific activities required in Part I.C. Unauthorized Discharges, Part I.D. Operation Maintenance of the Sewer System and, Part I.E. Alternate Power Source. The locations of the CSOs are: Merrimack River - Outfall #002 (Walker St.), Outfall #008 (West St.), Outfall #011 (Read St.), Outfall #012 (First St.), Outfall #027 (Tilden St.), Outfall #030(1) (Barasford St.), Outfall #030(2) (Merrimack River) Beaver Brook - Outfall #007 (Beaver Brook) Concord River - Outfall #020 (Warren St. Parking Lot)
Lowell Regional Water Utility	MAG640055	MA84A-01	The Lowell Regional Water Utility is authorized (MAG640055 issued June 2001) to discharge effluent from the water treatment facilities on Pawtucket Blvd to the Merrimack River. The permit application indicates maximum daily discharge is 0.5 MGD.

Permittee	NPDES #	Segment	Description
Lucent Technologies, Inc.	MA0001261	MA84A-04	Lucent Technologies Inc., was authorized (MA0001261) issued in July 2002 to discharge 0.2 MGD of treated sanitary effluent from its facility on Osgood St. in N. Andover into the Merrimack River via outfall #001B, 0.518 MGD maximum daily of treated effluent from a groundwater remediation system via outfalls #001E and 0.072 MGD via outfall #002C, and 0.075 MGD daily maximum flow of non-contact cooling water blowdown and chiller water blowdown and condensate via outfall #002A. Both discharges for outfalls 001B and 002A were tied into the Greater Lawrence Sanitary District at the time the permit was issued. Acute whole effluent toxicity testing was required using both C. dubia and P. promelas twice per year with an LC50 limit of 50% effluent. The facility has since closed down and EPA terminated the permit in September 2006. The two groundwater remediation outfalls are covered under MAG91045 and MAG91046. Between July 2001 and July 2002 acute whole effluent toxicity tests were conducted on Lucent Technologies Inc. (#001) treated effluent using both C. dubia and P. promelas (n=3). The LC50s ranged from 96 to 100% effluent (C. dubia more sensitive test species) and all tests met the LC50 limit of 50% effluent.
Merrimack Water Department	MAG640030	MA84002	The Merrimack Water Department is authorized (MAG640030 issued October 2001) to discharge effluent from the Merrimack Water Treatment Plant on Wallace Way to an unnamed swamp bordering Lake Attittash.
Town of Merrimac	MA0101150	MA84A-05	The Town of Merrimac is authorized (MA0101150 issued October 2006) to discharge an average monthly flow of 0.45 MGD of treated effluent from the Merrimac Wastewater Treatment Plant to the Merrimack River via outfall #001. Effluent is discharged to the Merrimack River through a 12 inch diameter pipe which travels approximately 3,700 feet from the WTF to the Merrimack River. The pipe extends approximately 100 feet into the river. The top of the pipe is submerged approximately four feet below the surface during low tide. Annual acute whole effluent toxicity testing with M. bahia is required each July. The LC50 limit is ≥50% effluent. During summer of 2005 the permittee installed a new ultraviolet disinfection system, replacing chlorine for effluent disinfection.
Newburyport Water Department	MAG640018	MA84A-06	The Newburyport Water Department is authorized (MAG640018 issued August 2001) to discharge an average monthly flow of 0.171 MGD (0.226 MGD maximum daily) of effluent from the Newburyport Water Treatment Plant located on Spring Lane to the Merrimack River.
City of Newburyport	MA0101427	MA84A-06	The City of Newburyport is authorized (MA0101427 issued in May 2004 and modified in October 2006) to discharge an average monthly flow of 3.4 MGD of treated effluent from the Newburyport Wastewater Treatment Plant via Outfall #001 to the Merrimack River Estuary. The TRC limits are 0.23 and 0.39 mg/L average monthly and maximum daily, respectively. Quarterly acute whole effluent toxicity tests using Mysidopsis bahia and Menidia beryllina.are required with an LC50 limit ≥100% effluent. Between June 2001 and May 2009, acute whole effluent toxicity was generally not detected in the Newburyport WPCF discharge (i.e., most LC50s were > 100% effluent), however it was detected by M. bahia in two of 33 valid tests events (32% in September 2001 and 95% in November 2003) and by M. beryllina in three of 31 valid tests (89% in June 2001, 70.7% in October 2005, and 74.8% in February 2008). Neither test species is consistently more sensitive.
Salisbury Sewer Commission	MA0102873	MA84A-06	The Salisbury Sewer Commission is authorized (MA0102873 issued in February 2002) to discharge 1.3 MGD of treated sanitary wastewater effluent via outfall #001 from the Salisbury Wastewater Treatment Plant to a tidal creek that drains into the Merrimack River. The facility is required to conduct modified acute and chronic whole effluent toxicity tests on a quarterly basis using M. beryllina as a test organism. The LC50 and CNOEC permit limits are >100% effluent. The facility uses UV for disinfection. Between May 2001 and March 2009, no acute whole effluent toxicity was detected in the Salisbury WWTP effluent (all LC50s were >100% effluent). Some chronic whole effluent toxicity (CNOECs = 25 or 50% effluent) was detected in four of the 28 chronic tests (September 2002 and 2003, June 2007 and 2008) and somewhat anomalous results occurred during the December 2002 test event.
Salisbury Water Supply Co.	MA0025038	Not a Segment (MA84A-06 subwatershed)	The Salisbury Water Supply Co. was authorized (MA0025038 issued July 1975) to discharge a monthly average flow of 0.685 MGD from their sewers into Black Rock Creek. The permit was terminated by EPA (no longer a surface water discharge) in January 2001.

Permittee	NPDES #	Segment	Description
Veryfine Products (Sunny Delight Beverages Co.)	MA0004936	MA84B-01	Veryfine Products, Inc. (now owned by Sunny Delight Beverages Co. as of November 2007) is authorized (MA0004936 issued September 2006) to discharge an average monthly flow of 0.55 MGD (max daily 0.75 MGD) of treated beverage product effluent, reverse osmosis reject water, and contact and non-contact cooling water from the bottling facility located on Harvard Rd. in Littleton, into the receiving waters of Reedy Meadow Brook via outfall #001. Whole effluent toxicity testing must be conducted 4 times annually (January, April, July, and October) using the species Pimephales promelas. The limits are LC50 ≥100% and C-NOEC ≥91% effluent. Between January 2001 and April 2009 modified acute and chronic whole effluent toxicity tests were conducted on Veryfine Products, Inc's. treated effluent using P. promelas. No acute whole effluent toxicity was detected (LC50's were all > 100% effluent, n=34). Chronic whole effluent toxicity was not usually detected (all CNOECs were 100% effluent) with the exception of 3 of the 32 valid test events. The CNOECs were ≤ 6.25% effluent in the July 2006, January 2007, and July 2008 test events.
Westford Anodizing	MA0024414	MA84B-03	Westford Anodizing was authorized (MA002414 issued August 2002) to discharge an average daily design flow of 0.0014 MGD (max daily 0.002 MGD) of treated process wastewater to Stony Brook via outfall #001. Whole effluent toxicity tests using C. dubia and Pimephales promelas was required quarterly. The limit was LC50 ≥50% effluent. Occasional acute whole effluent toxicity was detected in the Westford Anodizing effluent (LC50's ranged from 26.5 to 100%). The facility ceased discharging in December 2002. EPA terminated the permit in February 2004.

STORMWATER

The NPDES Phase II General Permit program requires NPDES permit coverage for stormwater discharges from small municipal separate storm sewer systems (MS4s), and construction activity disturbing one acre or more of land in a mapped "urbanized area" defined and delineated by the US Bureau of Census in 2000 http://www.epa.gov/npdes/pubs/fact2-2.pdf. Large and medium MS4s (populations over 100,000) were permitted during Phase I of the NPDES stormwater program. Under EPA's Phase II program, the definition of "municipal" includes Massachusetts communities, U.S. military installations, state or federal owned facilities such as hospitals, prison complexes, state colleges or universities and state highways. An MS4 is a system that: discharges at one or more a point sources; is a separate storm sewer system (not designed to carry combined stormwater and sanitary waste water); is operated by a public body; discharges to the Waters of the United States or to another MS4; and, is located in an "Urbanized Area". The NPDES Phase II General Permit requires operators of regulated MS4s to develop and implement a stormwater management program that prevents harmful pollutants from being washed or dumped directly into the storm sewer system which is subsequently discharged into local waterbodies. Certain Massachusetts communities were automatically designated (either in full or part) by the Phase II rule based on the urbanized area delineations from the 2000 U.S. Census.

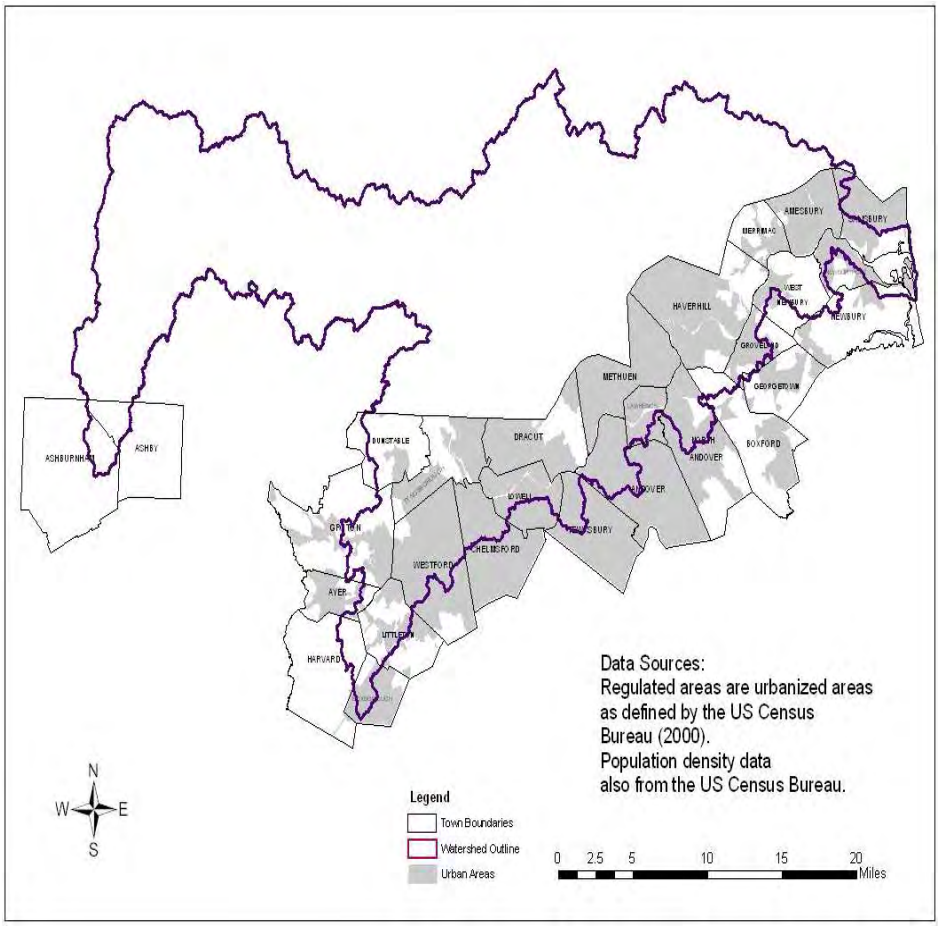

Figure 1. Merrimack Watershed and Associated Communities

As a result of the census mapping, 26 of the 28 communities in the Merrimack Watershed were located either totally or partially in the regulated Urbanized Area. Municipalities that are totally regulated must implement the requirements of the Phase II permit in the entire town, while communities that are partially regulated need to comply with the Phase II permit only in the mapped Urbanized Areas. Merrimack drainage area communities applied to EPA and MassDEP for coverage under the Phase II stormwater general permit, issued on 1 May 2003. EPA issued stormwater general permits to 24 Merrimack municipalities. After administrative review and, in coordination with MassDEP, a thorough review of the communities' stormwater management program was to be conducted during the five-year permit term. Phase II stormwater general permits expire on 1 May 2008 but remain in effect until a new permit is issued. All communities must reapply for coverage under the update general permit. The updated general permit will likely

require some monitoring within the MS4 Phase II area including outfalls and receiving waters and the general permit will require a more detailed and better defined Illicit Discharge Detection and Elimination Program (IDDEP). For detailed community maps see http://www.epa.gov/region01/npdes/stormwater/ma.html.

Table 2. NPDES Phase II stormwater permit information for Merrimack Watershed Communities

Community	Permit #	Permit Issued	Mapped Regulatory area in community
Amesbury	MAR041177	1/8/2004	Total
Andover	MAR041178	9/24/2003	Partial
Ashburnham	Not listed		Partial
Ashby	Not listed		Partial
Ayer	MAR041179	1/8/2004	Partial
Boxford	MAR041184	12/4/2003	Partial
Boxborough	MAR041183	1/20/2004	Partial
Chelmsford	MAR041185	8/28/2003	Partial
Dracut	MAR041194	9/26/2003	Total
Dunstable	Waiver4		Partial
Georgetown	MAR041191	9/26/2003	Partial
Groton	MAR041193	10/28/2003	Partial
Groveland	MAR041195	12/10/2003	Partial
Harvard	Waiver5		Partial
Haverhill	MAR041197	9/26/2003	Total
Lawrence	MAR041201	3/1/2004	Partial
Littleton	MAR041204	9/25/2003	Partial
Lowell	MAR041205	9/12/2003	Partial
Merrimac	MAR041209	1/26/2004	Total
Methuen	MAR041210	10/2/2003	Total
Newbury	MAR041212	9/26/2003	Partial
Newburyport	MAR041213	12/4/2003	Partial
North Andover	MAR041214	10/7/2003	Partial
Salisbury	MAR041220	10/30/2003	Partial
Tewksbury	MAR041226	9/12/2003	Partial
Tyngsborough	MAR041229	8/26/2003	Total
West Newbury	MAR041231	1/8/2004	Partial
Westford	MAR041232	10/7/2003	Partial

APPENDIX C – SUMMARY OF MONITORING SITE LOCATIONS

Table 1. Summary of all monitoring site locations cited in the assessment report and the source of the monitoring site.

Station ID	Location Description	Source
B0524	South Branch Souhegan River, downstream from Jones Hill Road, 275 m downstream from unnamed tributary, Ashby, MA	MassDEP
B0306	Richardson Brook, 200 m upstream from Methuen Street, Dracut, MA	MassDEP
B0308	Trull Brook, 100 m downstream from River Road, Tewksbury, MA	MassDEP
B0319	Martins Pond Brook, 25 m upstream from footpath extending from Loomis Lane, Groton, MA	MassDEP
B0516	Powwow River, 125 m downstream from Rt. 150 (Main Street), off Mill Street, Amesbury, MA	MassDEP
B0517	Fish Brook, ~300 m upstream from the dam at mouth of stream, south of Brundrett Ave., Andover, MA	MassDEP
B0518	Creek Brook, 25 m upstream from West Lowell Ave., Haverhill, MA	MassDEP
B0519	Bartlett Brook, 5 m upstream from Rt. 113 (North Lowell Street), Methuen, MA	MassDEP
B0520	Peppermint Brook, ~100 m downstream from Lakeview Ave., Dracut, MA	MassDEP
B0521	Black Brook, ~250 m upstream from Westford Street, below the golf course (Mt. Pleasant), Lowell, MA	MassDEP
B0522	Bridge Meadow Brook, 80m downstream from road to Tyngsborough Elementary School (205 Westford Road), Tyngsborough, MA	MassDEP
B0523	Tadmuck Brook, ~200 m upstream from Lowell Road, Westford, MA	MassDEP
B0525	Bennets Brook, ~100 m downstream from Willow Road, Ayer, MA	MassDEP
W1209	Unnamed Tributary, unnamed tributary to Johnson Creek, locally known as Argilla Brook, west off Baldwin Terrace approximately 1400 feet upstream/east of Main Street crossing, Groveland ,MA	MassDEP
W1106	Unnamed Tributary, unnamed tributary to Powwow River, approximately 50 feet upstream/northeast of R Street, Amesbury ,MA	MassDEP
W1198	Powwow River, approximately 550 feet downstream/east of Route 150 (approximately 225 feet downstream of Amesbury electrical substation but upstream of discharge pipe directly across from 35 Mill Street), Amesbury ,MA	MassDEP
W1212	Back River, Clinton Street crossing, Amesbury ,MA	MassDEP
W1213	East Meadow River, Thompson Road crossing, Haverhill ,MA	MassDEP
W1197	Johnson Creek, Center Street crossing, Groveland ,MA	MassDEP
W1210	Little River, Downstream/south at Winter Street crossing, Haverhill ,MA	MassDEP
W1203	Creek Brook, West Lowell Avenue crossing, Haverhill ,MA	MassDEP
W1195	Bare Meadow Brook, Renfrew Street crossing, Methuen ,MA	MassDEP
W1202	Bartlett Brook, Route 113 (North Lowell Street) crossing, Methuen ,MA	MassDEP
W1206	Fish Brook, River Road crossing, Andover ,MA	MassDEP
W1194	Trull Brook, Approximately 230 feet downstream/north of River Road, Tewksbury ,MA	MassDEP
W1192	Richardson Brook, Methuen Street crossing, Dracut ,MA	MassDEP
W1193	Trout Brook, Kenwood Road crossing, Dracut ,MA	MassDEP
W1211	Peppermint Brook, Lakeview Avenue crossing, Dracut ,MA	MassDEP
W1191	Black Brook, Westford Street crossing, Lowell ,MA	MassDEP
W1201	Tadmuck Brook, Lowell Road crossing, Westford ,MA	MassDEP

Station ID	Location Description	Source
W1200	Bennetts Brook, Willow Road crossing, Ayer ,MA	MassDEP
W1190	Deep Brook, Ledge Road crossing, Chelmsford ,MA	MassDEP
W1189	Lawrence Brook, Approximately 130 feet downstream/south of Sherburne Avenue, Tyngsborough ,MA	MassDEP
W1207	Bridge Meadow Brook, Downstream/northeast of the unnamed school access road crossing north off Westford Avenue between the localities of Hayward Corner and Swan Corner, Tyngsborough ,MA	MassDEP
W1199	Salmon Brook, Ridge Road crossing, Nashua, New Hampshire ,MA	MassDEP
W1208	Joint Grass Brook, Downstream/east of Main Street crossing (below confluence of unnamed tributary), Dunstable ,MA	MassDEP
W1188	Martins Pond Brook, Approximately 180 feet downstream from washed out culvert crossing of Loomis Lane, Groton ,MA	MassDEP
M011	Merrimack River, Upstream of Lowell, 500 feet downstream of Tyngs Island, Chelmsford, MA	CDM
T006	Stony Brook, Middlesex Road bridge (downstream side), Chelmsford, MA	CDM
M012	Merrimack River, Lowell Public Beach Adjacent to beach area, Lowell, MA	CDM
M013	Merrimack River, Upstream of Pawtucket Dam, 200 feet upstream of Float line, Lowell, MA	CDM
M014	Merrimack River, Downstream Pawtucket Dam, Ouelette Bridge- Aiken Street, Lowell, MA	CDM
T007	Beaver Brook Parker Ave bridge (upstream side), Dracut, MA	CDM
M015	Merrimack River, Downstream of Lowell USGS Gaging Station at Lowell, Lowell, MA	CDM
M016	Merrimack River, Lowell WWTP, 300 feet downstream of Lowell WWTP outfall, Lowell, MA	CDM
M017	Merrimack River, Upstream of Lawrence County Line, Methuen, MA	CDM
M018	Merrimack River, Upstream of Essex Dam Float line, Lawrence, MA	CDM
M019	Merrimack River, Downstream Essex Dam Casey Bridge, Lawrence, MA	CDM
T009	Spicket River Haverhill St bridge (downstream side), Lawrence, MA	CDM
M021	Merrimack River, GLSD WWTP 300 feet downstream of GLSD WWTP outfall, Lawrence, MA	CDM
M022	Merrimack River, Upstream of Haverhill Haverhill/N. Andover Town Line, Methuen, MA	CDM
M024	Merrimack River, Haverhill WWTP 300 feet downstream of Haverhill WWTP outfall, Haverhill, MA	CDM
M025	Merrimack River, Merrimac WWTP 300 feet downstream of Merrimac WWTP outfall, Merrimac, MA	CDM
M026	Merrimack River, Amesbury WWTP 300 feet downstream of Amesbury WWTP outfall, Amesbury, MA	CDM
T011	Powwow River 200-300 feet upstream of confluence, Amesbury, MA	CDM
M027	Merrimack River, Shellfish Bed Newburyport Boat Ramp in Joppa Flats, Newburyport, MA	CDM
M028	Merrimack River, Salisbury WWTP 300 feet downstream of Salisbury WWTP, Salisbury, MA	CDM
M029	Merrimack River, Newburyport WWTP 300 feet downstream of Newburyport WWTP, Newburyport, MA	CDM
M030	Shellfish Bed North side of bay, Salisbury, MA	CDM

Station ID	Location Description	Source
TA01	Tadmuck Brook, upstream from Lowell Road reach beginning at breached dam and continuing 150 m upstream., Westford, MA	MassDEP
BR01	Bridge Meadow Brook, downstream from elementary school entrance road off Chestnut Road., Tyngsborough, MA	MassDEP
DBR05	Deep Brook, downstream of Ledge Road, Behind houses off Dunstable Road. Upstream of un-named tributary., Chelmsford, MA	MassDEP
BB05	Black Brook, off of and adjacent to Montgomery Ave just downstream from golf course., Lowell, MA	MassDEP
PE01A	Peppermint Brook, 200 meters downstream from Lakeview Ave. Reach extended to riffle located approx 100 m downstream of bridge., Dracut, MA	MassDEP
TRB02	Trout Brook, upstream and downstream of Kenwood Sreet., Dracut, MA	MassDEP
RBR01A	Richardson Brook, reach beginning upstream of a new road off of Methuen Street, Dracut, MA	MassDEP
TB02	Trull Brook, downstream of River Road reach beginning just upstream from golf course, Tewksbury, MA	MassDEP
BA01A	Bartlett Brook, downstream and upstream of Rte 113 , Methuen, MA	MassDEP
FI01A	Fish Brook, near confluence with Merrimack River upstream of footpath at sewer line crossing., Andover, MA	MassDEP
FI02	Fish Brook, near confluence with Merrimack River downstream of footpath at sewer line crossing., Andover, MA	MassDEP
BMB01A	Bare Meadow Brook, downstream from Renfrew Street., Methuen, MA	MassDEP
CR01	Creek Brook, upstream from Lowell Avenue., Haverhill, MA	MassDEP
JC03	Johnson Creek, downstream of Center Street bridge., Groveland, MA	MassDEP
AR01A	Argilla Brook, west of circle at end of Baldwin Terrace downstream of footpath and bridge., Groveland, MA	MassDEP
EA01	East Meadow River, beginning 150 m downstream of cart road at end of Thompson Road, Haverhill, MA	MassDEP
511	Black Brook, Westford St (upstream), Lowell, MA	MA DFG
736	Johnson Brook, Main Street downstream, Groveland, MA	MA DFG
737	Powwow River, Newton Road bridge downstream, Amesbury, MA	MA DFG
738	Back River (2), Fern Ave upstream, Amesbury, MA	MA DFG
1456	UNT(Argella Brook), 75' upstream of Main St, Groveland, MA	MA DFG
1605	Bennetts Brook, Willow Rd downstream, 500' N of Littleton Rd, Ayer, MA	MA DFG
1607	Trout Brook, Pelczar Rd xing upstream, just E of Sesame St, Dracut, MA	MA DFG
1608	Trout Brook, Kenwood Rd xing 300' E of Sesame St, Dracut, MA	MA DFG
1609	Joint Grass Brook, Main St downstream, 400' S of Mill St, Dunstable, MA	MA DFG
1643	Bennetts Brook, Rt 2A xing downstream ~0.2mi W of Willow Rd, Ayer/Littleton, MA	MA DFG
1644	Reed Brook, N. Main St upstream. Next to Norman Day School, Westford, MA	MA DFG
1645	Stony Brook, Stony Brook Rd downstream, next to RR tracks, Westford, MA	MA DFG
1646	Stony Brook, Brookside Rd upstream, Westford, MA	MA DFG
1649	Cobbler Brook, Harriman Rd downstream 0.3mi N of Highland St, Merrimac, MA	MA DFG
1650	Cobbler Brook, Highland St xing upstream 0.3mi N of Harriman Rd, Merrimac, MA	MA DFG

Station ID	Location Description	Source
1651	Little River, Rosemont St xing upstream E of RR tracks, Haverhill, MA	MA DFG
2.7	Merrimack River, Newburyport WWTP	MRWA
3.6	Merrimack River, Cashman Park	MRWA
3.8	Merrimack River, North Boat	MRWA
4.4	Merrimack River, Yankee	MRWA
6.8	Merrimack River, PowWow	MRWA
8.3	Merrimack River, Artichoke	MRWA
9.4	Merrimack River, Indian RIver	MRWA
10.6	Merrimack River, Cobbler's Brook	MRWA
14.1	Merrimack River, North Canal	MRWA
16.8	Merrimack River, Johnson	MRWA
17.8	Merrimack River, Haverhill WWTP	MRWA
19.1	Merrimack River, Little River	MRWA
22.3	Merrimack River, Creek Brook	MRWA
25.6	Merrimack River, Lucent	MRWA
26.9	Merrimack River, Lawrence WWTP	MRWA
28.2	Merrimack River, Spickett River	MRWA
29.1	Merrimack River, Below Essex Dam	MRWA
29.6	Merrimack River, Above Essex	MRWA
31.4	Merrimack River, Methuen Intake	MRWA
32.2	Merrimack River, Bartlett	MRWA
33.4	Merrimack River, Fish Brook	MRWA
35.1	Merrimack River, Gravel Pt	MRWA
36.3	Merrimack River, Trull Brook	MRWA
37.9	Merrimack River, Duck Island	MRWA
41.1	Merrimack River, Falls	MRWA
42.4	Merrimack River, Rourke	MRWA
43.4	Merrimack River, Stoney	MRWA
43.6	Merrimack River, Intake	MRWA
46.4	Merrimack River, Lawrence	MRWA
47.3	Merrimack River, Rte. 113	MRWA
48.9	Merrimack River, Limon Brook	MRWA
49.6	Merrimack River, NH Border	MRWA