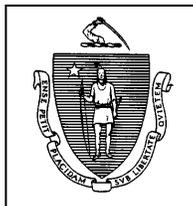


BLACKSTONE RIVER WATERSHED 2003 - 2007 WATER QUALITY ASSESSMENT REPORT



The Blackstone River, Millville, MA

**COMMONWEALTH OF MASSACHUSETTS
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BLACKSTONE RIVER WATERSHED
2003-2007 WATER QUALITY ASSESSMENT REPORT

The Blackstone River, Millville, MA

Prepared by:
Massachusetts Department of Environmental Protection
Division of Watershed Management

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

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- United States Geological Survey (USGS)
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LIST OF ACRONYMS AND ABBREVIATIONS

A.....Class A waterbody	MS4.....Municipal Separate Stormwater System
ACOE.....Army Corps of Engineers (United States)	NPDES.....National Pollutant Discharge Elimination System
B.....Class B waterbody	NPS.....non-point source pollution
BMP.....best management practice	PAH.....polycyclic aromatic hydrocarbon
CMR.....Code of Massachusetts Regulations	PCB.....polychlorinated biphenyls
CNOEC.....chronic no observed effect concentration	RBP.....rapid bioassessment protocol
CSO.....combined sewer overflow	PWS.....Public Water Supply
CWA.....Clean Water Act	SWQS.....Surface Water Quality Standards
DO.....dissolved oxygen	TIE/TRE.....toxicity identification evaluation/toxicity reduction evaluation
DPW.....Department of Public Works	TMDL.....total maximum daily load
DWM.....Division of Watershed Management	TOXTD.....MassDEP DWM Toxicity Testing Database
EPA.....United States Environmental Protection Agency	USGS.....United States Geological Survey
EPT.....Ephemeroptera, Plecoptera, and Tricoptera	WBS.....Waterbody System database
LC ₅₀lethal concentration to 50% of the test organisms	WMA.....Water Management Act
MA DFG.....Massachusetts Department of Fish and Game	WWTP.....wastewater treatment plant
MA DPH.....Massachusetts Department of Public Health	
MassDEP.....Massachusetts Department of Environmental Protection	

LIST OF UNITS

cfs.....cubic feet per second
cfu.....colony forming unit
fps.....foot per second
MGD.....million gallons per day
m.....meters
ml.....milliliters
mg/L.....milligram per liter
ppm.....parts per million
ppt.....parts per thousand
SU.....standard units
µS/cm.....micro seimens per centimeter

TABLE OF FISH SCIENTIFIC NAMES

Common Name	Latin name	Common Name	Latin name
American brook lamprey	<i>Lampetra appendix</i>	golden shiner	<i>Notemigonus crysoleucas</i>
black crappie	<i>Pomoxis nigromaculatus</i>	green sunfish	<i>Lepomis cyanellus</i>
blacknose dace	<i>Rhinichthys atratulus</i>	largemouth bass	<i>Micropterus salmoides</i>
bluegill	<i>Lepomis macrochirus</i>	longnose dace	<i>Rhinichthys cataractae</i>
brook trout	<i>Salvelinus fontinalis</i>	northern pike	<i>Esox lucius</i>
brown bullhead	<i>Ameiurus nebulosus</i>	pumpkinseed	<i>Lepomis gibbosus</i>
brown trout	<i>Salmo trutta</i>	redfin pickerel	<i>Esox americanus</i>
chain pickerel	<i>Esox niger</i>	tesselated darter	<i>Etheostoma olmstedii</i>
common carp	<i>Cyprinus carpio</i>	white catfish	<i>Ameiurus catus</i>
common shiner	<i>Luxilus cornutus</i>	white perch	<i>Morone americana</i>
creek chubsucker	<i>Erimyzon oblongus</i>	white sucker	<i>Catostomus commersonii</i>
fallfish	<i>Semotilus corporalis</i>	yellow bullhead	<i>Ameiurus natalis</i>
fathead minnow	<i>Pimephales promelas</i>	yellow perch	<i>Perca flavescens</i>

EXECUTIVE SUMMARY
BLACKSTONE RIVER WATERSHED
2003-2007 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 provides an evaluation of the current status of the designated uses as defined in the SWQS in the Blackstone River Watershed. The designated uses, where applicable, include: *Aquatic Life, Fish Consumption, Drinking Water, Primary and Secondary Contact Recreation and Aesthetics*. Each use, within a given segment, is individually assessed as **support** or **impaired**. When too little current data/information exists or no reliable data are available 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”. It is important to note that not all waters are assessed. Many small and/or unnamed rivers, lakes, and estuarine areas have never been assessed; the status of their designated uses has never been 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 Waterbody System (WBS) or the new Assessment Database (ADB). These are considered **not assessed other waters**.

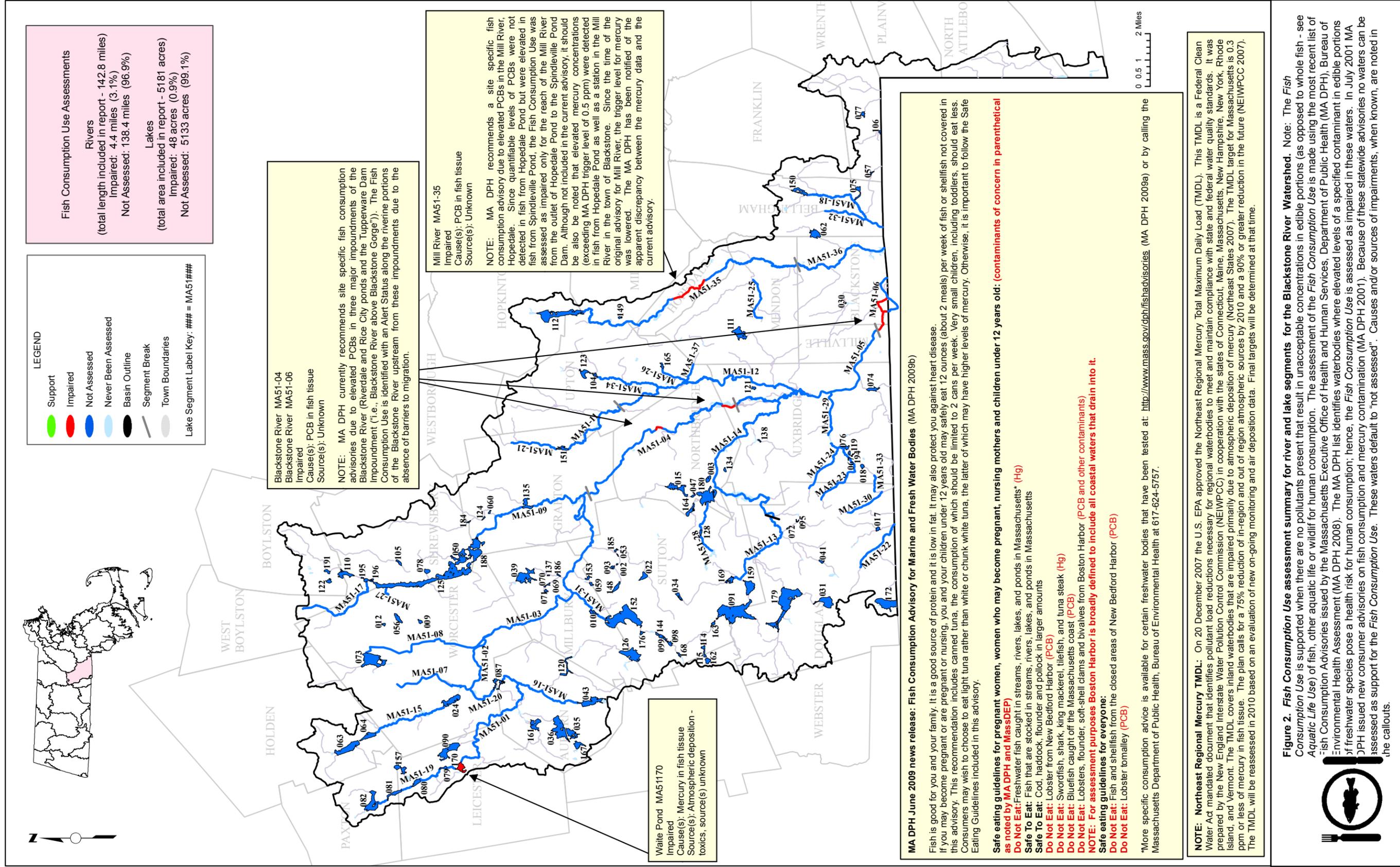
This report summarizes information generated in the Blackstone River Watershed since the last water quality assessment report that was published in May 2001 (Weinstein *et al.* 2001). The new assessments are based on the most currently available validated water quality data/information developed by the Massachusetts Department of Environmental Protection (MassDEP) as well as more recent data collected by external data sources in the watershed in partial fulfillment of MassDEP’s federal mandate to report on the status of the Commonwealth’s waters under the CWA. It should be noted here that there are several large datasets for the Blackstone River Watershed which unfortunately were not available for use for this assessment cycle primarily because data validation procedures were not yet completed. These data sources included, but are not necessarily limited to, the 2008 MassDEP DWM Blackstone River Watershed surveys, the MassDEP 2004-2009 SMART water quality monitoring data, the USGS 2007-2009 Nutrient and Trace Metal Loading to the Blackstone River, Massachusetts and Rhode Island, and a study initiated in 2004 for the UBWPAD. These data sources will be utilized in the next assessment cycle for the watershed.

The summary of the assessments for the *Aquatic Life, Fish Consumption, Primary and Secondary Contact Recreation, and Aesthetics* uses in the Blackstone River Watershed segments are illustrated in Figures 1 through 5, respectively. Where sufficient data/current information were not available, the uses were not assessed.

The status of the *Drinking Water Use* is not assessed in this report since the most current 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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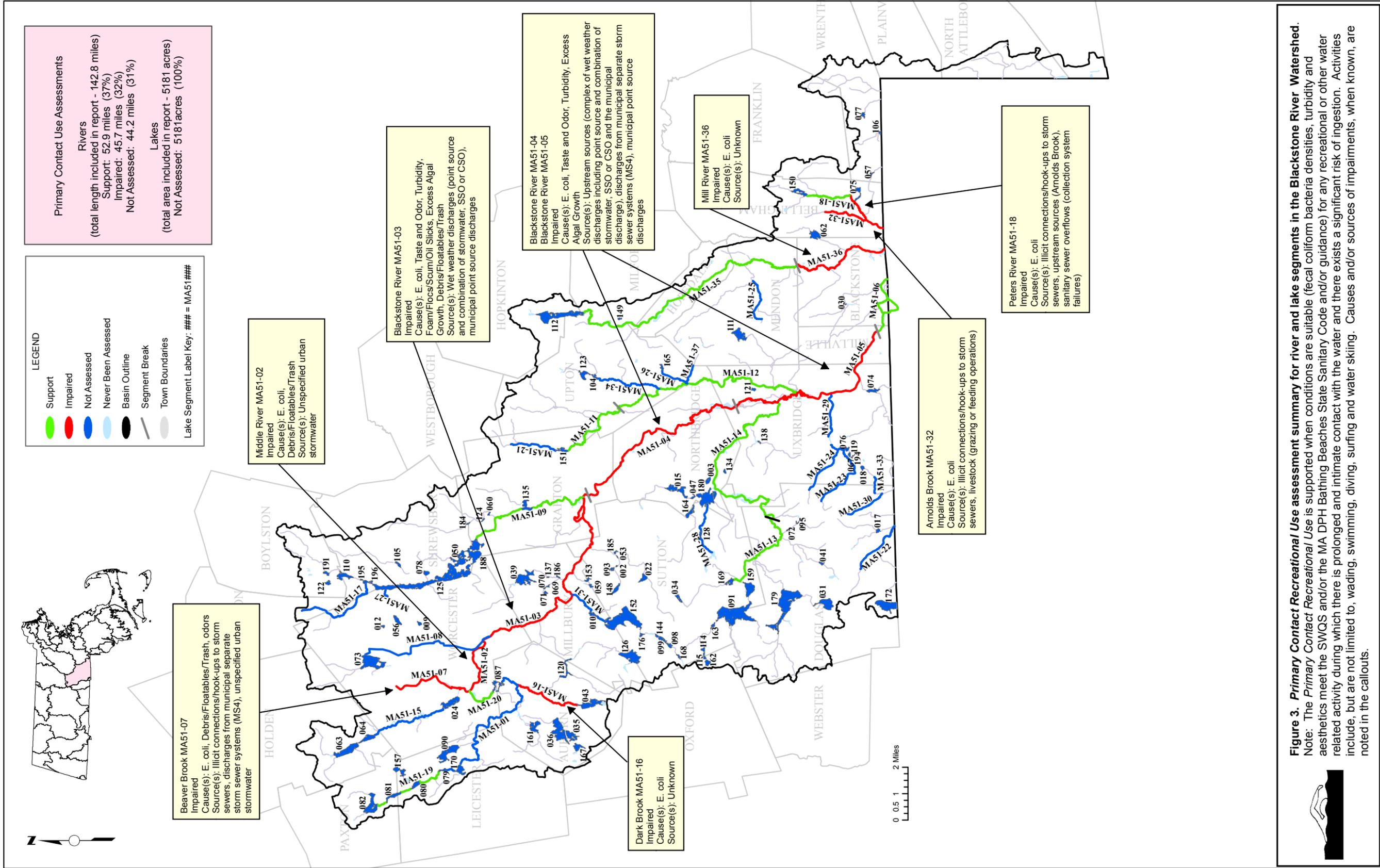


Figure 3. Primary Contact Recreational Use assessment summary for river and lake segments in the Blackstone River Watershed.
 Note: The Primary Contact Recreational Use is supported when conditions are suitable (fecal coliform bacteria densities, turbidity and aesthetics meet the SWQS and/or the MA DPH Bathing Beaches State Sanitary Code and/or guidance) for any recreational or other water related activity during which there is prolonged and intimate contact with the water and there exists a significant risk of ingestion. Activities include, but are not limited to, wading, swimming, diving, surfing and water skiing. Causes and/or sources of impairments, when known, are noted in the callouts.

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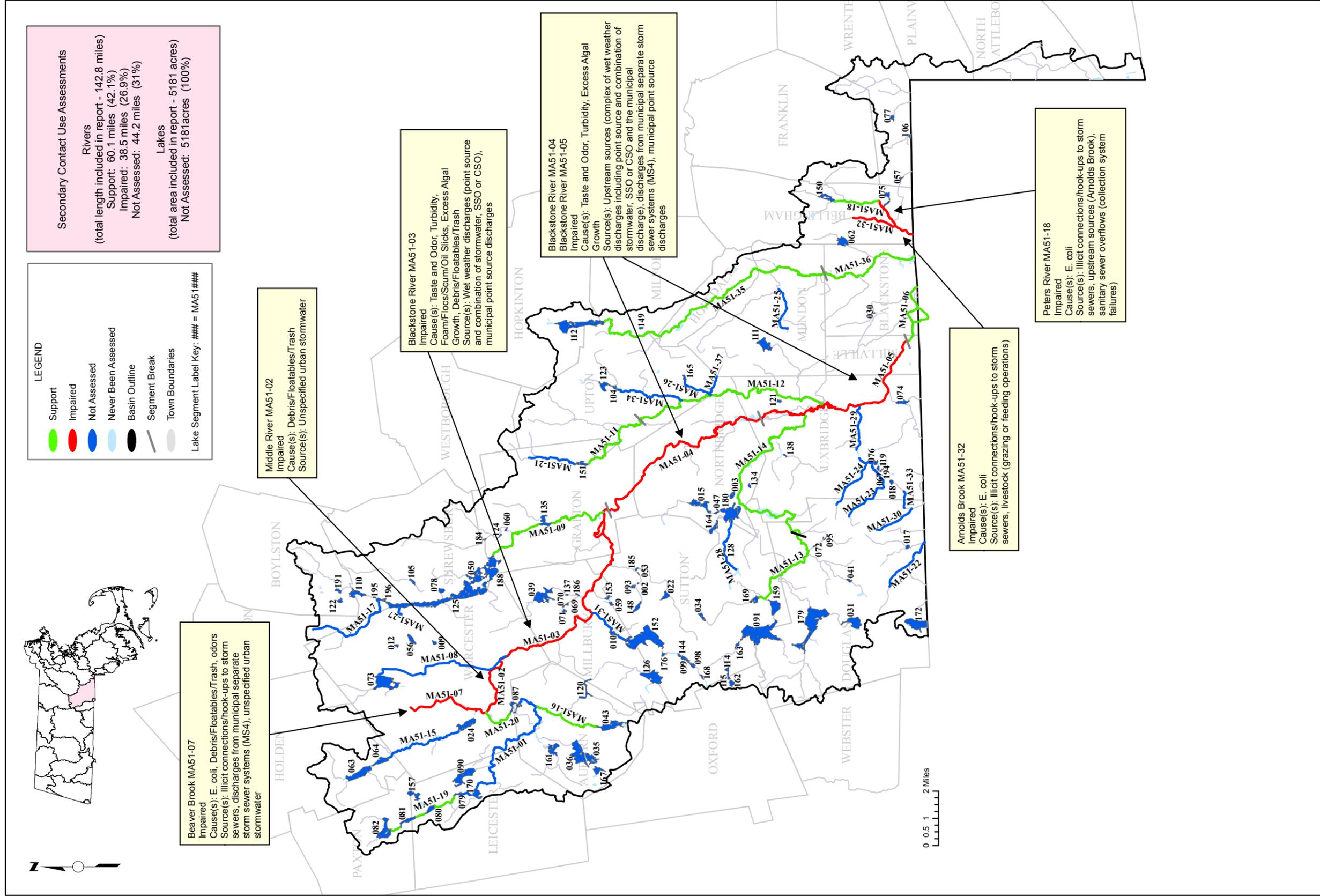


Figure 4. Secondary Contact Recreational Use assessment summary for river and lake segments in the Blackstone River Watershed. The Secondary Contact Recreational Use is supported when conditions are suitable for any recreational or other water use during which contact with the water is either incidental or accidental. These include, but are not limited to, fishing, boating and limited contact related to shoreline activities. For lakes, non-native aquatic macrophyte cover and/or transparency data (Secchi disk depth) are evaluated to assess the status of the recreational uses. Causes and/or sources of impairments, when known, are noted in the callouts.

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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 (Environmental Law Reporter 1988). 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. 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). The surface waters are segmented and each segment is assigned to one of six classes (see Appendix A). Under Section 305(b) of the Federal Clean Water Act, every two years MassDEP must submit a statewide report which describes the status of water quality in the Commonwealth to the EPA. 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 required the states 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 INTEGRATED LIST OF WATERS

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. The Massachusetts Year 2008 Integrated List of Waters (MassDEP 2008a) was approved by the EPA in May 2009 (Moraff 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) 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 (i.e., 2010). 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.

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.

DESCRIPTION OF BLACKSTONE RIVER WATERSHED

The Blackstone River (Figure 6) is formed in the City of Worcester by the confluence of the Middle River and Mill Brook. The mainstem flows generally southeast through Worcester, Millbury, Sutton, and Grafton to Fisherville Pond, where it is joined by the Quinsigamond River. Below Fisherville Pond, the Blackstone River flows in a southerly direction through Northbridge, Uxbridge, Millville, and Blackstone and crosses for the first time into Rhode Island. Just south of the RI border, it is joined by the Branch River, turns north and re-enters Massachusetts for a short distance, then turns south again and enters Woonsocket RI. The Blackstone River Basin is bordered by the Chicopee River Basin to the northwest, the French River Basin to the southwest, the Concord River Basin to the northeast and by the Charles River Basin to the southeast. The north and south portions of the basin are bordered by the Nashua River Basin and the state of Rhode Island, respectively. Major tributaries that discharge to the Blackstone River in Massachusetts include the Quinsigamond, West, and Mumford rivers. The Mill and Peters rivers join the Blackstone River in Rhode Island. There are 188 lakes in the Massachusetts portion of the basin which cover approximately 7,087 acres.

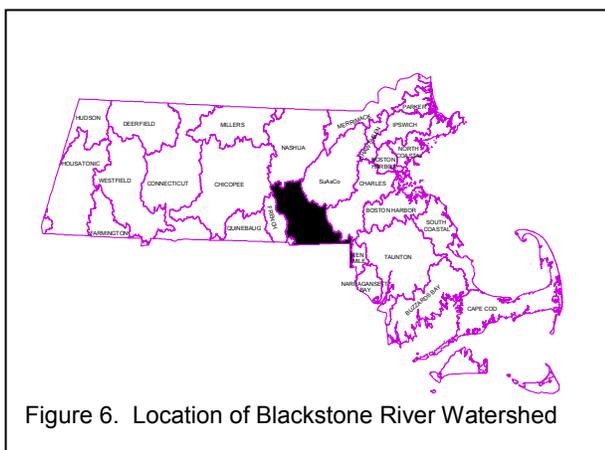


Figure 6. Location of Blackstone River Watershed

The mainstem Blackstone River is characterized by numerous impoundments formed by the remains of old mill-dams used historically for water power. In Massachusetts, two of these are still used at varying levels to generate power: Riverdale and Synergics (Tupperware). Water levels in the river fluctuate rapidly over short periods of time due to a combination of storm impacts and water flow regulations. The flow impacts during storm events are compounded by the predominance of impervious surfaces and the scarcity of wetlands. A decrease in impervious surfaces and an increase in wetlands would moderate flows through absorbing and releasing the water over larger time events.

The drainage area of the Blackstone River Basin encompasses a total of 540 square miles of which approximately 335 square miles lie in Massachusetts including portions of Bristol, Middlesex, Norfolk, and Worcester counties. The communities of Attleboro, Auburn, Bellingham, Blackstone, Boylston, Douglas, Franklin, Grafton, Holden, Hopedale, Hopkinton, Leicester, Milford, Millbury, Millville, Northbridge, Mendon, North Attleborough, Oxford, Paxton, Plainville, Shrewsbury, Sutton, Upton, Uxbridge, Webster, Westborough, West Boylston, Worcester, and Wrentham lie wholly or in part within the watershed boundaries.

OBJECTIVES

This report summarizes information generated about the Blackstone River Watershed since the last water quality assessment report that was published in May 2001 (Weinstein *et al.* 2001). The new assessments are based on the most currently available validated water quality data/information developed by the Massachusetts Department of Environmental Protection (MassDEP) as well as more recent data collected by external data sources in the watershed in partial fulfillment of MassDEP's federal mandate to report on the status of the Commonwealth's waters under the CWA. It should be noted here that there are several large datasets for the Blackstone River Watershed which unfortunately were not available for use for this assessment cycle primarily because data validation procedures were not yet completed. These data sources included, but are not necessarily limited to, the 2008 MassDEP DWM Blackstone River Watershed surveys, the MassDEP 2004-2009 SMART water quality monitoring data, the USGS 2007-2009 Nutrient and Trace Metal Loading to the Blackstone River, Massachusetts and Rhode Island, and a study initiated in 2004 for the UBWPAD. These data sources will be utilized in the next assessment cycle for the watershed.

The methodology used to assess the status of water quality conditions of rivers and lakes in accordance with EPA's and MassDEP's use assessment methods is provided in Appendix A. Appendix B provides the Blackstone River Watershed 2003 DWM Water Quality Monitoring Data Technical Memorandum. The Blackstone River Watershed 2003 Biological Assessment Technical Memorandum is Appendix C. Appendix D provides the Blackstone River Watershed 2003 Fish Population Monitoring and Assessment Technical Memorandum. Appendix E provides the 2003 Blackstone River Water Quality Survey Results of Periphyton Sampling memorandum. Appendix F is the MassDEP SMART Water Quality Sampling Data 2000 – 2004 for the

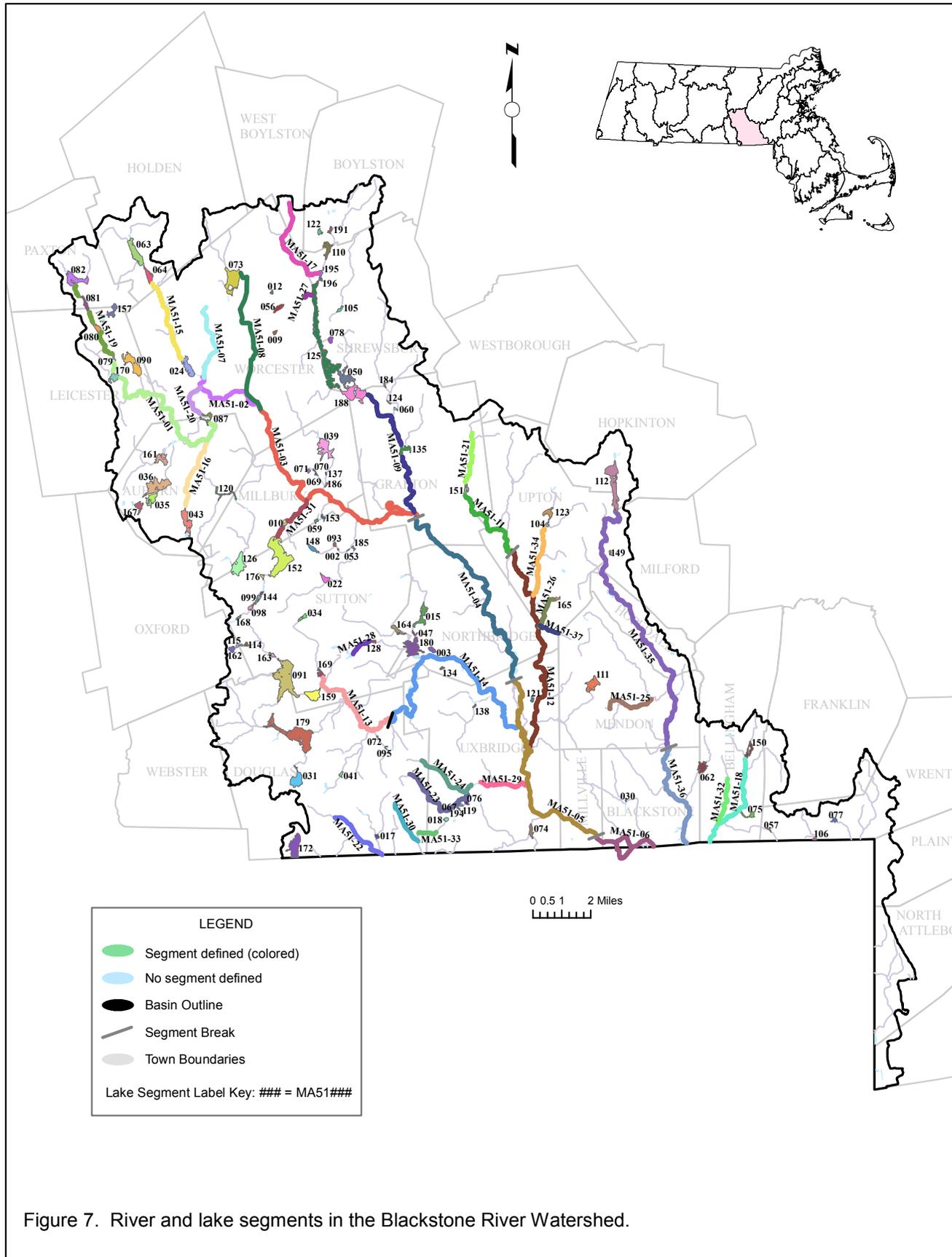
Blackstone River Watershed. Appendix G provides the DWM Technical Memorandum TM-51-14 Continuous Temperature Data at Four Locations in the Blackstone River Watershed (August-September, 2003). Lastly Appendix H contains a brief summary of information for Water Management Act (WMA) registrations and permits as well as National Pollutant Discharge Elimination System (NPDES) permits in the Blackstone River Watershed. For this report however only *surface water* withdrawal sources for WMA users are listed in segment summaries.

The objectives of this water quality assessment report are as follows:

1. evaluate whether or not surface waters in the Blackstone River Watershed, defined as segments in the MassDEP/EPA databases, currently support their designated uses (i.e., meet Massachusetts Surface Water Quality Standards),
2. identify stressors impairing designated uses and any confirmed sources of those stressors [e.g., water withdrawals (habitat quality/water quantity) and/or major point (e.g., wastewater discharges, storm sewer system) and non-point (e.g., land-use practices, overland runoff, etc.) sources of pollution that may impair water quality conditions],
3. identify the presence or absence of any non-native macrophyte(s),
4. identify waters (or segments) of concern that will require additional data to fully assess water quality conditions, and
5. recommend additional monitoring needs and/or remediation actions in order to better determine the level of impairment or to improve/restore water quality conditions.

There are a total of 36 river segments (27 named streams and two unnamed tributaries) which represent 142.8 river miles and 101 lake segments representing 5181 acres included in this report (Figure 7). It should be noted that there were 31 lake segments on the 2008 Integrated List for the Blackstone River Watershed which are not reported as lake segments in this report. These 31 former lake segments (representing 792 total acres) are considered run-of-river impoundments (primarily since their estimated retention times are less than 14 days). Information for these waterbodies has been incorporated in the river segments as noted below:

Former Lake Segment	Current River Segment
Auburn Pond (Segment MA51004)	Dark Brook (MA51-16)
Bazely Pond (Segment MA51008)	Laurel Brook (MA51-23)
Caprons Pond (Segment MA51014)	Mumford River (MA51-14)
City Farm Pond (Segment MA51020)	Poor Farm Brook (MA51-17)
City Millpond (Segment MA51019)	Miscoe Brook (MA51-21)
City Pond (Segment MA51021)	Kettle Brook (MA51-01)
Cook Pond (Segment MA51027)	Tatnuck Brook (MA51-15)
Curtis Ponds (Segment MA51032)	Unnamed Tributary (MA51-20)
Curtis Ponds (Segment MA51033)	Unnamed Tributary (MA51-20)
Fisherville Pond (Segment MA51048)	Blackstone River (MA51-03) and Quinsigamond River (MA51-09)
Fiske Mill Pond (Segment MA51049)	Mill River (MA51-35)
Gilboa Pond (Segment MA51052)	Mumford River (MA51-14)
Harris Pond (Segment MA51058)	Mill River (MA51-36)
Hopedale Pond (Segment MA51065)	Mill River (MA51-35)
Hovey Pond (Segment MA51068)	Quinsigamond River (MA51-09)
Lackey Pond (Segment MA51083)	Mumford River (MA51-14)
Lee Reservoir (Segment MA51086)	Scadden Brook (MA51-24)
Linwood Pond (Segment MA51088)	Mumford River (MA51-14)
Patch Reservoir (Segment MA51118)	Tatnuck Brook (MA51-15)
Rice City Pond (Segment MA51131)	Blackstone River (MA51-04)
Riverdale Impoundment (Segment MA51136)	Blackstone River (MA51-04)
Salisbury Pond (Segment MA51142)	Unnamed Tributary (MA51-08)
Spindleville Pond (Segment MA51158)	Mill River (MA51-35)
Stoneville Pond (Segment MA51160)	Kettle Brook (MA51-01)
West River Pond (Segment MA51177)	West River (MA51-12)
Whitin Pond (Segment MA51178)	Mumford River (MA51-14)
Lake Wildwood (Segment MA51181)	West River (MA51-11)
Meadow Pond (Segment MA51193)	Mumford River (MA51-14)
Harrington Pool (West Hill Dam Impoundment) (Segment MA51197)	West River (MA51-12)
Mill Pond (Segment MA51102)	Mill River (MA51-35)
Smiths Pond (Segment MA51156)	Kettle Brook (MA51-01)



RIVER SEGMENTS

KETTLE BROOK (MA51-19)

Location: Outlet Kettle Brook Reservoir #4, Paxton, to inlet of Kettle Brook Reservoir #1, Leicester. (excluding Kettle Brook Reservoir #3 segment MA51081 and Kettle Brook Reservoir #2 segment MA51080)
Size: 1.9 Miles
Classification: A\PWS\ORW
2008 303(d) List: Category 2

This segment is on the 2008 Integrated List of Waters in Category 2 - Attaining Some Uses (Aquatic Life, Aesthetics); Others Not Assessed (MassDEP 2008a).

WMA with surface water source(s) (APPENDIX H, Table H1):

City of Worcester DPW (registration 21234805, permit 9P321234803)

NPDES (APPENDIX H, Table H2):

Town of Paxton (MAR041148)

Note: This segment of Kettle Brook includes Kettle Brook Reservoirs #1-4, which are active sources of drinking water supply for the City of Worcester. The contributing watershed is largely undeveloped and Worcester watershed security guards patrol the area and limit access to this zone (Lilyestrom 2004). These waters are not available for primary and secondary contact recreation. Parts of the Worcester Airport, including runways, lie within the drainage area.

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Water Chemistry

DWM staff conducted monthly in-situ and water quality monitoring in Kettle Brook near Earle Street in Leicester (KB10) on five occasions between May and October 2003. Early morning DO measurements (between 01:46 and 08:18am, n=5) ranged from 7.7 to 10.1 mg/L and the other physico-chemical monitoring data were indicative of excellent conditions. The maximum water temperature was 24.8°C while the maximum TP concentration was 0.014 mg/L (Appendix B Tamul 2005).

The *Aquatic Life Use* is assessed as support based on the limited water quality data which were indicative of good conditions.

Primary and Secondary Contact Recreational and Aesthetics Uses

In 2003, MassDEP DWM collected six *E. coli* samples from Kettle Brook near Earle Street in Leicester (KB10) during the primary contact season (Appendix B). The geometric mean of the six samples was 17 *cfu*/100 ml. No aesthetically objectionable conditions (e.g., odors, oils, turbidity, growths, deposits) were observed (MassDEP 2003).

Since the geometric mean for the *E. coli* bacteria results meet the criteria for both primary and secondary contact recreation (126 and 630 *cfu*/100 ml, respectively) and no aesthetically objectionable conditions were observed the *Primary and Secondary Contact Recreational and Aesthetics* uses are assessed as support.

Kettle Brook (MA51-19) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT
Fish Consumption		NOT ASSESSED
Drinking Water*		NOT ASSESSED
Primary Contact		SUPPORT
Secondary Contact		SUPPORT
Aesthetics		SUPPORT

* The MassDEP Drinking Water Program maintains current drinking water supply data.

KETTLE BROOK (MA51-01)

Location: Outlet Kettle Brook Reservoir #1, Leicester to the inlet of Leesville Pond, Auburn (excluding the approximately 0.4 miles through Waite Pond segment MA51170, Leicester) (through former segments: City Pond MA51021, Smiths Pond MA51156, and Stoneville Pond MA51160)

Size: 7.0 Miles

Classification: B\WWF

2008 303(d) List: Category 5

This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Cause Unknown, Nutrients, Organic enrichment/Low DO, (Flow alteration*), Pathogens). * denotes a non-pollutant (MassDEP 2008a).

The following water bodies will no longer be reported as lake segments, they will be considered run of the river impoundments (McVoy 2006):

City Pond (MA51021), approximate size: 3 acres, approximate retention time: 3 days

Smiths Pond (MA51156), approximate size: 13 acres, approximate retention time: 1day

Stoneville Pond (MA51160) approximate size: 35 acres, approximate retention time: 6 days

The retention time estimates were based on the annual historical mean discharge from two stream gages in the Blackstone River Basin (01110000 and 01124500) and the normal storage volume of the dams reported by DCR in their Massachusetts Dam Safety Program Database (Socolow et al. 2004 and DCR 2002).

[Site Awaiting NPL Decision \(SAND\): WORCESTER SPINNING & FINISHING COMPANY](#)

Smiths Pond (MA51156) is on the 2008 Integrated List of Waters in Category 4a-TMDL is Completed (Turbidity [5/2/2002, CN070.1 {MassDEP 2002a}]).

City Pond (MA51021) is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed.

Stoneville Pond (MA51160) is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Noxious aquatic plants [5/2/2002, CN070.1 {MassDEP 2002a}], Exotic species*). * denotes a non-pollutant.

NPDES (APPENDIX H and Table H2):

Town of Leicester (MAR041202)

City of Worcester (MAS010002)

Town of Auburn (MAR041088)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

In general, the numerous dams in this segment of Kettle Brook are no longer in use, and by default operate in a run-of-river mode. The Waite Pond Dam is in poor condition, and requires major and extensive repairs (Lilyestrom 2009). The Massachusetts Office of Dam Safety has required that the dam either be fixed or breached by November 2009.

The Kettle Brook flood control project was built in 1960 to alleviate flooding issues in the lower Kettle Brook area, including Webster Square, Worcester. The entire project includes: a control dam at Leesville Pond; an intake weir and transition section below the junction of Kettle and Dark Brook (below Auburn Pond Dark Brook is locally known as Dunn's Brooks), and a concrete lined diversion tunnel under Pakachoag Hill that conveys flood waters via an open channel directly to the Blackstone River. Thus, the project diverts high flows from the Kettle Brook drainage area away from densely developed areas in southern Worcester (City of Worcester 2000). Pond outfall in Auburn on 9/10/2005 and 8/12/2006 (Gilpatrick 2007).

Biology

MA DFG conducted fish population sampling (sites 300 and 301) along this segment of Kettle Brook (Site 300 was located east of Burnett Street in Worcester and Site 301 was located east of Rockland Road in Auburn) on 20 August 2001 (MA DFG 2008). At Site 300 a total of 87 fish were collected, representing seven species,

including 44 white sucker (*Catostomus commersonii*), 11 pumpkinseed (*Lepomis gibbosus*) and largemouth bass (*Micropterus salmoides*), seven bluegill (*Lepomis macrochirus*), six golden shiner (*Notemigonus crysoleucas*), and four yellow bullhead (*Ameiurus natalis*) and chain pickerel (*Esox niger*). At Site 301 a total of 114 fish were collected, representing seven species, including 71 tessellated darter (*Etheostoma olmstedi*), 15 yellow bullhead (*A. natalis*), 14 largemouth bass (*M. salmoides*), six white suckers (*C. commersonii*), four bluegill (*L. macrochirus*), three pumpkinseed (*L. gibbosus*), and one chain pickerel (*E. niger*). The fish assemblage at both locations was well represented by fluvial species. At site 300 the large number of white sucker (*C. commersonii*), a species which is tolerant of both water quality and habitat degradation, corresponds with DFG field notes which describe habitat and water quality problems (MA DFG 2008). Further downstream at site 301 the fish sample was dominated by tessellated darter (*E. olmstedi*), a moderately tolerant fluvial species. Habitat was noted as being good at this sampling location.

A non-native species (*Cabomba caroliniana*) was observed in Stoneville Pond during the 1994 synoptic surveys (MassDEP 1994). A second potential non-native macrophyte species (*Myriophyllum* sp., possibly *M. heterophyllum*) was also observed.

The *Aquatic Life Use* is assessed as impaired for the 0.7 mile reach through Stoneville Pond based on the presence of a non-native species (*C. caroliniana*). The potential infestation with *M. heterophyllum* in Stoneville Pond is also noted as a concern. In light of the conflicting fish population information and the lack of any other water quality data the remaining 6.3 mile reach of this segment of Kettle Brook is not assessed for the *Aquatic Life Use*.

Primary and Secondary Contact Recreational and Aesthetics Uses

During a shoreline survey conducted by the Leesville Pond Watershed and Neighborhood Association (LPWNA) with assistance from DCR Riverways in 2002 surveyors noted the presence of significant algae and submerged tires (12) in Stoneville Pond (LPWNA 2002).

On 29 Sept 2008, a break in a sewage line on Southbridge Street Court, Auburn resulted in the discharge of approximately 10,000 gallons of raw sewage to Dark Brook (the lower portion of Dark Brook, below Auburn Pond, is locally known as Dunn's Brook). Samples were collected at one station above the main break and 4 stations below; all results were below the bathing standard (235 cfu/100 ml) with the exception of the station immediately below the discharge. The *E. coli* counts in Kettle Brook at Sword Street in Auburn were reported as 185.0 and a field duplicate of 114.5 (MPN). The memo describing the sampling investigation conducted on Dunn's and Kettle Brooks concludes with the following summary (Beaudoin 2008b):

"The results indicate that the sewage break was localized, and that the water quality in the areas sampled ...suitable for both swimming and boating except the segment of Dunn's Brook below the break and above the Kettle Brook confluence...impacts were short term...the break was fixed."

The Blackstone River Watershed Association in conjunction with Blackstone River Coalition recorded aesthetic observations at two sites within this segment in 2004, 2005 and 2006, monthly from April through November, as part of their ongoing volunteer water quality monitoring program (Gilpatrick 2007). At Kettle Brook upstream of James Street, Worcester, aesthetics conditions were generally of high quality, with few odors or unusual colors, and little trash. At Leesville Pond, upstream of the culvert on Sword Street in Auburn, (Leesville Pond inflow) aesthetic conditions were also of high overall value, with occasional notes of dark or milky color, dense aquatic plant coverage and light trash.

No bacteria data are available so *Primary and Secondary Contact Recreational Uses* are not assessed. The *Aesthetics Use* is assessed as support, as generally no aesthetically objectionable conditions (e.g., odors, oils, turbidity, growths) were observed in Kettle Brook upstream of James St. Bridge in Worcester and upstream of the culvert on Sword Street in Auburn during surveys conducted by Blackstone River Coalition between 2004 and 2006 (Gilpatrick 2007). This use identified with an Alert Status because of occasional notes regarding trash/debris and an oily sheen and the debris noted in Leesville Pond.

Kettle Brook (MA51-01) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED 0.7 mile reach through Stoneville Pond Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism NOT ASSESSED remaining 6.3 miles
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT*

* Alert Status issues identified, see details in use assessment

UNNAMED TRIBUTARY (MA51-20)

Location: From the outlet of Leesville Pond, Worcester to the confluence with the Middle River, Worcester (through Curtis ponds formerly reported as segments MA51033 and MA51032).
Size: 1.4 Miles
Classification: B\WWF
2008 303(d) List: Category

This is a new segment but contains a portion of segment MA51-01 which is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Cause Unknown, Nutrients, Organic enrichment/Low DO, (Flow alteration*), Pathogens). * denotes a non-pollutant (MassDEP 2008a).

According to City of Worcester officials, the end of this segment is at the confluence with Beaver Brook (the lower section of which is locally known as the Halfway River), rather than with the Middle River; the Middle River begins at this juncture (Buckley 2009).

Curtis Ponds South and North (MA51033 and MA51032) will no longer be reported as approximately 14-and 31-acre lake segments respectively since the retention time of the more downstream Curtis Pond (North) was estimated at less than 2 days and the upper pond (South) was included in the drainage area calculation for that estimate. These waterbodies will be considered run of the river impoundments (McVoy 2006). The retention time estimate was based on the annual historical mean discharge from two stream gages in the Blackstone River Basin (01110000 and 01124500) and the normal storage volume of the dam reported by DCR in their Massachusetts Dam Safety Program Database (Socolow et al. 2004 and DCR 2002).

Curtis Ponds (South) (MA51033) is on the Massachusetts Year 2008 Integrated List of Waters – Category 5, “Waters requiring a TMDL”. Pollutants needing TMDLs: Siltation, Noxious aquatic plants [5/2/2002, CN070.1 {MassDEP 2002a}].

Curtis Ponds (North) (MA51032) is on the Massachusetts Year 2008 Integrated List of Waters – Category 4c, “Impairment Cause” – Noxious aquatic plants [5/2/2002, CN070.1 {MassDEP 2002a}], (exotic species*)

NPDES (APPENDIX H):

City of Worcester (MAS010002)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

The dam at the outlet of Leesville Pond is part of the Kettle Brook flood control project was built in 1960 to alleviate flooding issues in the lower Kettle Brook area, including Webster Square, Worcester (City of Worcester 2000).

Low flow was observed within this segment by Blackstone Headwaters Coalition volunteer monitors at the Leesville Pond outfall in Auburn on 9/10/2005 and 8/12/2006 (Gilpatrick 2007).

Biology

It should be noted that dense periphyton cover and filamentous green algae were observed on substrates during all surveys at Station KB02, upstream/southeast of Webster Street [was identified incorrectly as Oxford Street in the technical memorandum], Worcester (Appendix B Tamul 2005).

A non-native aquatic macrophyte species, *Cabomba caroliniana*, was observed in Curtis Pond (North) during the 1994 Blackstone River Watershed synoptic lake surveys (MassDEP 1994).

Water Chemistry

DWM staff conducted monthly in-situ and water quality monitoring in this unnamed tributary near Webster Street [was identified incorrectly as Oxford Street in the technical memorandum] in Worcester (KB02) on five occasions between May and October 2003. Early morning DO measurements (between 02:15 and 08:49am, n=5) ranged from 7.3 to 9.6 mg/L and the other physico-chemical monitoring data were indicative of generally good conditions.

The maximum water temperature was 24.3°C. The maximum TP concentration was 0.076 mg/L, and 3 of the 5 measurements were slightly elevated (> 0.05 mg/L), which is of concern (Appendix B Tamul 2005).

The *Aquatic Life Use* is assessed as support in the upper 0.9 mile reach based on the generally good water quality conditions, but is assessed as impaired through the 0.5 mile reach through Curtis Pond North due to the infestation with the exotic species *Cabomba caroliniana*. The upper 0.9 mile reach is identified with an Alert status due to observations of filamentous green algae and dense periphytic cover, as well as the slightly elevated total phosphorus concentrations.

Primary and Secondary Contact Recreational and Aesthetics Uses

In 2003, MassDEP DWM collected six *E. coli* samples from the unnamed tributary near Webster Street [was identified incorrectly as Oxford Street in the technical memorandum] in Worcester (KB02) during the primary contact season (Appendix B). The geometric mean of the five valid samples was 33 cfu/100 ml. In general, no aesthetically objectionable conditions (e.g., odors, oils, turbidity, growths, deposits) were observed, although dense periphytic cover and filamentous algae were observed on rocks during all surveys (MassDEP 2003).

On 29 Sept 2008, a break in a sewage line on Southbridge Street Court, Auburn resulted in the discharge of approximately 10,000 gallons of raw sewage to Dark Brook (the lower portion of Dark Brook below Auburn Pond is locally referred to Dunn’s Brook). Numerous samples were taken on Dunn’s and Kettle Brook, including a site on Kettle Brook near Webster Street, Worcester (downstream of Leesville Pond). The results of *E. coli* sampling showed 25.9 MPN/100 ml at this location, well below the bathing beach standard (126 cfu/100 ml).

The Blackstone River Watershed Association in conjunction with Blackstone River Coalition recorded aesthetic observations below the Leesville Pond Dam in 2004, 2005 and 2006, monthly from April through November, as part of their ongoing volunteer water quality monitoring program (Gilpatrick 2007). Observations included a boom trapping a milky substance in April 2004, although its ability to contain the material had failed by May. Odors were usually absent or slight, with occasional foam and light trash noted.

Since the geometric mean for the *E. coli* bacteria results meet the criteria for both primary and secondary contact recreation (126 and 630 cfu/100 ml, respectively) and relatively few aesthetically objectionable conditions were observed, the *Primary and Secondary Contact Recreational and Aesthetics uses* are assessed as support. These uses are identified with an Alert Status due to observations of filamentous green algae and dense periphytic cover, as well as the slightly elevated total phosphorus concentrations.

Unnamed Tributary (MA51-20) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT* Upper 0.9 miles IMPAIRED remaining 0.5 mile reach through Curtis Pond North Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT*
Secondary Contact		SUPPORT*
Aesthetics		SUPPORT*

* Alert Status issues identified, see details in use assessment

DARK BROOK (MA51-16)

Location: Outlet Eddy Pond, Auburn to confluence with Kettle Brook, Auburn.
(through Auburn Pond formerly segment MA51004)
Size: 2.8 Miles
Classification: B
2008 303(d) List: Category 5

This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Cause Unknown) (MassDEP 2008a).

Auburn Pond (MA51004) will no longer be reported on as an approximately 4-acre lake segment since the estimated retention time of this waterbody is approximately 2 days; it will be considered a run of the river impoundment (McVoy 2006). The retention time estimate was based on the annual historical mean discharge from two stream gages in the Blackstone River Basin (01110000 and 01124500) and the normal storage volume of the dams reported by DCR in their Massachusetts Dam Safety Program Database (Socolow et al. 2004 and DCR 2002).

Auburn Pond (MA51004) is on the Massachusetts Year 2008 Integrated List of Waters – Category 4c, -Noxious aquatic plants [5/2/2002, CN070.1 {MassDEP 2002a}], -(Exotic species*) * denotes a non-pollutant.

NPDES (APPENDIX H and Table H2):

Town of Auburn Water District (MAG640072)
Town of Auburn Water District (MAG640004)
Town of Auburn (MAR041088)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

MassDEP DWM biologists observed *Cabomba caroliniana* and also noted *Myriophyllum* sp. (possibly *M. heterophyllum*) in Auburn Pond in July 1994 (MassDEP 1994). Both *M. heterophyllum* and *Cabomba caroliniana* are noted to be present in the pond (MassDEP 2008b).

Water Chemistry

DWM staff conducted monthly in-situ and water quality monitoring in Dark Brook near Route 12 in Auburn (RB01) on five occasions between May and October 2003. Early morning DO measurements (between 02:33 and 09:10am, n=5) ranged from 7.2 to 8.9 mg/L and the other physico-chemical monitoring data were indicative of generally good conditions. The maximum water temperature was 23.0°C while the maximum TP concentration was 0.07 mg/L (Appendix B Tamul 2005).

The *Aquatic Life Use* is assessed as impaired for the 0.1 mile reach of Dark Brook that flows through Auburn Pond due to the non-native macrophyte infestation (*C. caroliniana* and *M. heterophyllum*). The remaining 2.7 miles are assessed as support based on the limited water quality monitoring data indicative of generally good conditions. This use is identified with an Alert Status however because total phosphorus exceeded 0.05 mg/L during one sampling event.

Primary and Secondary Contact Recreational and Aesthetics Uses

DWM staff collected bacteria samples from Dark Brook near Route 12 in Auburn (RB01) on six occasions between April and October 2003 (Appendix B Tamul 2005). The geometric mean of the six samples was 185 cfu/100 ml. The highest count (1600 cfu/100 ml) was representative of wet weather conditions although dry weather samples were also slightly above standards on a few occasions. There were no field observations indicating prolonged or frequent occurrences of any objectionable deposits, odors, turbidity or color, floating scum, or overabundant growths of aquatic plants or algae at this sampling location (MassDEP 2003).

The Blackstone River Watershed Association in conjunction with the Blackstone River Coalition recorded aesthetic observations at Dark Brook near the Auburn High School, Auburn in 2004, 2005 and 2006, monthly from April through November, as part of their ongoing volunteer water quality monitoring program (Gilpatrick 2007). Observations included intermittent foam, light to heavy trash, and a slight oil sheen (on one occasion).

On 29 Sept 2008, a break in a sewage line on Southbridge Street Court, Auburn resulted in the discharge of approximately 10,000 gallons of raw sewage to Dark Brook; the line was repaired within 24 hours (the lower part of Dark Brook, below Auburn Pond, is locally known as Dunn's Brook). Samples were collected at one station above the main break and 4 stations below; all results were below the bathing standard with the exception of the location closest to the discharge (235 cfu/100 ml) (Beaudoin 2008b).

The *Primary Contact Recreational Use* is assessed as impaired because the bacteria results violate the geometric mean criterion (126 cfu/100 ml) for *E. coli*. Since this result meets the geometric mean criterion (630 cfu/100 ml) for *E. coli* and no frequent or prolonged aesthetically objectionable conditions were observed, the *Secondary Contact Recreational* and *Aesthetic* uses are assessed as support. The *Secondary Contact Recreational Use* is identified with an Alert Status however because of elevated bacteria counts during a wet weather sampling event.

Dark Brook (MA51-16) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED 0.1 mile reach through Auburn Pond Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism SUPPORT remaining 2.7 miles
Fish Consumption		NOT ASSESSED
Primary Contact		IMPAIRED Cause: <i>Escherichia coli</i> Source: Unknown Suspected sources: Unspecified urban stormwater, waterfowl
Secondary Contact		SUPPORT*
Aesthetics		SUPPORT

* Alert Status issues identified see details in use assessment

RECOMMENDATIONS

Site visits should be conducted at both the Auburn Water District Well #6 water treatment facility (MAG640072) and the Walsh Avenue Water Treatment Facility (MAG640004) by DEP. More detailed information regarding the discharges should be collected including whether or not the discharges are intermittent or continuous, the sampling location of the effluent monitoring, and whether or not there are any visible impacts on the receiving stream (e.g., sedimentation). The new general permit for water treatment plant discharges is being developed for EPA. When this new permit becomes available, there will be limits for TRC based on available dilution rather than monitoring only requirements.

MIDDLE RIVER (MA51-02)

Location: Outlet Coes Pond, Worcester to confluence with the unnamed tributary locally known as "Mill Brook" (downstream of the railroad spur bridge west of Tobias Boland Boulevard), Worcester.

Size: 3.4 Miles

Classification: B\WWF

2008 303(d) List: Category 5

This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Cause Unknown, Unknown toxicity, Metals, Nutrients, pH, Organic enrichment/Low DO, (Other habitat alterations*), Pathogens, Turbidity, (Objectionable deposits*)). * denotes a non-pollutant (MassDEP 2008a).

It should be noted that, according to City of Worcester officials, Tatnuck Brook continues below Coes Pond to the confluence with Beaver Brook; below this junction, the stream is either called Beaver Brook or Halfway River until the junction with Kettle Brook, forming the Middle River (Buckley 2009).

NPDES (APPENDIX H):

True Plastics, Inc. (MAG250962)
Town of Worcester (MAS010002)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

A small portion of the Middle River between Southbridge Street and McKeon Road is culverted and underground (below Fitton Field and Holy Cross stadium). Other sections are channelized with natural substrate.

Low flow was observed within this segment by Blackstone Headwaters Coalition volunteer monitors at St. John's Cemetery in Worcester on 8/2/2004; good flow was noted when the site was revisited on 9/11/2004 (heavy rains preceded this observation) (Gilpatrick 2007).

Biology

MA DFG conducted fish population sampling (Site 542) along the Middle River downstream from the Saint John's cemetery bridge in Worcester on 26 June 2001 (MA DFG 2008). A total of 42 fish, representing 5 species, were collected including 33 white sucker (*Catostomus commersonii*), four tessellated darter (*Etheostoma olmstedii*), three yellow bullhead (*Ameiurus natalis*), and one pumpkinseed (*Lepomis gibbosus*) and bluegill (*Lepomis macrochirus*). The sample was dominated by fluvial species.

Toxicity

Ambient

Dilution water has been collected at the downstream end of the Middle River just north of the Mill Brook outfall for use in the city of Worcester's QCSOSTF acute whole effluent toxicity tests (MassDEP 2008c). Between November 2005 and April 2007 survival of *Ceriodaphnia dubia* (48-hour exposure period) has ranged from 0 to 100% (n=5). Survival was 100% in four of the five test events (exception being July 2006 test with 0% survival).

Water Chemistry

DWM staff conducted monthly *in-situ* and water quality monitoring in the Middle River near the former Millbury Street bridge at Hurley Square (now near McKeon Road) in Worcester (BLK00) on seven occasions between May and October 2003. Early/mid morning DO measurements (between 02:54 and 09:43 am, n=7) ranged from 7.9 to 9.8 mg/L and the other physico-chemical monitoring data were indicative of good conditions. The maximum water temperature was 23.8°C while the maximum TP concentration was 0.079 mg/L (n=5) (Appendix B Tamul 2005). Two of the 5 measurements were slightly elevated (> 0.05 mg/L), which is of concern.

With the exception of the 0.2 mile reach culverted underground, the *Aquatic Life Use* is assessed as support based on the water quality data, survival of test organisms, and the fish population information (sample dominated by fluvial species). This use identified with an Alert Status however because of the extremely poor survival of *C. dubia* during one test event and the lack of recent benthic macroinvertebrate monitoring data (prior survey in July 1998 indicated moderately impacted community).

Primary and Secondary Contact Recreational and Aesthetics Uses

On 29 Sept 2008, a break in a sewage line on Southbridge Street Court, Auburn resulted in the discharge of approximately 10,000 gallons of raw sewage to Dunn’s Brook. A sample collected on the Middle River at Webster Square as part of the site investigation showed 49.6 MPN, well below the bathing standard (Beaudoin 2008b).

DWM staff collected bacteria samples from the Middle River at the former Millbury Street bridge near Hurley Square, Worcester (BLK00) on six occasions between April and October 2003 (Appendix B Tamul 2005). The geometric mean of the six samples was 414 cfu/100 ml. The highest count (2200 cfu/100 ml) was representative of wet weather conditions although dry weather samples were slightly elevated on all occasions sampled. Field observations indicated the continuous presence of debris/floatables/trash at this location (MassDEP 2003).

The Blackstone River Watershed Association in conjunction with the Blackstone River Coalition recorded aesthetic observations on the Middle River at St. John’s Cemetery, Worcester in 2004, 2005 and 2006, monthly from April through November, as part of their ongoing volunteer water quality monitoring program (Gilpatrick 2007). Observations noted a generally clear stream, free from objectionable conditions with the exception of light trash.

The *Primary Contact Recreation Use* is assessed as impaired based on elevated *E. coli* (geometric mean exceeds 126 cfu/100 mls) as well as the aesthetically objectionable conditions (deposits of debris/floatables/trash). The *Secondary Contact Recreational and Aesthetics uses* are assessed as impaired based on the objectionable deposits of trash/debris. Elevated *E. coli* during storm events are also noted as a concern for the *Secondary Contact Recreational Use*.

Middle River (MA51-02) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED 0.2 mile reach culverted underground Cause: Physical substrate habitat alterations Source: Channelization SUPPORT* remaining 3.2 miles
Fish Consumption		NOT ASSESSED
Primary Contact		IMPAIRED Cause: Debris/Floatables/Trash, Elevated <i>E. coli</i> bacteria Source: Unspecified urban stormwater
Secondary Contact		IMPAIRED Cause: Debris/Floatables/Trash Source: Unspecified urban stormwater
Aesthetics		IMPAIRED Cause: Debris/Floatables/Trash Source: Unspecified urban stormwater

* Alert Status issues identified, see details in use assessment

RECOMMENDATIONS

Benthic macroinvertebrate sampling should be conducted to better evaluate the *Aquatic Life Use*.

TATNUCK BROOK (MA51-15)

Location: Outlet Holden Reservoir #2, Holden to inlet of Coes Reservoir, Worcester (through Cook Pond formerly segment MA51027 and Patch Reservoir formerly segment MA51118).
Size: 3.3 Miles
Classification: B
2008 303(d) List: Category 5

This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Cause Unknown, (Other habitat alterations*), Turbidity, (Objectionable deposits*)). * denotes a non-pollutant (MassDEP 2008a).

NOTE: Cook Pond (MA51027) and Patch Reservoir (MA51118) will no longer be reported on as approximately 17 acre and 34-acre lake segments, respectively, since the retention time of these waterbodies was estimated at approximately four days; they will be considered run of the river impoundments (McVoy 2006). The retention time estimates were based on the annual historical mean discharge from two stream gages in the Blackstone River Basin (01110000 and 01124500) and the normal storage volume of the dams reported by DCR in their Massachusetts Dam Safety Program Database (Socolow et al. 2004 and DCR 2002).

MA DFG identifies this waterbody as a "Cold Water Fishery Resource" (MA DFG 2007).

NPDES (APPENDIX H):

City of Worcester (MAS010002)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

Cook Pond is managed by the Tatnuck Island Club including the seasonal lowering of the pond level for weed control (Donovan 2009). In 2008, a valve on the dam was unintentionally left in the open position for approximately 10 days following dam maintenance activities, resulting in the partial drainage of the pond (Williamson 2009).

Biology

A non-native aquatic macrophyte species (*Cabomba caroliniana*) was observed by DWM staff in Cook Pond during the 1998 synoptic surveys (MassDEP 1998).

The *Aquatic Life Use* is assessed as impaired for Tatnuck Brook through the 0.3 mile reach through Cook Pond because of the infestation with *C. caroliniana*, a non-native aquatic macrophyte. No other recent quality assured water quality data are available so the *Aquatic Life Use* is not assessed for the other 3.0 river miles of the brook.

Fish Consumption Use

Fish were collected by DWM biologists from Patch Reservoir in 1991 and were analyzed for metals (Maietta 2007). MA DPH did not issue a site specific fish consumption advisory based on the results of the analyses (MassDEP 2009).

The *Fish Consumption Use* is not assessed for Patch Reservoir or this segment of Tatnuck Brook since no site-specific fish consumption advisory was issued by MA DPH. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody.

Primary and Secondary Contact Recreational and Aesthetic Uses

The Blackstone River Watershed Association in conjunction with the Blackstone River Coalition recorded aesthetic observations of Tatnuck Brook at 570 Mill St., Worcester (upstream of Patch Reservoir) in 2004, 2005 and 2006, monthly from April through November, as part of their ongoing volunteer water quality monitoring program (Gilpatrick 2007). Observations indicated a generally clear stream free from odors, turbidity, trash, or nuisance aquatic vegetation; however, on two occasions the streambed was covered with a red/orange substrate, as well as a sewage/swampy odor.

In May/June 2005, field reconnaissance and Bacteria Source Tracking work was conducted by MassDEP in the lower reach of Tatnuck Brook (between June Street and the inlet to Coes Reservoir) as part of the Mill Street

Beach investigation (Duerring and Beaudoin 2007). No objectionable odors, color or turbidity were observed (MassDEP 2005).

The *Primary* and *Secondary Contact Recreational Uses* are not assessed for Tatnuck Brook due to the lack of available quality assured bacteria data. The *Aesthetics Use* is assessed as support based on the general lack of objectionable conditions (e.g., odors, colors, turbidity).

Tatnuck Brook (MA51-15) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED 0.3 mile reach through Cook Pond Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism NOT ASSESSED 3.0 miles
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

BEAVER BROOK (MA51-07)

Location: Outlet of small unnamed impoundment north of Beth Israel School and Flag Street School, Worcester to confluence with Middle River, Worcester. (Includes underground portion)
Size: 2.9 Miles
Classification: B\WWF
2008 303(d) List: Category 5

This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Cause Unknown, (Other habitat alterations*), Pathogens, (Objectionable deposits*)). * denotes a non-pollutant (MassDEP 2008a).

NPDES (APPENDIX H):

City of Worcester (MAS010002)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

The upper 2.7-mile reach of Beaver Brook, between the outlet of the small unnamed impoundment at its headwaters to Maywood Street in Worcester, is culverted and underground. A small length of this segment between Chandler and May Streets (1,175 feet) has been daylighted, as described below.

The City of Worcester conducted a daylighting project of a portion of Beaver Brook; construction began in November 2005 (MEPA 2005, Plumb 2005). A 0.2-mile section of the brook within Beaver Brook Park, downstream of Chandler Street, had long flowed within an underground culvert. The project included the restoration of 1,175 linear feet of wetland shelf, bank and channel substrate, with recreated meanders and habitat structure, as well as the planting of native vegetation. Although daylighting was also evaluated for an additional 2,351 feet of culverted stream downstream of this section, it was determined to be infeasible due to the potential for increased flooding in this dense residential neighborhood, as well as other safety issues.

In 2002, a car wash on Park Ave, Worcester was found to be dumping gritty waste from carwashing operations onto the banks of Beaver Brook and a tributary (Monahan 2004c). The waste residue and grit potentially contained petroleum and other contaminants. The company was fined \$7,600 and required to remove the disposed material and restore the brook and bank areas affected. The company was also required to develop and implement a procedure for proper disposal of this material.

The Blackstone River Watershed Association, in conjunction with Mass Riverways, conducted shoreline surveys on several reaches of Beaver Brook in October, 2004 (Harvey and Singler, 2004). They noted that segments were contained within concrete walls, and the brook flowed underground for approximately 100 feet in 3 locations. Vegetation and wildlife were minimal, with little canopy cover. The stream bed appeared to be mostly sand (under bridges the bottom consisted of concrete covered in sand) with much trash, although moderate to high turbidity limited visual observations. Flow from May Street to Mill Street was quick, although flow in the lower brook was slow (Harvey and Singler 2004).

Water Chemistry

DWM staff conducted monthly in-situ and water quality monitoring in Beaver Brook near Park Ave in Worcester (BB01) on five occasions between May and October 2003. Early/mid morning DO measurements (between 01:18 and 07:51am, n=5) ranged from 5.9 to 9.3 mg/L; the maximum water temperature was 19.0°C. Although most physico-chemical monitoring data were indicative of good conditions, the maximum TP concentration was 0.16 mg/L (Appendix B Tamul 2005).

The *Aquatic Life Use* is assessed as impaired for Beaver Brook based primarily on habitat alteration (culverting, sedimentation). Occasional highly elevated TP concentrations are also of concern.

Primary and Secondary Contact Recreational and Aesthetics Uses

In 2003, MassDEP DWM collected six *E. coli* samples from Beaver Brook near Park Ave in Worcester (BB01) during the primary contact season (Appendix B). The geometric mean of the five valid samples was 1,823

cfu/100 ml. Aesthetically objectionable conditions included: debris/floatables/trash; evidence of illicit connections (toilet paper, soap scum); oily sheens; and moderate filamentous algal growth were observed (MassDEP 2003).

The Blackstone River Watershed Association, in conjunction with Mass Riverways, conducted shoreline surveys on several reaches of Beaver Brook in October, 2004 (Harvey and Singler, 2004). They noted: moderate to high turbidity; a large quantity of trash, including “car junk” on the banks; strong odors (windshield washer fluid-like chemical odor, petroleum), greenish color; a petroleum sheen; and a pipe in poor condition and exuding a “bad odor” (Harvey and Singler 2004).

The Blackstone River Watershed Association in conjunction with the Blackstone River Coalition recorded aesthetic observations at two sites in this segment in 2004, 2005 and 2006, monthly from April through November, as part of their ongoing volunteer water quality monitoring program (Gilpatrick 2007). At Beaver Brook downstream of the Maywood Street Bridge, Worcester observations included frequent dark colors, sewage odors (two occasions) and light to abundant trash. At the confluence of Beaver and Tatnuck Brooks near Park Ave. in Worcester, light trash was consistently noted, as well as occasional instances of light color and light to heavy algal growth. In general, the water was clear and odorless.

The Primary and Secondary Recreational and Aesthetic Uses are impaired for Beaver Brook based on elevated *E. coli* results, as well as the aesthetically objectionable conditions i.e., debris/floatables/trash, odors, evidence of illicit connections, et cetera.

Beaver Brook (MA51-07) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Physical substrate habitat alterations (culverting), bottom deposits Source: Channelization, habitat modification
Fish Consumption		NOT ASSESSED
Primary Contact		IMPAIRED Cause: Elevated <i>E. coli</i> , Debris/Floatables/Trash, odors Source: Illicit connections/hook-ups to storm sewers, discharges from Municipal Separate Storm Sewer Systems, unspecified urban stormwater
Secondary Contact		IMPAIRED Cause: Elevated <i>E. coli</i> , Debris/Floatables/Trash, odors Source: Illicit connections/hook-ups to storm sewers, discharges from Municipal Separate Storm Sewer Systems, unspecified urban stormwater
Aesthetics		IMPAIRED Cause: Debris/Floatables/Trash, odors Source: Illicit connections/hook-ups to storm sewers, discharges from Municipal Separate Storm Sewer Systems, unspecified urban stormwater

UNNAMED TRIBUTARY (MA51-08)

Location: (Also known as "Mill Brook") Outlet Indian Lake, Worcester to confluence with Middle River (downstream of the railroad spur bridge west of Tobias Boland Boulevard), Worcester (through Salisbury Pond formerly segment MA51142).

Size: 5.6 Miles

Classification: B/WWF/CSO

2008 303(d) List: Category 5

This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Priority organics, Metals, Unionized Ammonia, Nutrients, Organic enrichment/Low DO, (Other habitat alterations*), Pathogens, Oil and grease, Taste, odor and color, Suspended solids, Turbidity, (Objectionable deposits*)). * denotes a non-pollutant (MassDEP 2008a).

Salisbury Pond (MA51142) will no longer be reported on as an approximately 13-acre lake segment since the estimated retention time of this waterbody is less than 3 days; it will be considered as a run of the river impoundment (McVoy 2006). The retention time estimate was based on the annual historical mean discharge from two stream gages in the Blackstone River Basin (01110000 and 01124500) and the normal storage volume of the dam reported by DCR in their Massachusetts Dam Safety Program Database (Socolow et al. 2004 and DCR 2002).

Salisbury Pond (MA51142) is on the Massachusetts Year 2008 Integrated List of Waters – Category 5, "Waters requiring a TMDL". Pollutants needing TMDLs: Taste, odor and color, Noxious aquatic plants [6/28/2002-CN114.0], Turbidity [6/28/2002-CN114.0] (MassDEP 2002d).

In January 2005 Bovenzi Park was created on the western side of I-190, encompassing 80+ acres, the second-largest conservation area in Worcester (GWLTL 2009). The property includes 4 vernal pools, 25 acres of wetland and over a mile of Weasel Brook, one of the two headwater streams of Mill Brook. The conservation easement on the park affords long-term protection of these resources from development.

NPDES (APPENDIX H):

City of Worcester (MAS010002)

Saint-Gobain Abrasives, Inc. and Saint-Gobain Ceramics & Plastics, Inc. (MA0000817)

New England Plating Company (MA0005088) – The facility ceased operation and the permit was terminated by EPA in March 2002.

City of Worcester MA0102997 (Quinsigamond Avenue Combined Sewer Overflow Storage and Treatment Facility -QCSOSTF)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

The Mill Brook subwatershed lies entirely within the City of Worcester; impervious surface coverage within the watershed is greater than 60%. Watersheds with 25% or greater impervious surface coverage have been shown to reflect increasing water quality degradation associated with the surface water runoff of nonpoint source pollutants (CWP 1998). The entire watershed is characterized by heavy residential, commercial and industrial development.

Most of Mill Brook flows within underground conduits. It surfaces at one location, Salisbury Pond in Institute Park. Downstream from the pond, the brook continues underground to its confluence with the Blackstone River. The confluence was originally located near the Millbury Street Bridge; since the restructuring of the Route 146 corridor (since 2007), the discharge location is now approximately 1800 feet downstream. This additional reach is also culverted and underground.

The 17-acre eutrophic Salisbury Pond is an impoundment of Mill Brook (the original pond was only approximately 5 acres) created to provide water to the Blackstone Canal, which operated from 1828 to 1848. The pond has received pollutants through an unknown number of illegal discharges as well as large quantities of stormwater.

Studies conducted at Salisbury Pond by MassDEP, in conjunction with Worcester Polytechnic Institute (WPI), indicated that significant sedimentation was occurring at the two main inlets to the pond: just below the northern inlet, where depths decreased from 3+ feet in 1989 to 2 inches in 1999 (Beaudoin 2000), and is now an exposed mud flat 1-3 inches above the typical water level (Beaudoin 2006); and at the Park Ave/Salisbury Street inlet. Chemical and grain size analyses showed that the overlying sediment in both locations is typical of road sand, likely from winter sanding operations in the contributing subwatersheds, which includes numerous highways and other heavily-trafficked roads (Farren *et al.* 2001). The Mill Brook Task Force, a group of state and municipal agencies, WPI, businesses and industries, residents, and a variety of nonprofit organizations, along with the City of Worcester, obtained a Clean Water Act Section 319 grant to address the sedimentation issues, and in 2006, two particle separation units were installed in the tributary to the Park Ave/Salisbury Street inlet, which are owned and maintained by the City of Worcester. The grant also provided for the design of a sedimentation project to remediate sedimentation from the northern watershed (MBTF 2005); however, funding is not yet available for the construction of this phase (Antonelli 2009). Future plans for the pond include dredging and shoreline improvements (Nemeth 2009).

The City of Worcester CSO treatment facility, Quinsigamond Avenue Combined Sewer Overflow Storage and Treatment Facility (QCSOSTF) discharges to the lower Mill Brook. During runoff conditions, the facility treats storm and sewage flows from the roughly 20% of the city that has combined storm/sewer conduits.

Biology

Numerous fish kills have been observed at Salisbury Pond. Citizen monitors discovered an ongoing event at the northern inlet to the pond on 15 January 2002 (Monahan 2004a). The cause was shown to be the illegal discharge of toxic cleaning chemicals into a storm drain upstream of the pond; several parties were later fined for this event. A large portion of the \$32,250 fine was used to fund environmental projects at the pond. In late March/early April 2006, several hundred dead fish were observed at the bottom of the northern inlet (Mill Brook). An investigation determined that the likely source was chlorinated water escaping to a storm drain as a result of hydrant repair (Kimball 2006); the source was corrected.

In 2000 and 2006, increasingly dense stands of milfoil were observed at Salisbury Pond (*Myriophyllum* sp.) (Beaudoin 2000, Beaudoin 2006).

In 2000, MassDEP conducted fish tissue monitoring on Salisbury Pond. Fish collected for tissue analyses included *Perca flavescens* (yellow perch), *Micropterus salmoides* (largemouth bass), *Cyprinus carpio* (carp), and *Ameiurus natalis* (yellow bullhead). Additional species observed included *Lepomis gibbosus* (pumpkinseed), *Lepomis macrochirus* (bluegill), *Ameiurus nebulosus*, (brown bullhead) and *Morone americana* (white perch).

Toxicity

Effluent

Saint-Gobain is located in the upper watershed of the Mill Brook. The facility actually discharges to Weasel Brook, one of two headwater streams that form Mill Brook. Acute whole effluent toxicity to *C. dubia* was detected in three of four test events conducted on the Saint-Gobain outfall 001 discharge. The LC₅₀s ranged from 37.9 to 93.3% effluent in the three acutely toxic test events (July 2004, July 2006, and August 2007). Acute whole effluent toxicity to *C. dubia* was also detected in two of the four test events conducted on outfall 003 with LC₅₀s = 36.6 and 35.4 % effluent in the July 2004 and July 2006 tests, respectively.

Between November 2005 and April 2007 six acute whole effluent toxicity tests were conducted on the city of Worcester's QCSOSTF. Of the five valid tests conducted no acute whole effluent toxicity to *C. dubia* was detected (all LC₅₀s \geq 100% effluent).

Modified acute and chronic whole effluent toxicity tests were conducted on the New England Plating Company treated wastewater discharge using both *C. dubia* and *Pimephales promelas* as test species. The effluent exhibited acute toxicity to both species but the *C. dubia* were always most sensitive. The LC₅₀s to *C. dubia* ranged from 20.8 to >100% effluent with extreme acute toxicity in 5 of 6 test events and chronic whole effluent toxicity (CNOEC results) ranging from <1 to 12.5% effluent (n=5 test events). The LC₅₀s to *P. promelas* ranged from 23.9 to >100% effluent (n=6) and the CNOEC test results ranged from 12.5 to 100% effluent (n=5). The facility ceased operation and the permit was terminated by EPA in March 2002.

Water Chemistry

In situ measurements were collected at a station (MB01) located at the mouth of the unnamed tributary to Blackstone River (locally known as Mill Brook) on two occasions in September 2003 (Tamul 2005).

The *Aquatic Life Use* is assessed as impaired based on physical substrate habitat alterations (culverting), and sedimentation, habitat quality degradation (bottom deposits) and habitat alteration (culverting). Other issues of concern include the potential presence of a non-native aquatic macrophyte (*M. spicatum*), occasional fish kills associated with anthropogenic activities, as well as the presence of acute whole effluent toxicity in the Saint-Gobain discharge.

Fish Consumption Use

Fish were collected by DWM biologists from Salisbury Pond in 2000 and were analyzed for metals, PCBs, organochlorine pesticides and PAHs (Maietta 2007). Although the presence of a wide array of bioaccumulative contaminants in Salisbury Pond fishes may shed light on the nature of discharges that this waterbody has received, no one contaminant was found in excess of the more common public health standards and/or criteria. MA DPH did not issue a site specific fish consumption advisory based on the results of the analyses (MassDEP 2009).

The *Fish Consumption Use* is not assessed for Salisbury Pond or this "Mill Brook" segment since no site-specific fish consumption advisory was issued by MA DPH. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination, however, apply to this waterbody.

Primary and Secondary Contact Recreational and Aesthetics Uses

Stormwater runoff has also resulted in sheens in the pond. Both manganous and petroleum sheens have been observed in the northern inlet (Beaudoin 1999, 2000). Canoeists reported an oily sheen near Grove Street on 27 July 2001 (Child 2001).

Due to the lack of bacteria data and aesthetics observations, this segment is not assessed for *Primary and Secondary Contact Recreational and Aesthetics Uses*. An Alert Status is applied due to the frequent occurrence of petroleum sheens, and the presence of the City of Worcester QCSOSTF treatment facility discharge.

Unnamed Tributary- "Mill Brook" (MA51-08) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Physical substrate habitat alteration (culverting), bottom deposits Source: Channelization, habitat modification
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED*
Secondary Contact		NOT ASSESSED*
Aesthetics		NOT ASSESSED*

* Alert Status issues identified, see details in use assessment

RECOMMENDATIONS

Saint-Gobain Abrasives, Inc. and Saint-Gobain Ceramics & Plastics, Inc. (MA0000817) should be required to conduct a toxicity identification evaluation/toxicity reduction evaluation (TIE/TRE) for both Outfalls 001 and 003. The facility should then eliminate the acute whole effluent toxicity in both Outfalls 001 and 003.

Conduct aquatic macrophyte survey in late July/August to confirm species of *Myriophyllum*.

BLACKSTONE RIVER (MA51-03)

Location: Confluence of Middle River and Mill Brook (downstream of the railroad spur bridge west of Tobias Boland Boulevard), Worcester to Fisherville Dam, Grafton. (through a portion of Fisherville Pond formerly segment MA51048)

Size: 10.4 Miles

Classification: B\WWF\CSO

2008 303(d) List: Category 5

This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Unknown toxicity, Priority organics, Metals, Unionized Ammonia, Nutrients, Organic enrichment/Low DO, (Flow alteration*), (Other habitat alterations*), Pathogens, Suspended solids, Turbidity, (Objectionable deposits*)). * denotes a non-pollutant (MassDEP 2008a).

NPDES (APPENDIX H and Table H2):

City of Worcester (MAS010002)
Upper Blackstone Water Pollution Abatement District (UBWPAD) (MA0102369)
United County Industries (MAG250014)
Town of Millbury (MA0100650)
Town of Millbury (MAR041136)
Lewcott Corporation (MAG250969)
Town of Sutton (MAR041241)
Town of Grafton (MAR041193)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

There is a USGS flow gaging station located at West Main Street, Millbury; the period of record began on 7/1/2002. The Blackstone River experiences rapid flow fluctuations as a result of surface water runoff of precipitation and snow melt over large expanses of impervious surfaces in the urbanized headwaters. Flow fluctuations also occur daily as a result of wastewater treatment plant flows downstream of the UBWPAD discharge (USGS 2009a).

Station BS09C was accessed upstream of the former (southern) Millbury Street Bridge by SMART crews every two months from March 2000 to June 2002 (Appendix F, Beaudoin 2004b). Within the stream, undercut banks were prominent, as was a depositional gravel bar.

When the Millbury Street Bridge was demolished, and the lower end of Millbury Street closed, Station BS09C was relocated to the Blackstone River Road Bridge, approximately 135 yards upstream; access is via the Blackstone River Bikeway which is adjacent to the station. Both locations for Station BS09C are considered to represent similar conditions. SMART monitoring has been conducted at this location since October 2002 (to the present). As with the original location of this station, instream aquatic vegetation was absent. Dense periphytic growth (as filamentous algae) typically covers bottom substrates. During and after runoff events, flow fluctuates widely here, associated with the highly urbanized nature of the upstream watershed (USGS 2009a). Numerous observations of rapidly falling water levels were noted, as well as recurring deposits of sand on the bank approximately 5 feet higher than the typical water level (Appendix F, Beaudoin 2004b). The channel was scoured and bottom substrates embedded.

The City of Worcester operates a CSO treatment facility, the Quinsigamond Avenue Combined Sewer Overflow Storage and Treatment Facility (QCSOSTF), which discharges approximately 2 river miles upstream of Station BS09C on Mill Brook. During runoff conditions, the facility treats storm and sewage flows from the roughly 20% of the city that has combined storm/sewer conduits. Both of the Station BS09C locations are within the area impacted by the discharge, as evidenced by bacteria data (collected since July 2007), periphyton, color and odor observations (Beaudoin 2009a).

In 1985, the U.S. Army Corps of Engineers constructed a bank protection project on the Blackstone River near the former location of the McCracken Road Bridge (now a one-lane bridge that provides access from McCracken

Road to the east side of the Blackstone River above the current McCracken Road Bridge; adjacent to the Blackstone River Bikeway). According to the USACOE (2009d):

“Large shoals had formed in the center of the Blackstone River and redirected the flow of the river. These redirected waters eroded a 300-foot-long section of the west riverbank, undermining the bridge's west abutment and threatening the bridge's stability. The Corps removed the shoals to restore the flow of the river to its original channel and constructed about 300 feet of stone slope protection along each riverbank. Although erosion had occurred only on the west riverbank, stone slope protection was also placed on the east riverbank to protect it from possible erosion when the original river channel was restored.”

DWM conducted benthic macroinvertebrate sampling in this reach of the Blackstone River in 2003, near an abandoned bridge that was formerly the river crossing of McCracken Road (since relocated a short distance downstream) in Millbury (BLK02). Habitat quality was limited mostly by some instream sedimentation and associated embeddedness, as well as the limited riparian vegetative zone width and instream cover. Instream aquatic vegetation was extremely abundant, covering virtually the entire river bottom and dominated by rooted submerged macrophytes, including *Potamogeton crispus*; a luxuriant algal community was also observed (Appendix C).

The Blackstone River Coalition is conducting a feasibility study to determine if the Consolidated Street Railway (Mass Electric) Dam, Millbury is a candidate for removal. The removal of this small dam (3 m height, 36 m length) would enhance aquatic habitat as well as improve the safety of recreational paddlers in this reach. Issues identified include: the lack of data on sediment quantity, quality and management; the lack of a target fish species and critical habitat; and the scarcity of project resources (staff, funds).

Biology

A fish kill in August 2002 resulted from the release of chlorinated water from the draining of a public swimming pool to the municipal storm drain system, entering the river at the base of Mill Brook (Hartley 2002). Over 1,000 fish were found, including 11 species: bluegill (*Lepomis macrochirus*), largemouth bass (*Micropterus salmoides*), white sucker (*Catostomus commersonii*), golden shiner (*Notemigonus crysoleucas*), yellow bullhead (*Ameiurus natalis*), blacknose dace (*Rhinichthys atratulus*), chain pickerel (*Esox niger*), yellow perch (*Perca flavescens*), pumpkinseed (*Lepomis gibbosus*), tessellated darter *Etheostoma olmstedii*) and black crappie (*Pomoxis nigromaculatus*) (Hartley 2009). Other fish kills have occurred in headwater streams that impact this segment i.e., Salisbury Pond.

In September 2003, MassDEP DWM biologists conducted benthic macroinvertebrate sampling in the Blackstone River in the reach near the historic McCracken Road Bridge, downstream from the UBWPAD discharge in Millbury, MA (BLK02). The RBP III analysis indicated that the benthic macroinvertebrate community was "moderately/severely-impacted" compared to the reference station conditions on the Mumford River below Manchaug Street, Douglas (Station BLK09-8A)(Appendix C, Fiorentino 2006). This analysis was similar to the one noted in the 1997 survey.

MA DFG conducted fish population sampling at six sampling locations along this segment of the Blackstone River in August and September 2001 and July 2007. From upstream to downstream, the sites were located off Blackstone River Road, west of Rte 146 (2384), north of Millbury Street; Worcester (323), east of Cemetery & railroad tracks near Saint Brigid Cemetery off West Street (2214), the Blackstone River Cemetery, Millbury (467), south of Rte. 122A, Millbury (441), and north and south of Depot Street, Sutton (466) (MassDFG 2008). The fish assemblage was dominated by white sucker (*Catostomus commersonii*), a fluvial specialist tolerant of organic enrichment, thermal and habitat stressors. With the exception of a single brook trout (*Salvelinus fontinalis*), the remaining fish observed were macrohabitat generalists. The MADFG noted fin rot and lesions on fish collected from 3 of the 4 stations sampled during 2001.

Toxicity

Ambient

Water from the Blackstone River was collected just downstream of the Millbury Street Bridge in Worcester for use as dilution water in the UBWPAD facility's whole effluent toxicity tests. Between January 2000 and January 2008, survival of *C. dubia* exposed (approximately 7 days) to the Blackstone River water was $\geq 90\%$ with the exception of the July 2000 test event when survival was 0% (n=34). Survival of *P. promelas* exposed to the Blackstone

River water (approximately 7 day exposures) ranged from 50 to 100% (n=31) and was < 75% in seven test events -- April 2000, 2002, 2004, 2005, and 2007, October 2006 and January 2008.

Water from the Blackstone River was collected at the Riverlin Street Bridge off Route 122A in Millbury for use as dilution water in the Millbury WWTP's acute whole effluent toxicity tests. Between February 2001 and December 2004, survival of both *C. dubia* and *P. promelas* exposed (48 hours) to the Blackstone River water was 100% (n=15).

Effluent

Modified acute and chronic whole effluent toxicity tests have been conducted on the UBWPAD treated effluent. Between January 2000 and January 2008, 32 valid chronic tests were conducted using *C. dubia* and 21 valid tests using *P. promelas*. No acute whole effluent toxicity was detected by either test organism (i.e., LC₅₀'s were all ≥100% effluent). The CNOEC results for *C. dubia* ranged from <12.5 to 100% effluent and did not meet the CNOEC limit of ≥90% effluent in 13 of the 32 valid test events (CNOECs all =50% effluent in April and October 2000, April, July, and October 2003, April and June 2005, January 2007; CNOECs = 25% effluent in January 2004 and October 2007; CNOECs = 12.5% effluent in January 2001 and June 2003; and CNOEC <12.5% effluent in October 2001). The CNOEC results for the *P. promelas* tests all met the CNOEC limit.

Acute whole effluent toxicity tests were conducted on the Millbury Wastewater Treatment Plant (WWTP) treated effluent between February 2001 and December 2004. A total of 15 tests were conducted using both *C. dubia* and *P. promelas*. Acute toxicity to *C. dubia* was detected in five of the 15 test events with LC₅₀'s ranging from 18.9% to 78.4% effluent. Acute toxicity to *P. promelas* was detected in three test events with LC₅₀s ranging from 70.7 to 94% effluent. All other test events did not indicate acute whole effluent toxicity (i.e., LC₅₀s >100% effluent). The facility tied its discharge into the UBWPAD system in January 2005.

Water Chemistry

A dry weather study of water quality in the Blackstone Watershed was conducted from 2000-2003 (Wright et al 2004). Samples were collected at 24 sites on the Blackstone, Mumford, Quinsigamond and West Rivers on four dates under dry weather conditions. Insufficient data are currently available to complete the DWM external data validation process required for assessment decision.

The Greenwood Street Landfill, Worcester is located on the west side of the Blackstone River, north of the Upper Blackstone Water Pollution Abatement District (UBWPAD) facility and discharge. Some of the leachate from the landfill is conveyed to the UBWPAD facility for treatment; an additional volume flowed to a concrete-lined channel that discharged to the Blackstone River. An assessment of the leachate reaching the channel indicated elevated levels of suspended solids, PCBs, chloride, arsenic, lead and manganese (Monahan 2004d). The city was ordered to immediately cap the pipes conveying this leachate to the discharge channel, as these pollutants constituted a violation of state and federal clean water laws. Capping was completed between November 9-12, 2004, and the leachate has since been pumped to the UBWPAD facility for treatment (Belsito 2009).

CERO SMART staff conducted bimonthly *in situ* and water quality monitoring in the upper Blackstone River (BS09B and BS09C) on 26 occasions from March 2000 through October 2004 (Appendix F, Beaudoin 2004b). Mid-morning DO values ranged from 7.5 to 13.6 mg/L (08:30 to 10:02 am). The maximum water temperature was 23.6°C while pH ranged from 6.5 to 7.3 SU. When compared to reference conditions at the West River station, conductivity values were consistently elevated; values at Station BS09C ranged from 239 to 1,250 uS/cm. Ammonia concentrations were low, ranging from <0.01 to 0.29 mg/L (as NH₃-N) and ammonia toxicity was not a concern. Total phosphorus concentrations ranged from 0.028 to 0.33 mg/L from March 2000 to Nov 2004; of these, approximately half (12 of 26) of the values were greater than 0.050 mg/L.

On 2 October 2003, the failure of two electrical grids and the lack of a backup generator at the Upper Blackstone wastewater treatment facility resulted in the release of approximately 9 million gallons of untreated and partially treated waste to the Blackstone River over a six-hour period (Boynton 2003, Monahan 2004b). MassDEP staff conducted water quality and bacteria monitoring to track the spill on October 3rd and 6th (Beaudoin 2003, Appendix B-1 Tamul 2005). Approximately 60 feet upstream of the UBWPAD effluent discharge (Station 1), mid-morning DO measurements ranged from 7.8 to 9.7 mg/L; the maximum temperature was 18.5°C; and conductivity values were high (444 to 620 μS/cm).

Downstream of the discharge (BLK02), water quality varied with the location and intensity of the spill plume i.e., as the plume flowed downstream, various factors caused the plume to elongate. The maximum temperature

observed was immediately downstream of the discharge on both dates (17.6°C), which was approximately 6°C warmer than the river 60 feet upstream of the discharge. Conductivity also rose below the discharge, approximately 100 µS/cm above background. DO decreased by approximately 3 mg/L below the discharge on both dates.

DWM staff conducted monthly *in situ* and water quality monitoring at two locations in this segment of the Blackstone River between May and October 2003: on eight dates at the McCracken Road station, Millbury (BLK02); and on six occasions downstream of Singing Dam, Sutton (BS12). At McCracken Road, the maximum temperature was 22.7°C. Early to mid-morning DO measurements (between 03:14 and 10:16 am, n=9) ranged from 1.5 to 7.9 mg/L. It should be noted that all measurements between 24 July and 12 September were less than 5.0 mg/L, a seven-week period. Conductivity values were high, ranging from 492 to 782 µS/cm, and pH values varied little (6.8 to 7.0 SU). Ammonia concentrations ranged from 0.58 to 4.8 mg/L (NH₃-N). Ammonia levels were below the criteria with the possible exception of one measurement (4.7 mg/L) on 27 August; however, no *in situ* measurements were taken at that time, so a comparison to criteria cannot be made. Total phosphorus concentrations were all elevated, ranging from 0.19 to 0.76 mg/L (n=4) (Appendix B Tamul 2005).

At Singing Dam, Sutton, the maximum temperature was 22.4°C. Early to mid-morning DO measurements (between 3:35 to 11:10, n=6) ranged from 7.3 to 9.5 mg/L. Conductivity values ranged from 480 to 737 µS/cm, and pH values ranged from 7.0 to 7.3 SU. Ammonia concentrations ranged from 0.35 to 4.2 mg/L, and none exceeded the criteria. Total phosphorus concentrations were elevated here as well, ranging from 0.18 to 1.1 mg/L (Appendix B Tamul 2005).

The *Aquatic Life Use* is assessed as impaired for this segment due to the moderately/severely impaired benthic and fish communities, habitat quality degradation (physical substrate habitat alteration -- sedimentation/erosion/embeddedness, and other flow regime alterations -- rapid flow fluctuations), and poor water quality conditions (low DO, evidence of enrichment, elevated total phosphorus). The presence of the non-native *Potamogeton crispus* in this segment is of concern, as well as episodic fish kill event(s), elevated conductivity (possibly related to road salting activities) and occasional ambient toxicity. Sources of these conditions include the municipal point source discharge, the complex of wet weather discharges (point source and combination of stormwater, SSO and/or CSOs), habitat modification (scouring, erosion, deposition) associated with rapid flow fluctuations resulting from impervious surface runoff, and infrastructure construction activities.

Fish Consumption

Fish were collected by DWM biologists from this segment of the Blackstone River in 1985 and were analyzed for metals (Maietta 2007). The *Fish Consumption Use* is not assessed for this segment since no site-specific fish consumption advisory was issued by MA DPH. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody.

Primary and Secondary Contact Recreational and Aesthetics Uses

The Blackstone River is used by canoeists and kayakers for recreation. In 2000 and 2005, the John H. Chaffee Blackstone River Valley National Heritage Corridor organized canoe trips on the Blackstone River; the first spanned 4 days, and went from the Middle River, Worcester to Providence, RI. The Rhode Island Canoe and Kayak Association (RICKA) organizes canoe/kayak events throughout the Blackstone Valley each summer (RICKA 2009).

Station BS09C was accessed upstream of the former (southern) Millbury Street Bridge by SMART crews every two months from March 2000 to June 2002 (Appendix F, Beaudoin 2004b). Banks were populated with dense poison ivy, grape vines and shrubs, with overhanging canopy up- and downstream from the bridge footprint; however, instream aquatic vegetation was completely absent throughout this area. Undercut banks were prominent. The bottom is mainly cobble and gravel, typically covered in a dense growth of filamentous algae. Turbidity is common at this station; observations ranged from low to highly turbid ("coffee-colored") on nearly every sampling date (Beaudoin 2004b). Oily sheens were noted on five events. The banks and stream bed were heavily littered with trash, including construction debris, chain link fencing, metals, cables, wood, silt fencing, hay bales, tires, buckets, floatables, fabric, and shopping carts. Colors and odors were also indicative of the urbanized nature of this headwater station. Observations of color included clear, green, coffee, brown, chocolate and gray; odors included none, septic, musty and raw sewage. As noted above, discharges from the Worcester CSO treatment facility infrequently impact this part of the Blackstone River.

When the Millbury Street Bridge was demolished, and the lower end of Millbury Street closed, Station BS09C was relocated to the Blackstone River Road Bridge, approximately 135 yards upstream (beginning in October 2002). Both locations are considered to represent similar conditions. As with the original location of this station, instream aquatic vegetation was consistently absent; dense periphytic growth (as filamentous algae) typically covered bottom substrates; elevated turbidity was consistently noted; and foam and oily sheens were observed frequently. Trash was always present at this location, although at a reduced density overall than the downstream location.

In 2003, MassDEP DWM collected six *E. coli* samples from the Blackstone River near the historic McCracken Road Bridge in Millbury (BLK02) during the primary contact season. The geometric mean of the six samples was 207 cfu/100 ml, with counts ranging from 90 to 890 cfu/100 ml. DWM also conducted bacteria monitoring downstream of Singing Dam at Blackstone Street, Sutton (BS12) in 2003. The geomean of six samples was 144 cfu/100 ml, with counts ranging from 45 to 560 cfu/100 ml.

MassDEP staff conducted water quality and bacteria monitoring to track the UBWPAD sewage spill described above on October 3rd and 6th (Beaudoin 2003). Bacteria samples collected on October 2nd before the spill began showed background levels in this segment ranged from 84 to 210 cfu/100 ml. On October 3rd, *E. coli* ranged from 1,000 cfu/100 ml above the UBWPAD spill to 300,000 cfu/100 ml at the Pleasant Street Bridge, Grafton, which indicated the approximate location of the spill. By October 6th, the highest value in this segment was down to 210 cfu/100 ml.

Record levels of rainfall in October 2005 (15.65 inches) caused the Blackstone River to rise to nearly 100 times its normal volume (Larrabee 2005; NWS 2009). As a result, bar racks at the Upper Blackstone facility became clogged, causing the release of more than 90 million gallons of raw sewage (over a 14-hour period) to the river. MassDEP conducted bacteria sampling on October 18th to evaluate the impact of the release on the river. *E. coli* collected in this segment ranged from 517.2 cfu/100 ml at the Pleasant Street Bridge, Grafton to >2419.6 cfu/100 ml (above the discharge, at Blackstone River Road)(Connors 2005).

DWM staff observed aesthetic conditions at seven locations in this segment in 2003. Observations documented recurring issues at some and/or all locations: odors (septic, effluent, chlorine, musty); dense patches of aquatic macrophytes; and moderate to dense periphyton.

The *Primary and Secondary Contact Recreational and Aesthetic Uses* are assessed as impaired due to aesthetically objectionable conditions throughout the segment (odors, elevated turbidity, foams and sheens, dense periphyton cover and objectionable deposits of debris/floatables/trash). The *Primary Contact Recreational Use* is also assessed as impaired based on elevated *E. coli* counts.

Blackstone River (MA51-03) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Causes: Aquatic macroinvertebrate bioassessments, fishes bioassessments, physical substrate habitat alterations, other flow regime alterations, nutrient/eutrophication biological indicators, low dissolved oxygen, elevated total phosphorus Sources: Municipal point source discharge, wet weather discharges (point source and combination of stormwater, SSO or CSO), habitat modification - other than hydromodification, new construction activities - highways, roads, bridges, infrastructure
Fish Consumption		NOT ASSESSED
Primary Contact		IMPAIRED Causes: <i>Escherichia coli</i> , Taste and Odor, Turbidity, Foam/Flocs/Scum/Oil Slicks, Excess Algal Growth, Debris/Floatables/Trash Sources: Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO), Municipal Point Source Discharge
Secondary Contact		IMPAIRED Causes: Taste and Odor, Turbidity, Foam/Flocs/Scum/Oil Slicks, Excess Algal Growth, Debris/Floatables/Trash Sources: Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO), Municipal Point Source Discharge
Aesthetics		IMPAIRED Causes: Taste and Odor, Turbidity, Foam/Flocs/Scum/Oil Slicks, Excess Algal Growth, Debris/Floatables/Trash Sources: Wet Weather Discharges (Point Source and Combination of Stormwater, SSO or CSO), Municipal Point Source Discharge

* Alert Status issues identified, see details in use assessment

RECOMMENDATIONS

Evidence of episodes of instream toxicity to *P. promelas* in the Blackstone River just downstream from the new Millbury Street Bridge in Worcester is of concern. Most of these episodes occurred during the April testing events. Additional instream toxicity testing should be conducted by environmental monitoring agencies (e.g., EPA) if possible. UBWPAD should continue to monitor survival of test organisms exposed to river water samples as part of their whole effluent toxicity tests. Continue to closely monitor the UBWPAD WET toxicity test results. If either the frequency and/or magnitude of the CNOEC permit limit violations increases, evaluate the need to require additional testing or implement a toxicity identification/toxicity reduction evaluation to better evaluate the cause(s) of the problem.

Conduct an investigation on the source(s) of elevated conductivity in this segment using chloride as an indicator.

United County Industries (MAG250014) - The new general permit for non-contact cooling water discharges is being finalized. When this new permit becomes available, United County Industries should submit their application for coverage.

The Lewcott Corporation (MAG250969): the new general permit for non-contact cooling water discharges is being finalized. When this new permit becomes available, there will be limits for TRC based on available dilution rather than monitoring only requirements. Since the source of water for this facility is municipal the effluent discharge may need to be dechlorinated prior to discharge in order to meet the TRC limits. Another option may be for the facility to install a closed loop cooling water system.

POOR FARM BROOK (MA51-17)

Location: Headwaters, West Boylston to the inlet of Shirley Street Pond, Shrewsbury (through City Farm Pond formerly segment MA51020).
Size: 3.6 Miles
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

City Farm Pond is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Siltation, Noxious aquatic plants).

MA DFG identifies this waterbody as a "Cold Water Fishery Resource" (MA DFG 2007).

WMA with surface water source(s) (APPENDIX H, Table H1):

Worcester Country Club (registration 21234804 for 0.1 MGD over 210 days surface water withdrawal from pond on Poor Farm Brook)

NPDES (APPENDIX H and Table H2):

West Boylston (MAR041171)
Worcester (MAS010002)
Shrewsbury (MAR041158)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

There are concerns regarding low flow conditions in Poor Farm Brook. In the upper reach of the brook water is withdrawn directly from a pond by the Worcester Country Club (WCC) for irrigation purposes. Very low flow conditions were observed in Poor Farm Brook at Roberto Clemente Field in Worcester by Blackstone Headwaters Coalition (BHC) volunteer monitors on 10 July 2004 (Gilpatrick 2007). Riverways and MassDEP staff also observed dry conditions in the brook downstream from the outlet of Farm City Pond in September 2004. Results of additional monitoring conducted by Riverways staff (installation of a pressure transducer, streamflow measurements, and observations) were reported to MassDEP in August 2005 (Kearns 2005). Followup field reconnaissance was conducted by MassDEP staff later in August and again in September 2005 (MassDEP 2005). Very low flows were observed along Poor Farm Brook down to the Route 70 overpass in Shrewsbury. All sites downstream from this location were dewatered by either the August and/or September surveys (MassDEP 2005). It should also be noted that Shrewsbury's Home Farm Wells may also exacerbate the low flow problems in the brook.

The City Farm Pond and dam (which no longer has any flashboards) also influences habitat/flow conditions in Poor Farm Brook (Kickham 2009). The pond was described as a big shallow meadow that allows a huge amount of evaporation. During low flow periods water flows over the dam only during large storm events. Channelization is evident in the reach downstream from the pond; large direct stormwater discharges drain to this lower reach of the brook (Kickham 2009).

Biology

MA DFG conducted fish population sampling at two sites along Poor Farm Brook on 11 June 2001: east of Mountain Street in Worcester (Site 534) and further downstream north of Route 70 in Shrewsbury (Site 444) (MassDFG 2008). At the upstream location (Site 534) a total of 95 fish were collected, representing four species, including 77 blacknose dace (*Rhinichthys atratulus*), 15 white sucker (*Catostomus commersonii*), two tessellated darter (*Etheostoma olmstedii*), and one small (74mm) brook trout (*Salvelinus fontinalis*). Further downstream (Site 444) a total of 141 fish were collected including 106 blacknose dace (*R. atratulus*), 28 white sucker (*C. commersonii*), and seven brook trout (*S. fontinalis*) (192mm – 253mm). All fish collected are fluvial specialist/dependant species. The presence of multiple age classes of brook trout, an intolerant species, is indicative of excellent water and habitat quality.

The *Aquatic Life Use* is assessed as support for the upper 3.0 mile reach of Poor Farm Brook based primarily on the fish population information (presence of multiple age classes of brook trout). This use is identified with an Alert Status however due to the extremely low flow conditions observed by MassDEP staff throughout this portion

of the brook in September 2005. Downstream from the Route 70 overpass, the *Aquatic Life Use* is assessed as impaired due to lack of streamflow. Water withdrawals certainly exacerbate these conditions although stormwater runoff, the City Farm Pond dam, the influence of groundwater withdrawals, and/or natural conditions is not yet completely understood.

Primary and Secondary Contact Recreational and Aesthetics Uses

The Blackstone River Watershed Association in conjunction with the Blackstone River Coalition recorded aesthetic observations on Poor Farm Brook at the Roberto Clemente Field in Worcester in 2004, 2005 and 2006, monthly from April through November, as part of their ongoing volunteer water quality monitoring program (Gilpatrick 2007). Observations indicated a generally clear water column free from odors; the presence of trash was consistent, at times heavy enough to block stream flow through the culvert.

No objectionable turbidity or debris/floatables/trash was observed by MassDEP staff in Poor Farm Brook during field reconnaissance conducted in August and September 2005 (MassDEP 2005). During a June 2008 stream survey on Poor Farm Brook, MassDEP staff noted little to moderate trash on the banks and/or within the stream bed at all seven locations along Poor Farm Brook between Burncoat Street, Worcester downstream to the confluence with Shirley Street Pond (Beaudoin 2008a).

The *Primary and Secondary Contact Recreational Uses* are not assessed due to the lack of bacteria data. The *Aesthetics Use* is assessed as support since few objectionable conditions were noted by MassDEP staff and BHC volunteers. These uses are identified with an Alert status due to trash.

Poor Farm Brook (MA51-17) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT Upper 3.0 miles IMPAIRED Lower 0.6 miles Cause: Low flow alterations Suspected cause: Other flow regime alterations Source: Flow alterations from water diversions, unknown Suspected source: Habitat modification - other than hydromodification, discharges from municipal separate storm sewer systems (MS4), channelization, baseflow depletion from groundwater withdrawals
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED*
Secondary Contact		NOT ASSESSED*
Aesthetics		SUPPORT*

* Alert Status issues identified, see details in use assessment

COAL MINE BROOK (MA51-27)

Location: Perennial portion, from unnamed road approximately 0.2 miles upstream from Plantation Street, Worcester to inlet of Lake Quinsigamond, Worcester.
Size: 0.4 Miles
Classification: B
2008 303(d) List: Category

This is a new segment so there is no prior listing in the 2008 Integrated List of Waters.

MA DFG identifies this waterbody as a "Cold Water Fishery Resource" (MA DFG 2007).

NPDES (APPENDIX H):

City of Worcester (MAS010002)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

Coal Mine Brook has suffered from siltation associated with local construction projects. Numerous erosion and siltation events at the Lincoln Plaza redevelopment site in 2001-2002 resulted in fines associated with siltation and elevated turbidity in the stream (Foskett, Jr. 2001, Monahan 2002) as well as a large sewage release from a pipe broken during grading activities (Luttrell 2001, Monahan 2001). More siltation occurred as a result of inadequate erosion controls at the Plantation Towers site (Williamson 2003).

In September 2003 MassDEP DWM biologists conducted backpack electrofishing in Coal Mine Brook upstream from Lake Avenue North in Worcester (CMB01, Appendix D). Habitat quality was noted to be limited most by the extremely low flow conditions encountered and poor bank stability. Evidence of extremely high flow conditions were also noted. This observation was based on the erosional areas on the stream bank and the presence of debris caught in tree branches well above the normal water line. Much of the upper watershed is developed both residentially and commercially. There is also a large shopping plaza and a major six-lane highway (Route 290) that drain to this sub-watershed. Recent re-construction of the shopping plaza included best management practices (e.g., stormwater detention/infiltration basins) to try and minimize the negative effects of fluctuating flows and temperatures related to storm events. It is unclear if these BMPs have been successful in mitigating the negative effects of stormwater runoff to the brook (Appendix D).

Biology

Numerous fish kills have been observed at Coal Mine Brook, including one in late July 2002 (Monahan 2002). Fifteen brook trout (*Salvelinus fontinalis*) were assumed to have been killed by a thermal pulse, caused by rain running over (summer) heated impervious surfaces covering much of the drainage area.

In September 2003 DWM biologists conducted backpack electrofishin in Coal Mine Brook upstream from Lake Avenue North in Worcester (CMB01, Appendix D). The survey resulted in the collection of only two golden shiner (*Notemigonus crysoleucas*), a macrohabitat generalist. These fish are commonly sold and used as bait and possibly were bait bucket releases. It is unclear if the lack of fish in Coal Mine Brook is a result of historic conditions or if the water quality and flow regime of this brook remain unsuitable to support a balanced and indigenous fish community (Appendix D).

Water Chemistry

A Stowaway continuous temperature data logger was deployed by DWM staff in Coal Mine Brook upstream from Lake Avenue North in Worcester on 11 August 2003 and retrieved on 22 September 2003 (Appendix G). The 7-day mean maximum temperature (rolling average) exceeded the cold water standard (20°C) on 12 of 37 days (32.4% of the days within the rolling average period). The minimum observed temperature was 11.9°C, and the maximum was 26.1°C. There were no exceedences of the warm water standard (28.3°C).

The *Aquatic Life Use* is assessed as impaired for Coal Mine Brook based on the lack of fish, the document fish kills related to heated stormwater runoff, and the sediment/siltation and erosional problems associated with stormwater runoff from construction activities and the impervious surfaces in the watershed.

Primary and Secondary Contact Recreational and Aesthetics Uses

Volunteers with the Blackstone River Coalition Volunteer Water Quality Monitoring Program have been noting conditions near Plantation Street (Worcester) on Coal Mine Brook since 2004 (BRC 2008). In general, the volunteers noted turbidity was slight or not visible through this time period, with one observation of milky appearance and slight turbidity. Monahan (2003) noted silt in sections of the brook up to approximately 6 inches thick, resulting from erosion at construction sites upstream.

No objectionable conditions (e.g., color, turbidity, odors, deposits of debris/floatables/trash) were noted by DWM biologists during the backpack electrofishing surveys in Coal Mine Brook (Appendix D).

The *Primary and Secondary Contact Recreational Uses* are not assessed due to the lack of bacteria data. The *Aesthetics Use* is assessed as support based on the general lack of objectionable conditions noted by BRC volunteers and DWM biologists.

Coal Mine Brook (MA51-27) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Sedimentation/siltation, lack of fish (fishes bioassessment), fish kills, elevated water temperature Source: Impervious surface/parking lot runoff, construction stormwater discharge (permitted)
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

RECOMMENDATIONS

Additional fish population monitoring should be conducted to document whether or not trout are reproducing in Coal Mine Brook.

Temperature monitoring with expanded spatial coverage should be conducted to evaluate the thermal effects if any of stormwater runoff in Coal Mine Brook.

QUINSIGAMOND RIVER (MA51-09)

Location: Outlet Flint Pond, Grafton to confluence with Blackstone River, Grafton (excluding Lake Ripple segment MA51135) (segment includes all of Hovey Pond formerly segment MA51068 and a portion of Fisherville Pond formerly segment MA51048)

Size: 5.2 Miles

Classification: B\WWF

2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

Hovey Pond (MA51068) and Fisherville Pond (MA51048) will no longer be reported on as approximately 20 acre and 38 acre lake segments, respectively, since the retention time of these waterbodies was estimated at approximately one day and less than one day respectively; they will be considered run of the river impoundments (McVoy 2006). The retention time estimates were based on the annual historical mean discharge from two stream gages in the Blackstone River Basin (01110000 and 01124500) and the normal storage volume of the dams reported by DCR in their Massachusetts Dam Safety Program Database (Socolow et al. 2004 and DCR 2002).

[Site Awaiting NPL Decision \(SAND\): DURALITE COMPANY, INC](#)
[Short Term/Removal \(SHORT\): FISHERVILLE MILL](#)

Hovey Pond (MA51068) is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Exotic species*). * denotes a non-pollutant.

Fisherville Pond (MA51048) is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed.

WMA with surface water source(s) (APPENDIX H, Table H1):

Wyman Gordon Company (21211001)

NPDES (APPENDIX H and Table H2):

Wyman Gordon Company in North Grafton (MA0001121) to tributary of the Quinsigamond River

Wyman Gordon Company in North Grafton (MA0004341) to tributary of the Quinsigamond River
Town of Grafton (MAR041193)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

Hovey Pond has been impacted by the release of hazardous materials associated with the Wyman-Gordon industrial site, Grafton. However, Hovey Pond was only identified as part of the Wyman-Gordon (hazardous waste) site in 2007, and is still under investigation (Vigeant 2009c).

The SMART program established a water quality monitoring station on the Quinsigamond River above the former Bridge Street Bridge in North Grafton in March 2000 (Appendix F, Beaudoin 2004b). The station was sampled bimonthly 27 times from 2000 through November 2004. The bottom of the stream bed at Station QU02A consists mainly of embedded gravel and cobble stained black, as well as pieces of broken glass and metals. A small eastern "cove" above the stone arch bridge has a sand/muck bottom with a thin layer of silt over all. The banks are covered with shrubs, trees and herbaceous vegetation; the overhanging canopy shades the stream upstream of the station.

The Fisherville Pond Dam located upstream of the Rte. 122A/Main Street bridge, Grafton controls the surface area of Fisherville Pond. According to the U.S. Army Corps of Engineers (Kennelly 2005), "under full pool conditions the dam maintains about 70 acres of open water and 100 acres of vegetated wetland, including about 40 acres of wet meadow." In 1986, the outlet gate was permanently welded in the open position due to concerns about the dam viability. Although the full pool was re-established when the spillway became clogged with debris, the pool drained again when the debris was dislodged in 2000. Typically, the pool is now approximately 26 acres and functions in a run-of-river mode.

According to the USACOE (2009f) "A \$400,000 federally funded reconnaissance study focusing on ecological needs in the Blackstone River watershed was completed in 1997...The originally estimated \$2 million cost-shared feasibility study is currently ongoing and is one of the rivers selected as part of the Urban Rivers Restoration Initiative between the Corps and the U.S...EPA...An interim report that recommends restorative measures for Fisherville Pond is currently being prepared. Additional sediment contamination data will be collected during the summer of 2009 prior to finalizing the draft report. Corps peer review should start in the fall 2009. Some of the data produced to date can be viewed on the Corps web site <http://www.nae.usace.army.mil/projects/ma/blackstone/>."

Biology

Two non-native macrophyte species, *Myriophyllum spicatum* and *Cabomba caroliniana* were observed in Hovey Pond during the 1994 Blackstone River Watershed synoptic lake surveys (MassDEP 1994).

The Quinsigamond River in Grafton was stocked with trout in 2009 (MA DFG 2009).

In 2001 MA DFG biologists conducted barge electrofishing at two sites in the Quinsigamond River in Grafton in 2001 (Millbury Street, Sample ID 540 and Pleasant Street, Sample ID 454). The fish sample collected near Millbury Street contained fifty-five individuals representing eight species; white sucker (*Catostomus commersonii*), a fluvial dependent, dominated the sample; most species observed were macrohabitat generalists, however. The fish sample collected further downstream near Pleasant Street was dominated by macrohabitat generalists, although fallfish (*Semotilus corporalis*), white sucker (*C. commersonii*) and tessellated darter (*Etheostoma olmstedii*) (fluvial species) were present. It should be noted that white sucker is highly tolerant of degraded conditions.

Toxicity

Effluent

Wyman Gordon Company has two NPDES permits for discharges within this subwatershed area; see Appendix H for toxicity information.

Water Chemistry

CERO SMART conducted bimonthly *in-situ* water quality monitoring at a station in the Quinsigamond River on 27 occasions from March 2000 through October 2004 (Appendix F, Beaudoin 2004b). The maximum recorded temperature in this five year period was 27.6°C. When compared to reference conditions at the West River station, conductivity values were consistently elevated; values at Station QU02A ranged from 365 to 724 uS/cm. Mid-morning DO values ranged from 7.1 to 13.3 mg/L, while pH ranged from 6.4 to 7.4 SU. Ammonia levels ranged from <0.01mg/L to 0.19 mg/L, and none exceeded the criteria. Total phosphorus concentrations ranged from 0.010 to 0.28 mg/L from March 2000 to Nov 2004; of these, only one value was greater than 0.040 mg/L.

A dry weather study of water quality in the Blackstone Watershed was conducted from 2000-2003 (Wright et al 2004). Samples were collected at 24 sites on the Blackstone, Mumford, Quinsigamond and West Rivers on four dates under dry weather conditions. Insufficient data are currently available to complete the DWM external data validation process required for assessment decision.

DWM staff conducted monthly *in situ* and water quality monitoring in the Quinsigamond River near Pleasant Street in Grafton (QU05) on five occasions between May and October 2003. Early morning DO measurements (between 03:55 and 10:44am, n=5) ranged from 5.9 to 9.1 mg/L and the other physico-chemical monitoring data were indicative of good conditions. The maximum water temperature was 23.9°C while the maximum TP concentration was 0.043 mg/L (Appendix B Tamul 2005).

The *Aquatic Life Use* is assessed as impaired in the 0.4 mile reach through Hovey Pond due to the infestation with two non-native macrophyte species, *M. spicatum* and *C. caroliniana*. The remaining 4.8 miles of this segment are assessed as support. This use is identified with an Alert status, however, due to the dominance of the fish communities by macrohabitat generalist species and the low number of fluvial species.

Fish Consumption Use

Fish were collected by DWM biologists from Hovey Pond in 1996 and were analyzed for metals, PCBs and organochlorine pesticides (Maietta 2007). MA DPH did not issue a site specific fish consumption advisory based on the results of the analyses (MA DPH 2009).

The *Fish Consumption Use* is not assessed for Hovey Pond or this segment of the Quinsigamond River since no site-specific fish consumption advisory was issued by MA DPH. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody.

Primary and Secondary Contact Recreational and Aesthetics Uses

The lower Quinsigamond River is used by kayakers and canoers; a car top boat ramp, the Ekbow Launch, provides access to the river from Rte. 122 in Grafton. The Rhode Island Canoe and Kayak Association (RICKA 2009), describes the canoe experience from the Mass. Turnpike Bridge (I-90) to the Blackstone River on their web site (<http://www.ricka-flatwater.org/bv%20facts.htm>). This section of river is described as “offering pleasant scenery with one portage.”

The Massachusetts Department of Fish and Game Office of Fishing and Boating Access notes that this area can be fished for largemouth bass (*Micropterus salmoides*), northern pike (*Esox lucius*), pickerel (*Esox spp.*) and black crappie (*Pomoxis nigromaculatus*) (MA DFG 2009).

Station QU02A was located upstream of the historic stone arch bridge at the former Bridge Street crossing by SMART crews every two months from March 2000 to the present (Appendix F, Beaudoin 2004b). Few objectionable conditions were noted at this station, and were limited to a moderate quantity of trash on the west bank, and broken glass, chunks of metal and other trash/debris embedded in the bottom of the main part of the channel (near western shore)(Beaudoin 2004b). The bottom debris is stained black, and is not observable under most conditions due to the angle of sunlight on the water surface.

In 2003, MassDEP DWM collected six *E. coli* samples from the Quinsigamond River near Pleasant Street in Grafton (QU05) during the primary contact recreation season (Appendix B). The geometric mean of the six samples was 26 cfu/100 ml, and the maximum count was 130 cfu/100 ml. No aesthetically objectionable conditions (e.g., odors, oils, turbidity, growths, deposits) were observed (MassDEP 2003).

The Blackstone River Watershed Association in conjunction with the Blackstone River Coalition recorded aesthetic observations at three sites on the Quinsigamond River in 2004, 2005 and 2006, monthly from April through November, as part of their ongoing volunteer water quality monitoring program (Gilpatrick 2007). At the station located approximately 40ft west of the historic stone arch bridge east of Route 140 in Grafton, the stream was typically clear and odorless, with infrequent observations of an earthy or fishy odor, foam, and light trash. At Wheeler Rd., 100ft downstream of Route 122/140 Bridge in Grafton, the river remained clear and odorless overall, with infrequent observations of light trash. And downstream of the Pleasant St. Bridge in Grafton, the river was again typically clear and odorless, with intermittent observations of brown color, odors (fishy, sewage, stale) and light to heavy vegetation.

Since the geometric mean for the *E. coli* bacteria results meet the criteria for both primary and secondary contact recreation (126 and 630 cfu/100 ml, respectively) and minimal aesthetically objectionable conditions were observed, the *Primary and Secondary Contact Recreational and Aesthetics* uses are assessed as support.

Quinsigamond River (MA51-09) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED 0.4 mile reach through Hovey Pond Cause: Non-native aquatic macrophyte infestation, Eurasian Water Milfoil (<i>Myriophyllum spicatum</i>) Source: Introduction of non-native organism SUPPORT* remaining 4.8 miles
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT
Secondary Contact		SUPPORT
Aesthetics		SUPPORT

RECOMMENDATIONS

The Wyman Gordon Company in North Grafton (MA0001121) should continue to conduct acute whole effluent toxicity tests on their treated stormwater effluent from outfall #002. Since *C. dubia* has consistently been the more sensitive test organism testing with *P. promelas* could be eliminated. The results of new tests should be closely monitored and if testing continues to indicate acute toxicity the facility should be required to conduct a toxicity identification evaluation/toxicity reduction evaluation (TIE/TRE).

The Wyman Gordon Company (MA0004341) should continue to conduct acute whole effluent toxicity tests on their Runoff Management Facility (RMF) outfalls. Since *C. dubia* has consistently been the more sensitive test organism testing with *P. promelas* could be eliminated. The results of new tests should be closely monitored and if testing continues to indicate acute toxicity the facility should be required to conduct a toxicity identification evaluation/toxicity reduction evaluation (TIE/TRE). The facility staff should also collect river water upstream from the outfall for use as dilution water in their toxicity tests.

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

BLACKSTONE RIVER (MA51-04)

Location: Fisherville Dam, Grafton to outlet Rice City Pond, Uxbridge. (through Riverdale Pond Impoundment formerly segment MA51136 and Rice City Pond formerly segment MA51131)
Size: 8.8 Miles
Classification: B\WWF
2008 303(d) List: Category 5

This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Unknown toxicity, Priority organics, Metals, Nutrients, Organic enrichment/Low DO, (Flow alteration*), Pathogens, Taste, odor and color, Suspended solids, Turbidity). * denotes a non-pollutant (MassDEP 2008a).

Riverdale Impoundment (MA51136) and Rice City Pond (MA51131) will no longer be reported on as approximately 2 acre and 22-acre lake segments, respectively, since the retention time of these waterbodies was estimated at less than one day; they will be considered run of the river impoundments (McVoy 2006). The retention time estimates were based on the annual historical mean discharge from two stream gages in the Blackstone River Basin (01110000 and 01124500) and the normal storage volume of the dams reported by DCR in their Massachusetts Dam Safety Program Database (Socolow et al. 2004 and DCR 2002).

Riverdale Impoundment (MA51136) is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Priority organics, Turbidity).

Rice City Pond (MA51131) is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Pesticides, Priority organics, Siltation, Turbidity).

WMA with surface water source(s) (APPENDIX H, Table H1):

Riverdale Mills Corporation (9P21221602)

NPDES (APPENDIX H and Table H2):

Town of Grafton (MAR041193)

Grafton Wastewater Treatment Plant (WWTP) (MA0101311)

Town of Northbridge (MAR041144)

Polyfoam Inc. (MAG250743) –Closed-loop their 0.13 MGD non-contact cooling water operation, EPA terminated permit in August 2001.

Coz Plastics, Inc. (MA0032549) - Ceased operation November 2000.

Riverdale Mills Corporation (MAG250279)

Northbridge WWTP (MA0100722) (discharge to an unnamed tributary)

Town of Uxbridge (MAR041166)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

In the report of a study conducted from 1994-1995, the Farnumsville Mill and Riverdale Mill hydropower facilities were identified as the primary sources of erosion of contaminated bank sediments, as well as chronic downstream transport of these contaminants (Snook 1996). The Farnumsville Mill hydropower plant has been off-line since 1996, when the town of Grafton requested that the impoundment be lowered to allow maintenance of bridge and roadways, resulting in an approximately 4-acre loss of impounded surface area. In a recent decision by the Federal Energy Regulatory Commission (FERC), it was ruled that the Blackstone River is navigable (earlier rulings deemed that the river was non-navigable), and thus subject to FERC jurisdiction when and if the facility is returned to operational condition (Beaudoin 2001).

The SMART monitoring program staff began bimonthly monitoring at the Sutton Street Bridge, Northbridge (BS14A) in this segment in March 2000 (Appendix F, Beaudoin 2004b). Stream banks are undercut. When visible, the bottom consisted of sand and gravel under a layer of silt covered in green to orange filamentous algae. Impounding is common at this station, resulting from downstream hydropower activities at the Riverdale hydropower facility. Flow fluctuations also occur diurnally as a result of wastewater treatment plant flows from the Upper Blackstone Water Pollution Abatement District (UBWPAD) and the Grafton WWTP.

Riverdale Mills has a 150 kilowatt licensed hydropower facility (FERC Project # 9100) in the village of Riverdale, Northbridge on the Blackstone River. Riverdale Power & Electric Co., Inc. was established in 1985, and the 30-year permit was issued 15 June 1987 to operate as run-of-the-river. Currently one of the three tunnels with turbines is active, and the remaining two are being reconstructed. At present there are no fish passageways, however FERC may require them in the future.

The Riverdale Pond was largely dewatered in 1976, when the mill dam was breached. In 1984, the dam was rebuilt to its original height, and Riverdale Pond was again flooded. Studies confirmed that the Riverdale facility backwaters the Blackstone River for a distance upstream of the USGS flow gaging station in the village of Rockdale (Northbridge), and that habitat and flow impacts from the facility are measured as far downstream as Rice City Pond (Northbridge/Uxbridge) (Weinstein *et al.* 2001). It should be noted that, in April of 2007, the Riverdale Pond was drawn down to river level (thalweg filled) by the Riverdale Mill Corporation to prevent flooding of the mill.

Biology

In August 2001 and again in July 2007 MA DFG biologists conducted barge electrofishing at three locations in this segment of the Blackstone River (MA DFG 2008). Sites 446 (27 August 2001) and 2383 (12 July 2007) were located at Rte. 122A in Grafton. Sites 324 (28 Aug 2001) and 2391 (13 July 2007) were sampled at Sutton Street in Northbridge. Sites 321 (28 August 2001) and 2213 (17 July 2007) were located at the Church Street Extension in Northbridge. All samples were heavily dominated by white sucker (*Catostomus commersonii*); this was the only fluvial species observed in any of the locations/surveys in this segment. It should be noted that white sucker is a pollution-tolerant species. Macrohabitat generalists collected include yellow perch (*Perca flavescens*), largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), pumpkinseed (*Lepomis gibbosus*), yellow bullhead (*Ameiurus natalis*), golden shiner (*Notemigonus crysoleucas*), common carp (*Cyprinus carpio*), green sunfish (*Lepomis cyanellus*), brown bullhead (*Ameiurus nebulosus*), white catfish (*Ameiurus catus*) and chain pickerel (*Esox niger*). With the exception of white sucker, the absence of other fluvial species is indicative of historic and/or present habitat and water quality degradation. The presence of macrohabitat generalists is most likely due to the heavily impounded nature of this segment. It should be noted that both the number of individuals, and in two instances, the number of species were lower in 2007 as compared to 2001. Part of this difference can be attributed to changes in sampling procedure employed by the MA DFG which resulted in a shorter reach being sampled in 2007.

Toxicity

Effluent

A total of 11 acute whole effluent toxicity tests were conducted on the Grafton WWTP treated effluent between February 2000 and October 2002. No acute toxicity to *C. dubia* was detected in those test events. Between January 2003 and January 2008, 21 modified acute and chronic whole effluent toxicity tests were conducted using *C. dubia*. The LC₅₀'s were all $\geq 100\%$ effluent with the exception of the April 2003 test event when the LC₅₀ = 70% effluent. It should be noted that acute whole effluent toxicity was also detected in three additional test events (April 2004, April 2005, and January 2008) when survival of *C. dubia* in the whole effluent at the end of the test was 0%. During each of these three test events, acute toxicity was detected in one of the two renewal samples but not in the sample used to initiate the chronic test. Chronic whole effluent toxicity to *C. dubia* was also detected in 14 of the 21 test events (CNOECs ranged from <6.25 to 100% effluent). CNOECs in four of the 21 tests were $\leq 6.25\%$ effluent.

Modified acute and chronic whole effluent toxicity tests were conducted on the Northbridge WWTP treated effluent between February 2000 and January 2008. Prior to January 2007 tests were conducted using both *C. dubia* and *P. promelas* as test species but the new permit only requires testing with *P. promelas*. No acute whole effluent toxicity was detected by either *C. dubia* (n=32 test events) or *P. promelas* (n=35 test events). The CNOEC results for *C. dubia* (n=30 valid tests) were all 100% effluent with the exception of two tests (September 2000 and January 2004) with CNOEC = 50% effluent. The CNOEC results for *P. promelas* (n=30 valid test events) were all >83% effluent with the exception of three test events (CNOEC =50%, 25%, and <6.25% effluent in November 2001, January 2004, October 2004, respectively). Results of two additional *P. promelas* tests (August 2002 and November 2004) did not exhibit good dose-response relationships. The CNOEC was 12.5% effluent for the August 2002 test, however, only the 25% test concentration had a significant difference in growth from the control. The CNOEC was 6.25% effluent for the November 2004 test however only two test concentrations, 12.5% and 88% effluent, showed significant differences from the control. Both of these test results are anomalous and should be interpreted with caution.

Water Chemistry

A dry weather study of water quality in the Blackstone Watershed was conducted from 2000-2003 (Wright et al 2004). Samples were collected at 24 sites on the Blackstone, Mumford, Quinsigamond and West Rivers on four dates under dry weather conditions. Insufficient data are currently available to complete the DWM external data validation process required for assessment decision.

The Fisherville Mill site on the Blackstone River in Grafton contains high concentrations of industrial contaminants including petroleum products, trichloroethylene (TCE) and other pollutants that leach into the Blackstone Canal and the river, impacting downstream ecosystems and threatening a municipal water supply. In 2004, remedial activities at the site significantly reduced the chlorinated solvent contamination in the source area (Vigeant 2009a). Cleanup efforts were recently aided by \$1.2 million in EPA grant monies when Fisherville Mill was selected to be part of a pilot brownfields remediation program (Boynton 2009; Monahan 2009). The bulk of the funds (\$1 million) will be used to remove the oil at the site that leaches into the Blackstone Canal, including source removal and dredging of oil-containing sediments in the canal. Remaining funds will be used to complete the comprehensive site assessment; a pilot study using one or more remedial technologies to remove remaining residual chlorinated solvents and oil may also be included. Proposed stormwater treatment technologies include: vegetated swales and stormceptors; an oil-water separator in the canal (for floating oil); and two technologies based on biological processes (Vigeant 2009b). Future plans for the 35-acre site include redevelopment for residential, office and retail space, with open space and trail components highlighting the river and canal.

MassDEP staff conducted water quality and bacteria monitoring at three locations in this segment to track the UBWPAD sewage spill (described in MA51-03) on October 3rd and 6th (Beaudoin 2003, Tamul 2005). Water quality measurements were similar at all 3 locations on both dates (Route 122A (below Fisherville Pond), and Depot Road, Grafton and the Church Street Extension, Northbridge). The maximum temperature was 14.5°C, the DO ranged from 7.7 to 10.5 mg/L, and the pH from 7.0 to 7.2 SU.

DWM conducted water quality monitoring at the Sutton Street Bridge in Northbridge (BLK07-A) on four occasions between June and October in 2003. The maximum temperature was 22.4°C. Early morning DO measurements (between 04:11 and 11:01, n=4) ranged from 5.9 to 9.1 mg/L. Conductivity values were high, ranging from 447 to 656 µS/cm, and pH values varied little (6.9 to 7.2 SU). Ammonia concentrations ranged from 0.08 to 0.20 mg/L, and none exceeded the criteria. Total phosphorus concentrations were all elevated (>0.50 mg/L), ranging from 0.16 to 0.69 mg/L (n=4) (Appendix B Tamul 2005).

CERO SMART staff conducted bimonthly *in-situ* water quality monitoring in the Blackstone River (BS14A) on 27 occasions from March 2000 through October 2004 (Appendix F, Beaudoin 2004b). The maximum recorded temperature in this five year period was 24.8°C. When compared to reference conditions at the West River station, conductivity values were consistently elevated; with values ranging from 329 to 1,055 uS/cm. Mid-morning DO values ranged from 7.5 to 13.6 mg/L. Ammonia concentrations ranged from <0.02 to 4.6 mg/L, and none exceeded the criteria. Total phosphorus concentrations were consistently high (> 0.050 mg/L), ranging from 0.13 to 1.8 mg/L.

The *Aquatic Life Use* is assessed as impaired for this segment due to habitat quality degradation (flow fluctuations), poor water quality conditions (turbidity, evidence of enrichment, elevated total phosphorus), and the absence of fluvial fishes other than white sucker. Sources of impairment include upstream sources, municipal point source discharges, habitat modification associated with flow fluctuations resulting from both hydropower operations and rapid flow fluctuations resulting from impervious surface runoff. Infrequent episodes of whole effluent toxicity in both the Grafton and Northbridge discharges is of concern.

Fish Consumption Use

Fish were collected by DWM biologists from the Riverdale Pond impoundment in 1986, 1987, 1988, 1989, 1990 and 1993 and were analyzed for metals and PCBs (Maietta 2007). Organochlorine pesticides were also analyzed in 1993. In 1993 and 2006, fish from Rice City Pond were sampled and analyzed for metals, PCBs and organochlorine pesticides.

DPH issued a fish consumption advisory due to PCB contamination for Riverdale Pond, Northbridge as follows:

“Children under 12, pregnant women and nursing mothers should refrain from consuming any fish from this Pond in order to prevent exposure of developing fetuses, nursing infants and young children to PCBs. The general public should limit consumption of all fish species from Riverdale Pond to two meals per month.”

DPH issued a fish consumption advisory due to PCB contamination for Rice City Pond, Northbridge/Uxbridge as follows:

“Children under 12, pregnant women and nursing mothers should refrain from consuming any fish from this Pond in order to prevent exposure of developing fetuses, nursing infants and young children to PCBs. The general public should refrain from consumption of carp from Rice City Pond.”

MA DPH is currently re-evaluating these data for a potential modification to the existing advisory. Based on the elevated levels of PCB in edible fish fillets from the Riverdale and Rice City Ponds, the *Fish Consumption Use* is assessed as impaired for the 0.9 mile combined reaches of the Blackstone River through these impoundments. The remaining 7.9 miles reaches of this segment are not assessed for this use but are identified with an Alert Status since there are no barriers to migration.

Primary and Secondary Contact Recreational and Aesthetics Uses

The Blackstone River is used by canoeists and kayakers for recreation. In 2000 and 2005, the John H. Chaffee Blackstone River Valley National Heritage Corridor organized canoe trips on the Blackstone River; the first spanned 4 days, and went from the Middle River, Worcester to Providence, RI. The Rhode Island Canoe and Kayak Association (RICKA) Blackstone Valley Paddle Club organizes canoe/kayak events throughout the Blackstone Valley each summer (RICKA 2009). The canoe guide for some sections within this segment of the Blackstone River can be found at <http://www.ricka-flatwater.org/bv%20facts.htm>

In addition, the Massachusetts Department of Fish and Game Office of Fishing and Boating Access publishes public access to water bodies in this state; these can be found at http://www.mass.gov/dfwele/pab/pab_facilities.htm. In this segment of the Blackstone River, an access point for canoes and kayaks is located on the Blackstone River at the Church Street Extension Bridge at the Blackstone River and Canal State Park in Northbridge.

MassDEP staff conducted water quality and bacteria monitoring to track the 2 October 2003 UBWPAD sewage spill (described in MA51-03) on October 3rd and 6th (Beaudoin 2003). Data collected on October 2nd before the spill occurred had an *E. coli* level of 590 cfu/100 ml. On October 3rd, *E. coli* ranged from 390,000 cfu/100 ml at Rte. 122A, Grafton (the highest bacteria level associated with the spill) to 6,800 cfu/100 ml at Sutton Street, Northbridge. By October 6th, bacteria levels in the upper segment had fallen to 170 cfu/100 ml at Rte. 122A, 420 cfu/100 ml at Depot Road (Grafton), and 21,000 at Sutton Street.

When bar racks at the Upper Blackstone Water Pollution Abatement District became clogged after record rainfalls in October 2004, more than 90 million gallons of raw sewage were released to the river (Larrabee 2005; NWS 2009). MassDEP conducted bacteria sampling on October 18th at Rte. 122A in Grafton as part of the spill tracking effort; the bacteria level was 410.6 cfu/100 ml, while background levels (above the discharge) were >2419.6 cfu/100 ml.

In 2003, DWM collected six *E. coli* samples from the Blackstone River near Sutton Street, Northridge (BLK07-A) during the primary contact season (Appendix B). The geometric mean of the six samples was 275 cfu/100ml, with counts ranging from 74 to 1200 cfu/100mL. Observations of aesthetic conditions showed infrequent issues with odors (septic, chlorine), slight to high turbidity, and moderate periphyton density. In addition, when monitoring began on 23 April 2003, a channel was observed discharging highly turbid water from under the mill building on the northeast bank to the river a few meters upstream of Station BLK07-A; a bacteria sample was collected on this date (270 cfu/100 ml).

The SMART program conducted 27 bimonthly sampling events on the Blackstone River downstream of the Sutton Street Bridge, Northbridge, MA from March 2000 through October 2004 (Appendix F, Beaudoin 2004b). Observations made during this time period indicate a station characterized by septic/effluent odors (20 out of 27 dates), high turbidity (18 dates), dense periphytic growth (12 dates, although turbidity limited observations on 9 occasions), occasional oily sheens (5 dates), and trash (again, observations were only possible when turbidity was low enough to allow viewing of the bottom).

The Blackstone River Watershed Association in conjunction with the Blackstone River Coalition recorded aesthetic observations at three sites in this segment in 2004, 2005 and 2006, monthly from April through November, as part of their ongoing volunteer water quality monitoring program (Gilpatrick 2007). At the outlet of Fisherville Pond across from the Fisherville Mill in Grafton, frequent observations of brown/green or milky colors were noted, as well as erosion, light to abundant trash, and odors (musty, sulfur and sewage). At Sutton St. in

Northbridge, the water column was typically clear, with a sewage odor noted on most events (including infrequent sewage, fishy, pungent and chlorine odors), as well as light trash. And at Plummer's Landing on the Church Street Extension in Northbridge, the water column was again typically clear with a sewage odor (infrequent chlorine, sewage, pungent and organics odors noted), as well as light to heavy trash.

The *Primary and Secondary Contact Recreational and Aesthetic Uses* are assessed as impaired due to aesthetically objectionable conditions throughout the segment (odors, elevated turbidity, dense periphyton cover). The *Primary Contact Recreational Use* is also assessed as impaired because of elevated *E. coli* bacteria

Blackstone River (MA51-04) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Other flow regime alterations, nutrient /eutrophication biological indicators, elevated total phosphorus, fishes bioassessment (absence of fluvial fishes other than white sucker) Source: Upstream sources, municipal point source discharges, discharges from municipal separate storm sewer systems (MS4), impacts from hydrostructure flow regulation/modification, habitat modification - other than hydromodification
Fish Consumption		IMPAIRED (0.9 mile combined reaches, Riverdale and Rice City Ponds) Cause: PCB in fish tissue Source: Unknown Suspected source: Contaminated sediments NOT ASSESSED* remaining 7.9 miles
Primary Contact		IMPAIRED Cause: <i>E. coli</i> , Taste and Odor, Turbidity, Excess Algal Growth Source: Upstream sources (complex of wet weather discharges including point source and combination of stormwater, SSO or CSO and the municipal discharge), discharges from municipal separate storm sewer systems (MS4), municipal point source discharges
Secondary Contact		IMPAIRED Cause: Taste and Odor, Turbidity, Excess Algal Growth Source: Upstream sources (complex of wet weather discharges including point source and combination of stormwater, SSO or CSO and the municipal discharge), discharges from municipal separate storm sewer systems (MS4), municipal point source discharges
Aesthetics		IMPAIRED Cause: Taste and Odor, Turbidity, Excess Algal Growth Source: Upstream sources (complex of wet weather discharges including point source and combination of stormwater, SSO or CSO and the municipal discharge), discharges from municipal separate storm sewer systems (MS4), municipal point source discharges

* Alert Status issues identified, see details in use assessment

RECOMMENDATIONS

Staff at the Grafton Wastewater Treatment Plant (WWTP) (MA0101311) should collect water from the Blackstone River upstream from their discharge and use it as the site control in their WET tests. The results of the whole effluent toxicity tests should continue to be closely monitored to evaluate the frequency of acute toxicity in the discharge and to determine the need for any additional monitoring. If acute whole effluent toxicity is present in the second or third renewal composite sample, these samples should be analyzed for chemical constituents required for the first renewal sample and these data should be reported to MassDEP as part of the toxicity test report.

The Town of Northbridge sometimes uses small amounts of sodium hypochlorite for odor control in the sludge gravity thickeners at their wastewater treatment plant. The facility should minimize their use of chlorine and monitor concentrations in the effluent when it is being used since detectable levels of chlorine, although infrequent, have been reported in the facility's whole effluent toxicity testing reports. Continue to closely monitor chronic whole effluent toxicity to *P. promelas* and if either the frequency and/or magnitude of permit limit violations increases, evaluate the need to implement a toxicity identification/toxicity reduction evaluation or require additional testing to better evaluate the cause(s) of the problem.

Riverdale Mills Corporation (MAG250279): The new general permit for non-contact cooling water discharges is being finalized. When this new permit becomes available, Riverdale Mills Corporation should submit their application for coverage.

BLACKSTONE RIVER (MA51-05)

Location: Outlet Rice City Pond, Uxbridge to the old Water Quality Monitor (at the Conrail Railroad trestle due north of Collins Drive), Millville.
Size: 9.1 Miles
Classification: BWWF
2008 303(d) List: Category 5

This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Unknown toxicity, Priority organics, Metals, Nutrients, pH, (Flow alteration*), Pathogens, Taste, odor and color, Suspended solids, Turbidity). * denotes a non-pollutant (MassDEP 2008a).

NPDES (APPENDIX H and Table H2):

Town of Uxbridge (MAR041166)
Town of Uxbridge (MA0102440)
Town of Millville (MAR041138)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

In 2003, DWM conducted benthic macroinvertebrate monitoring immediately upstream from Central Street in Millville (BLK12A), where a small island splits the river into two channels of high-velocity water. Habitat quality was limited primarily by marginal channel flow status (water filled less than 75% of channel) which restricted instream cover, as well as embeddedness. Luxuriant algal growth covered most (70%) of the stream bottom throughout the reach.

MassDEP CERO staff conducted bimonthly SMART Monitoring from the center of the railroad trestle just off Route 122 approximately one mile south of the town center (BS18A) from March 2000 through October 2004 (Appendix F, Beaudoin 2004b). The river in this stretch is often impounded by downstream hydropower operations. Banks are undercut in this area, except where anchored with rock or bridge abutments. Sampling was not conducted in January 2003 when the river surface was frozen.

Biology

In 2003, MassDEP DWM conducted biological benthic macroinvertebrates monitoring upstream of Central Street in Millville (BLK12A). The RBP III score in comparison to the "reference" site indicated that the benthic macroinvertebrate community was "moderately impacted".

MADFG conducted fish population sampling at two locations (Site IDs 302, 2382 and 298) along this segment of the Blackstone River. Sites 302 and 2382 were both located near River Bend Farm in Uxbridge and were sampled in August 2001 and August 2007, respectively. During the 2001 survey a total of 262 fish were collected, representing eight species, including 209 common shiner (*Luxilus cornutus*), 26 white sucker (*Catostomus commersonii*), 16 pumpkinseed (*Lepomis gibbosus*), six fallfish (*Semotilus corporalis*), two bluegill (*Lepomis macrochirus*), and yellow perch (*Perca flavescens*), largemouth bass (*Micropterus salmoides*), and yellow bullhead (*Ameiurus natalis*). In 2007 (Site 2382) common shiner (*L. cornutus*) again dominated the sample with white sucker (*C. commersonii*), fallfish (*S. corporalis*), and tessellated darter (*Etheostoma olmstedii*) rounding out the fluvial species. Largemouth bass (*M. salmoides*), pumpkinseed (*L. gibbosus*), and bluegill (*L. macrochirus*) represented the macrohabitat generalist species. The river was sampled off Ironstone Road in Uxbridge (Site 298) in August 2001. A total of 78 fish were collected, representing eight species, which included 35 tessellated darter (*E. olmstedii*), 27 white sucker (*C. commersonii*), five common shiner (*L. cornutus*) and largemouth bass (*M. salmoides*), three yellow bullhead (*A. natalis*), and one yellow perch (*P. flavescens*), pumpkinseed (*L. gibbosus*), and blacknose dace *Rhinichthys atratulus*). The presence and dominance by fluvial specialists/dependant species seems to indicate a stable flow regime and adequate water quality. As noted upstream segment of the Blackstone River, the number of individuals was lower at the River Bend Farm station in 2007 as compared to 2001. Part of this difference can be attributed to changes in sampling procedure employed by the MA DFG which resulted in a shorter reach being sampled in 2007.

Toxicity

Ambient

Water from the Blackstone River was collected in May 2007 and used as a control in one acute whole effluent toxicity test for the Uxbridge WWTP. Survival of *C. dubia* (48-hour exposure) was 100%.

Effluent

Acute whole effluent toxicity tests have been conducted on the Town of Uxbridge treated effluent using *C. dubia*. Between April 2000 and December 2007, no acute whole effluent toxicity was detected in the 16 test events --the LC₅₀'s were all \geq 100% effluent.

Water Chemistry

A dry weather study of water quality in the Blackstone Watershed was conducted from 2000-2003 (Wright et al 2004). Samples were collected at 24 sites on the Blackstone, Mumford, Quinsigamond, and West rivers on four dates under dry weather conditions. Insufficient data are currently available to complete the DWM external data validation process required for assessment decision.

MassDEP staff conducted water quality and bacteria monitoring at three locations in this segment to track the UBWPAD sewage spill (described in MA51-03) on October 3rd and 6th (Beaudoin 2003, Tamul 2005). Water quality measurements were similar at two locations on both dates (below East Hartford Ave and Mendon Street in Uxbridge). The maximum temperature was 15.0°C, the DO was greater than 9.5 mg/L, and the pH varied little (7.0 to 7.2 SU).

DWM staff conducted monthly *in situ* and water quality monitoring in the Blackstone River upstream of Central Street in Millville (BLK12B) on five occasions between May and October 2003. Early morning DO measurements (between 03:11 and 09:44 am, n=5) ranged from 6.8 to 8.9 mg/L. The maximum water temperature was 23.3°C. Ammonia concentrations were low (maximum of 0.29 mg/L), and none exceeded the criteria. The total phosphorus concentrations were all elevated (i.e., >0.05 mg/L) ranging from 0.11 to 0.37 mg/L (Appendix B Tamul 2005).

CERO SMART conducted bimonthly *in-situ* water quality monitoring in the Blackstone River from the center of the railroad trestle just off Rte. 122 approximately 1 mile south of the town center (BS18A) on 27 occasions from March 2000 through November 2004 (Appendix F, Beaudoin 2004b). The maximum recorded temperature in this five year period was 24.0°C. When compared to reference conditions at the West River station, conductivity values were consistently elevated ranging from 286 to 1,062 μ S/cm. Mid-morning DO values ranged from 6.4 to 12.7 mg/L, while pH ranged from 6.4 to 7.2 SU. Ammonia levels ranged from <0.1mg/L to 1.8 mg/L, and none exceeded the criteria. Total phosphorus concentrations were consistently high (> 0.05 mg/L), and ranged from 0.095 to 0.89 mg/L.

USGS also conducted water quality monitoring in the Blackstone River at the railroad trestle approximately 1 mile south of Millville Center from 2000-2002 (n=17 for temperature, pH, conductivity, DO and n=11 for ammonia and total phosphorus concentrations). The maximum temperature recorded was 25°C. Conductivity values ranged from 205 to 502 μ S/cm. DO ranged from 6.3 to 12 mg/L, while pH ranged from 5.9 to 7.2 SU. Ammonia levels ranged from <0.04 to 0.87 mg/L and none exceeded the criteria. Total phosphorus concentrations were consistently high (>0.05 mg/L), and ranged from 0.1 to 1.1 mg/L.

The *Aquatic Life Use* is assessed as impaired for this segment of the Blackstone River due to the moderately impacted benthic community, and poor water quality conditions (turbidity, evidence of enrichment, elevated total phosphorus). The presence and dominance by fluvial specialists/dependant species seems to indicate a stable flow regime and adequate water quality. Sources of impairment include upstream sources, municipal point source discharges and discharges from municipal separate storm sewer systems (MS4). Flow fluctuations resulting from hydropower operations, impervious surface runoff, and municipal discharges are noted as a concern.

Fish Consumption

Although there are no fish consumption advisories currently in place for this segment of the Blackstone River, the MA DPH should re-evaluate their fish consumption advisory due to elevated PCBs for the Blackstone River due to the fact that there are advisories on many impoundments and there are essentially no barriers to migration on the upstream side of these impoundments.

The *Fish Consumption Use* is not assessed since currently there are no site-specific advisories in place for this segment of the Blackstone River. This use is identified with an Alert Status, however, since MA DPH has issued advisories for impoundments of the Blackstone River due to elevated levels of PCBs in edible fillets of fish both upstream and downstream from this segment of the River.

Primary and Secondary Contact Recreational and Aesthetics Uses

The Blackstone River is used by canoeists and kayakers for recreation. In 2000 and 2005, the John H. Chaffee Blackstone River Valley National Heritage Corridor organized canoe trips on the Blackstone River; the first spanned 4 days, and went from the Middle River, Worcester to Providence, RI. The Rhode Island Canoe and Kayak Association (RICKA) Blackstone Valley Paddle Club organizes canoe/kayak events throughout the Blackstone Valley each summer (RICKA 2009). The canoe guide for some sections within this segment of the Blackstone River can be found at <http://www.ricka-flatwater.org/bv%20facts.htm>.

MassDEP staff conducted water quality and bacteria monitoring in the river to track the UBWPAD sewage spill (described in MA51-03) on October 3rd and 6th (Beaudoin 2003). The bacteria count in the river before the spill occurred on October 2nd was 370 cfu/100 ml (near Central Street, Millville). On October 3rd, *E. coli* at East Hartford Ave, Uxbridge was 270 cfu/100 ml. By October 6th, *E. coli* values in this segment had increased to 4,600 cfu/100 ml, indicating the influence of the spill.

In 2003, MassDEP DWM collected five *E. coli* samples from the Blackstone River near Central Street in Millville (BLK12B) during the primary contact season (Appendix B). The geometric mean of the five samples was 143 cfu/100ml, and bacteria values ranged from 39 to 450 cfu/100 ml (n=5). Aesthetic conditions were noted on these surveys, and issues noted include frequent odors (musty, chlorine, effluent), slight turbidity, and moderate periphyton growth (when visibility permitted observations); bottom substrates were unobservable due to water depths.

CERO staff conducted SMART monitoring in the river at the P&W Railroad trestle south of Millville Center from March 2000 through November 2004 (Appendix F, Beaudoin 2004b). Of the 26 events at which this station was sampled, odors were largely absent (musty odors noted on 4 occasions). Turbidity was often slight/moderate to high (17 dates). The site is characterized by an absence of aquatic macrophytes, foam, and objectionable deposits. Although periphyton were often unobservable due to the elevated turbidity (24 events), twice it was described as moderate/dense.

Blackstone River Watershed Association (BRWA) members conducted stream walks throughout the Blackstone Valley in 2004 (Harvey and Singler 2004). Observations of the Blackstone River between Rt. 16 and Rte. 122 in Uxbridge included: trash in some sections; limited canoe access; sand pile near river at Rt. 16; and lawns abutting the river.

The Blackstone River Watershed Association in conjunction with the Blackstone River Coalition recorded aesthetic observations at one site in this segment in 2004, 2005 and 2006, monthly from April through November, as part of their ongoing volunteer water quality monitoring program (Gilpatrick 2007). At the Blackstone River north of the Stanley Woolen Mill in Uxbridge, the water column was typically clear with infrequent observations of a musty odor and light trash.

The *Primary and Secondary Contact Recreational and Aesthetic Uses* are assessed as impaired due to aesthetically objectionable conditions throughout the segment (odors, elevated turbidity, dense periphyton cover). The *Primary Contact Recreational Use* is also assessed as impaired because of elevated *E. coli* bacteria.

Blackstone River (MA51-05) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Aquatic macroinvertebrate bioassessments, nutrient/eutrophication biological indicators, elevated total phosphorus Source: Upstream sources, municipal point source discharges, discharges from municipal separate storm sewer systems (MS4)
Fish Consumption		NOT ASSESSED*
Primary Contact		IMPAIRED Cause: <i>Escherichia coli</i> , Taste and Odor, Turbidity, Excess Algal Growth Source: Upstream sources (complex of wet weather discharges including point source and combination of stormwater, SSO or CSO and the municipal discharge), discharges from municipal separate storm sewer systems (MS4), municipal point source discharges
Secondary Contact		IMPAIRED Cause: Taste and Odor, Turbidity, Excess Algal Growth Source: Upstream sources (complex of wet weather discharges including point source and combination of stormwater, SSO or CSO and the municipal discharge), discharges from municipal separate storm sewer systems (MS4), municipal point source discharges
Aesthetics		IMPAIRED Cause: Taste and Odor, Turbidity, Excess Algal Growth Source: Upstream sources (complex of wet weather discharges including point source and combination of stormwater, SSO or CSO and the municipal discharge), discharges from municipal separate storm sewer systems (MS4), municipal point source discharges

* Alert Status issues identified, see details in use assessment

RECOMMENDATIONS

River water should be collected upstream from the Uxbridge wastewater treatment plant discharge and used as dilution water in the facility's whole effluent toxicity tests.

The MA DPH should re-evaluate their fish consumption advisory due to elevated PCBs for the Blackstone River since there are currently advisories on impoundments both up and downstream from this segment of the Blackstone River and there are essentially no barriers to migration on the upstream side of these impoundments.

MUMFORD RIVER (MA51-13)

Location: Headwaters, outlet Tuckers Pond, Sutton to Douglas WWTP discharge, Douglas.
Size: 4.3 Miles
Classification: B\WWF
2008 303(d) List: Category 2

This segment is on the 2008 Integrated List of Waters in Category 2 - Attaining Some Uses (Aquatic Life, Aesthetics); Others Not Assessed (MassDEP 2008a).

NPDES (APPENDIX H, Table H2):

Douglas (MAR041106)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

The Manchaug Reservoir Corporation (owner of the Manchaug Pond and Whitin Reservoir dams) operated the dam to provide dilution flows at the downstream Guilford of Maine manufacturing facility. Although the Guilford of Maine facility for which a minimum flow was required has closed, there are ongoing issues with dam operations which are of concern. In the fall of 2008 (as well as many years prior), the flashboards were removed from the Manchaug Pond spillway (MassDEP 2009). Furthermore, the flashboards were not replaced in the spring. On April 21, 2009 MassDEP ordered the dam owner to install the flashboards according to historic practices.

In September 2003, MassDEP DWM biologists conducted an RBP III benthic macroinvertebrate survey in the Mumford River downstream from Manchaug Street in Douglas, MA (BLK09-8A). Habitat quality was considered excellent and was limited most by the reduced riparian zone along the south bank adjacent to the cemetery. The composite habitat score was 164/200 (Appendix C).

An investigative study of low flow issues in the Mumford River was conducted in 2003 (Gomez and Sullivan). In the watershed upstream from this segment, flow was largely controlled by operations at the Manchaug and Whitins Reservoirs (Douglas and Sutton). In terms of water usage in this segment, the Douglas Water Department utilized an estimated 15% of the total registered water withdrawn from the Mumford River watershed (Gomez and Sullivan 2003). Of this, the water withdrawn was returned to the watershed less evaporation and evapotranspiration.

Biology

The Mumford River in Douglas was stocked with trout in 2009 (MA DFG 2009).

Between August 2001 and August 2007 MA DFG biologists conducted backpack electrofishing at four sites in this segment of the Mumford River (MADFG 2008). A total of 70 fish were collected in the river near Manchaug Street in Sutton (Sample ID 468), representing seven species, including 46 fallfish (*Semotilus corporalis*), 11 tessellated darter (*Etheostoma olmstedi*), eight yellow perch (*Perca flavescens*), two chain pickerel (*Esox niger*), and one largemouth bass (*M. salmoides*), white sucker (*Catostomus commersonii*) and yellow bullhead (*Ameiurus natalis*). Eleven species, (n=132 fish) were collected in the river at the Potter Road crossing in Douglas (Sample ID 2316). Common shiners (*Luxilus cornutus*) (a fluvial dependant species) were also present in that sample. Further downstream near Manchaug Street in Douglas (Sample ID 409), a total of 79 fish were collected (n= six species). The sample was dominated by common shiner (*L. cornutus*) and tessellated darter (*E. olmstedi*). At the furthest downstream reach sampled, east of Gilboa Street in Douglas (Sample ID 411), common shiner (*L. cornutus*) dominated the sample. The fish assemblage in this segment of the Mumford River was dominated by fluvial specialist/dependant species such as common shiner (*L. cornutus*), fallfish (*Semotilus corporalis*), tessellated darter (*E. olmstedi*), and white sucker (*C. commersonii*). The presence of these fishes is indicative of a stable flow regime and good water quality.

In September 2003, MassDEP DWM biologists conducted benthic macroinvertebrate sampling in the Mumford River downstream from Manchaug Street in Douglas, MA (BLK09-8A). The assemblage was indicative of a healthy benthic community and was used as the regional reference condition (Appendix C, Fiorentino 2006).

Toxicity

Ambient

Water from the Mumford River was collected just downstream from the North Street Bridge in East Douglas for use as dilution water in the Interface Fabrics Group facility's whole effluent toxicity tests. Between March 2000 and August 2006, survival of *C. dubia* exposed (approximately 7 days) to the Mumford River water ranged from 40 to 100% (n=42) but was $\geq 80\%$ in all but the August 2005 test event (survival =40%). Manufacturing operations at the facility were ceased in the summer of 2006.

Water from the Mumford River was collected just downstream from the North Street Bridge in East Douglas for use as dilution water in the Douglas WWTF whole effluent toxicity tests. Between September 2000 and April 2006, survival of *C. dubia* exposed (48 hours) to the Mumford River water ranged from 85 to 100% (n=21). Between July 2006 and February 2008 survival of *C. dubia* exposed (approximately 7 days) to the Mumford River water was 100% in six of the tests conducted but was 0% in two tests (October 2007 at the 7-day exposure and January 2008 at the 24-hour exposure) and only 60% survival in the July 2007 test event (7-day exposure).

Water Chemistry

DWM staff conducted monthly in-situ and water quality monitoring in the Mumford River near Manchaug Street in Douglas (BLK09-8A) on five occasions between May and October 2003. Early morning DO measurements (between 01:41 and 11:32am, n=5) ranged from 7.5 to 9.4 mg/L and the other physico-chemical monitoring data were indicative of excellent conditions. The maximum water temperature was 22.5°C while the maximum TP concentration was 0.04 mg/L (Appendix B Tamul 2005).

The *Aquatic Life Use* is assessed as support based on the benthic macroinvertebrate, fish population, and water quality data. This use is identified with an Alert status, however, based on concerns with flow fluctuations associated with dam operations and the infrequent poor survival of *C. dubia* exposed to river water.

Primary and Secondary Contact Recreational and Aesthetics Uses

The Mumford River is used by canoeists and kayakers for recreation. The Rhode Island Canoe and Kayak Association (RICKA) Blackstone Valley Paddle Club organizes canoe/kayak events throughout the Blackstone Valley each summer (RICKA 2009), which has included jaunts on the Mumford. The description for canoeing the Mumford River begins at the Village of Manchaug, and can be found at <http://www.ricka-flatwater.org/bv%20facts.htm>

In 2003, MassDEP DWM collected six *E. coli* samples from the Mumford River near Manchaug Street in Douglas (BLK09-8A) during the primary contact season (Appendix B). The geometric mean of the six samples was 50 cfu/100 ml results ranged from <7 to 4000 cfu/100 mls). No aesthetically objectionable conditions (e.g., odors, oils, turbidity, growths, deposits) were observed by DWM staff (MassDEP 2003).

The Blackstone River Watershed Association in conjunction with the Blackstone River Coalition recorded aesthetic observations at one site in this segment in 2004, 2005 and 2006, monthly from April through November, as part of their ongoing volunteer water quality monitoring program (Gilpatrick 2007). At the Mumford River at Gilboa Street in Douglas, the water column was typically clear and without trash or odors, with infrequent notes of foam and a sewage or swampy odor.

In 2004, members of the Blackstone River Watershed Association (BRWA) conducted a stream survey in the Douglas area of the Mumford River (Harvey and Singler 2004). Trash was noted to be minimal in Douglas center. The stream channel was shaded; trout and dace were observed; and the water looked "clean".

Since the geometric mean for the *E. coli* bacteria results meet the criteria for both primary and secondary contact recreation (126 and 630 cfu/100 ml, respectively) and no aesthetically objectionable conditions were observed by DWM staff or BRC volunteers, the *Primary and Secondary Contact Recreational and Aesthetics* uses are assessed as support. An Alert status is identified for the *Primary and Secondary Contact Recreational* uses due to an elevated bacteria count during a wet weather event.

Mumford River (MA51-13) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT*
Secondary Contact		SUPPORT*
Aesthetics		SUPPORT

* Alert Status issues identified, see details in use assessment

RECOMMENDATIONS

Evidence of recent episodes of instream toxicity to *C. dubia* in the Mumford River just downstream from the North Street Bridge in East Douglas is of concern. Additional instream toxicity testing should be conducted if possible. Otherwise continue to monitor survival of test organisms exposed to river water samples as part of the Douglas WWTF whole effluent toxicity tests.

COOK ALLEN BROOK (MA51-28)

Location: Headwaters, outlet Reservoir No. 5, Sutton to inlet Whitins Pond, Northbridge. (excluding Reservoir No. 4, segment MA51128)
Size: 2.0 Miles
Classification: B
2008 303(d) List: Category

This is a new segment so there is no prior listing in the 2008 Integrated List of Waters.

MA DFG identifies this waterbody as a "Cold Water Fishery Resource" (MA DFG 2007).

WMA (APPENDIX H, Table H1):

Whitinsville Water Company (21221601 and 9P21221601) –Cook Allen tubular wellfield

NPDES (APPENDIX H, Table H2):

Northbridge (MAR041144)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

Cook Allen Brook is impounded by three dams; reservoir #4, 5, & 6. The Whitinsville Water Company (WWC) operates Reservoirs 6, 5 and 4 in Sutton to meet water supply needs, which peak in the summer (Gomez and Sullivan 2003). A low flow study of the Mumford River, prepared for EOE, indicated that in many instances the dam gates are closed, resulting in no flow other than leakage below the Reservoir 4 dam during these periods (Gomez and Sullivan 2003). Further downstream there is a small dam located adjacent to Mendon Road, Sutton (west of the junction with Carr Street), which impounds a small area; it functions in a run-of-river mode. Whitinsville's Cook Allen tubular wellfield which is adjacent to the brook downstream from Reservoir #4 has been determined to be under the direct influence of surface water and has an approved rate of 0.98 million gallons per day (Connors 2010).

In September 2003 MassDEP DWM biologists conducted backpack electrofishing in Cook Allen Brook downstream from Mendon Street in Sutton (CAB01, Appendix D). Habitat quality was noted to be limited most by very low flow conditions encountered and the lack of deep fast water habitats. It should be noted that Reservoir 5 is owned by the Town of Northbridge and operated by the Whitinsville Water Company (WWC). A town employee, who was interviewed on the day of the sampling, verbally confirmed that the Reservoir was on occasion managed in such a way that all flow was cut off from this segment. The watershed upstream of the sampling station is completely undeveloped and appears to be mostly, if not entirely, owned or managed by the WWC.

Biology

In September 2003 MassDEP DWM biologists conducted backpack electrofishing in Cook Allen Brook downstream from Mendon Street in Sutton (CAB01, Appendix D). Although no fish were collected or observed in this reach, fish sampling efficiency was rated excellent as frogs and invertebrates were observed being shocked and no fish were observed escaping.

The *Aquatic Life Use* is assessed as impaired for Cook Allen Brook based on the lack of fish in optimal habitat. The absence of fish from Cook Allen Brook likely reflects results of flow regulation by the WWC.

Primary and Secondary Contact Recreational and Aesthetics Uses

No objectionable conditions (e.g., color, turbidity, odors, deposits of trash/debris) were noted by DWM biologists during the backpack electrofishing survey in Cook Allen Brook near Mendon Street in Sutton (CAB01, Appendix D).

The Blackstone River Watershed Association in conjunction with the Blackstone River Coalition recorded aesthetic observations at one site on Cook Allen Brook in 2004, 2005 and 2006, monthly from April through November, as part of their ongoing volunteer water quality monitoring program (Gilpatrick 2007). At the Johnson Road bridge in Sutton, the water column was typically clear and trash- and odor-free; infrequent observations included musty odors, low density of filamentous algae, and light presence of aquatic vegetation.

The *Primary* and *Secondary Contact Recreational Uses* are not assessed due to the lack of bacteria data. The *Aesthetics Use* is assessed as support since no objectionable conditions were noted by DWM biologists and BRC sampling volunteers.

Cook Allen Brook (MA51-28) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Absence of fish (Fishes Bioassessment) Source: Flow Alterations from Water Diversions
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

RECOMMENDATIONS

Minimum releases from the reservoirs to mimic a natural flow regime are necessary to support any stream fish community that might be established in Cook Allen Brook. Re-establishment of lotic fishes to this section might require re-stocking due to this segment's isolation from other lotic environments.

MUMFORD RIVER (MA51-14)

Location: Douglas WWTP discharge, Douglas to confluence with Blackstone River, Uxbridge. (through former segments: Gilboa Pond MA51052, Lackey Pond MA51083, Meadow Pond MA51193, Linwood Pond MA51088, Whitin Pond MA51178, and Caprons Pond MA51014)
Size: 9.6 Miles
Classification: B\WWF
2008 303(d) List: Category 5

This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Metals, pH, Organic enrichment/Low DO, Pathogens) (MassDEP 2008a).

The following water bodies will no longer be reported as lake segments, they will be considered run of the river impoundments (McVoy 2006).

Gilboa Pond (MA51052), approximate size: 13 acres, approximate retention time: less than two days
Lackey Pond (MA51083), approximate size: 90 acres, approximate retention time: less than two days
Meadow Pond (MA51193), approximate size: 57 acres, approximate retention time: seven days
Linwood Pond (MA51088), approximate size: 36 acres, approximate retention time: less than two days
Whitin Pond (MA51178), approximate size: 22 acres, approximate retention time: less than one day
Caprons Pond (MA51014), approximate size: 10 acres, approximate retention time: less than one day,
The retention time estimates were based on the annual historical mean discharge from two stream gages in the Blackstone River Basin (01110000 and 01124500) and the normal storage volume of the dams reported by DCR in their Massachusetts Dam Safety Program Database (Socolow et al. 2004 and DCR 2002).

Gilboa Pond (MA51052) is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Noxious aquatic plants, (Exotic species*)). * denotes a non-pollutant.

Lackey Pond (MA51083) is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Flow alteration*). * denotes a non-pollutant.

Meadow Pond (MA51193) is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Noxious aquatic plants, (Exotic species*)). * denotes a non-pollutant.

Linwood Pond (MA51088) is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Exotic species*). * denotes a non-pollutant.

Whitin Pond (MA51178) is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Exotic species*). * denotes a non-pollutant.

Caprons Pond (MA51014) is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Exotic species*). * denotes a non-pollutant.

WMA with surface water source(s) (APPENDIX H, Table H1):

Interface Fabrics Group (9P321207702) (no withdrawal since 2006)
Whitinsville Golf Club (21221603)

NPDES (APPENDIX H and Table H2):

Town of Douglas Wastewater Treatment Facility WWTF (MA0101095)
Interface Fabrics Group (formerly the Guilford of Maine Fishing Services, Inc.) (MA0001538) – Manufacturing operations at the facility were ceased in the summer of 2006, EPA terminated permit in September 2006.
Sutton (MAR041241)
Northbridge (MAR041144)
Uxbridge (MAR041166)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

Instream habitat quality of the Mumford River in the reach downstream from North Street and the Douglas WWTP discharge in Douglas, MA (MF03B) in September 2003 was excellent (habitat assessment score 174/200) (Appendix C, Fiorentino 2006).

Withdrawals from this segment of the river by Interface Fabrics (historically 13%, no longer in operation), and the Whitinsville Golf Club (2%) were relatively small (Gomez and Sullivan 2003). Of these, the water withdrawn was returned to the watershed less evaporation and evapotranspiration.

Biology

In September 2003, MassDEP DWM biologists conducted benthic macroinvertebrate sampling in the Mumford River in the reach downstream from North Street in Douglas, MA and downstream from the Douglas WWTP discharge (MF03B). The RBP III analysis indicated that the benthic macroinvertebrate community was "slightly-impacted" compared to the reference station conditions ((Appendix C, Fiorentino 2006). It should be noted that the benthic community appeared to be considerably better than conditions noted in the 1993 survey.

In August 2001 MA DFG biologists conducted electrofishing (backpack and barge) at three sites in this segment of the Mumford River (MADFG 2008). The fish assemblage in this segment was a diverse mix of fluvial specialist/dependant and macrohabitat generalist species. The species composition of each sample was reflective of the habitat present at that particular sampling location. For example pool and low gradient habitats were dominated by macrohabitat generalists and lotic habitats were dominated by fluvial specialists/dependents. Examples of fluvial species present included white sucker (*Catostomus commersonii*), common shiner (*Luxilus cornutus*), blacknose dace (*Rhinichthys atratulus*), fallfish (*Semotilus corporalis*) and tessellated darter (*Etheostoma olmstedii*). The presence of these fishes is indicative of a stable flow regime and good water quality.

A non-native aquatic macrophyte species, *Myriophyllum heterophyllum*, was observed by DWM staff in Gilboa Pond during the 1994 Blackstone River Watershed synoptic lake surveys (MassDEP 1994).

A non-native species (*Cabomba caroliniana*) was observed in Meadow Pond during the 1998 synoptic surveys (MassDEP 1998).

A non-native aquatic macrophyte species, *Cabomba caroliniana*, was observed by DWM staff in Linwood Pond during the 1998 Blackstone River Watershed synoptic lake surveys (MassDEP 1998).

A non-native species (*Cabomba caroliniana*) was observed in Whitin Pond during the 1998 synoptic surveys (MassDEP 1998). A potential non-native macrophyte species (*Myriophyllum* sp., possibly *M. heterophyllum*) was observed during the 1994 Blackstone River Watershed synoptic lake surveys (MassDEP 1994).

A non-native aquatic macrophyte species, *Cabomba caroliniana*, was observed by DWM staff in Caprons Pond during the 1998 Blackstone River Watershed synoptic lake surveys (MassDEP 1998). A potential non-native macrophyte species (*Myriophyllum* sp., possibly *M. heterophyllum*) was also observed.

Toxicity

Effluent

Acute whole effluent toxicity tests were conducted on the Douglas Wastewater Treatment Facility treated effluent using *C. dubia* as a test species between September 2000 and April 2006. During that period, no acute whole effluent toxicity (n=21 valid tests) was detected in the effluent (i.e., the LC₅₀'s were all ≥100% effluent). Subsequently the facility has been required to conduct modified acute and chronic whole effluent toxicity tests. Between July 2006 and February 2008, nine tests were conducted. No acute whole effluent toxicity has been detected and the CNOEC test results have ranged from 12.5 to 100% effluent in the six valid tests conducted. In 2004-2005, the Douglas WWTP underwent \$7.7 million in improvements and upgrades to provide better plant safety, increase capacity and improve the quality of its discharge (Foskett 2004); the first two phases of the project were completed in 2005 (Foskett 2005a).

Modified acute and chronic whole effluent toxicity tests were conducted on the Interface Fabrics Group treated effluent using *C. dubia* as a test species between March 2000 and August 2006. A total of 42 test events were conducted. The LC₅₀'s were all ≥100% effluent with the exception of the March 2002 test event (LC₅₀ = 83% effluent) (n=42). The CNOEC results ranged from 5 to 100% effluent. It should be noted that only two of the 38

valid tests did not meet the CNOEC limit of >10.8% effluent. Both the December 2005, and the August 2006 CNOEC test results were 5% effluent. Manufacturing operations at the facility were ceased in the summer of 2006 and the permit was terminated by EPA in September 2006.

Water Chemistry

DWM staff conducted monthly in-situ and water quality monitoring at two sites in this segment of the Mumford River: south of Gilboa Street, approximately 500 feet downstream of Gilboa Pond, (just downstream of MA0001538 diffuser pipes), Douglas (MF03A) and at Mendon Street (Route 16), downstream of Caprons Pond, Uxbridge (MF07) on five occasions between May and October 2003. Early morning DO measurements in the river downstream from Gilboa Pond (between 01:52 and 12:03, n=5) ranged from 8.1 to 9.9 mg/L and the other physico-chemical monitoring data were indicative of good conditions. The maximum water temperature was 22.2°C. The total phosphorus concentrations ranged from 0.028 to 0.20 mg/L and three of the five measurements were >0.05 mg/L (Appendix B, Tamul 2005). Further downstream at Mendon Street, all of the physico-chemical monitoring data were indicative of excellent conditions (n=4) and total phosphorus concentrations were lower (ranging from 0.018 to 0.046 mg/L). The maximum temperature was 24.5°C (Appendix B, Tamul 2005).

A dry weather study of water quality in the Blackstone Watershed was conducted from 2000-2003 (Wright et al 2004). Samples were collected at 24 sites on the Blackstone, Mumford, Quinsigamond and West Rivers on four dates under dry weather conditions. Insufficient data are currently available to complete the DWM external data validation process required for assessment decision.

Although the benthic macroinvertebrate, fish population, and water quality data were indicative of good conditions, all of the impounded reaches are infested with non-native aquatic macrophytes (either *C. caroliniana* and/or *M. heterophyllum*). Because so much of this segment is impounded, the *Aquatic Life Use* is assessed as impaired for the entire length due to the presence of the non-natives. Of concern is the elevated phosphorus concentrations in the river downstream from Gilboa Pond.

Primary and Secondary Contact Recreational and Aesthetics Uses

The Mumford River is used by canoeists and kayakers for recreation. The Rhode Island Canoe and Kayak Association (RICKA) Blackstone Valley Paddle Club organizes canoe/kayak events throughout the Blackstone Valley each summer (RICKA 2009), which has included trips on the Mumford. The description for canoeing the Mumford River can be found at <http://www.ricka-flatwater.org/bv%20facts.htm>.

In 2003, MassDEP DWM collected five *E. coli* samples from two sites along this segment of the Mumford River: south of Gilboa Street, approximately 500 feet downstream of Gilboa Pond, (just downstream of MA0001538 diffuser pipes), Douglas (MF03A) and at Mendon Street (Route 16), downstream of Caprons Pond, Uxbridge (MF07) during the primary contact season (Appendix B). The geometric mean of the five samples was 115 and 93 cfu/100 ml, respectively (counts ranged from 19 to 1000 cfu/100 mls). No aesthetically objectionable conditions (e.g., odors, oils, turbidity, growths, deposits) were observed by either DWM biologists or survey staff (MassDEP 2003).

The Blackstone River Watershed Association in conjunction with the Blackstone River Coalition recorded aesthetic observations at two sites in this segment in 2004, 2005 and 2006, monthly from April through November, as part of their ongoing volunteer water quality monitoring program (Gilpatrick 2007). At the Mumford River site upstream of the Route 122 Bridge in Uxbridge, the water column was reported as greenish, milky or murky on most sampling events, with light trash consistently present. At Depot Street downstream of the Route 16 Bridge in Uxbridge, the water column was typically free from odor and nuisance vegetation, and clear on approximately half of the sampling events, with a greenish, foamy, orange, milky or dark brown appearance on the remaining events; light trash was commonly observed.

On multiple occasions in 2006, canoers with the Blackstone Valley Paddlers noted a fuel odor associated with a discharge from a pipe entering the west side of the Mumford River at the Capron Park dam above the Rte. 16 Bridge (Konvalinka 2006).

In May 2006, Blackstone River Watershed Association volunteers, under guidance from Mass Riverways, conducted a Stream Team survey in three reaches of this segment (BRWA 2006). Although the river was generally of high aesthetic quality with numerous observations of wildlife, issues noted included light debris/floatables/trash, illegal dumping, low water levels, algal blooms, isolated erosion, and activities within the buffer zone (gravel pit).

Since the geometric mean for the *E. coli* bacteria results meet the criteria for both primary and secondary contact recreation (126 and 630 cfu/100 ml, respectively) and few aesthetically objectionable conditions were observed by DWM staff and BRC volunteers, the *Primary* and *Secondary Contact Recreational* and *Aesthetics* uses are assessed as support. An Alert status is identified for the *Primary Contact Recreational* use due to an elevated bacteria count during a wet weather event.

Mumford River (MA51-14) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT*
Secondary Contact		SUPPORT
Aesthetics		SUPPORT

RECOMMENDATIONS

The Town of Douglas (MA0101095) should continue to collect dilution water from the Mumford River downstream from the North Street Bridge in East Douglas for use as dilution water in their whole effluent toxicity tests. If the river is found to be unreliable in terms of meeting test acceptability criteria, then the facility could request that it be used as a site control only.

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Proactively prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

MISCOE BROOK (MA51-21)

Location: Headwaters, south of Route 90, Grafton to inlet Silver Lake, Grafton (through Cider Millpond formerly segment MA51019).
Size: 1.9 Miles
Classification: B
2008 303(d) List: Category

This is a new segment so there is no prior listing in the 2008 Integrated List of Waters.

MA DFG identifies this waterbody as a "Cold Water Fishery Resource" (MA DFG 2007).

This segment is located within the Miscoe, Warren and Whitehall ACEC.

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

In September 2003 MassDEP DWM biologists conducted backpack electrofishing in Miscoe Brook downstream from Merriam Road in Grafton (MB01, Appendix D). Habitat quality was limited most by the lack of deep water habitats (limited velocity/depth combinations) and the limited riparian vegetative zone width along one bank (lawns down to waters edge) (MassDEP 2003). There were small pond/impoundments both up and downstream of the reach sampled.

Biology

The fish sample collected by DWM biologists in Miscoe Brook near Merriam Road in Grafton in September 2003 (MB01) contained in order of abundance included redbfin pickerel (*Esox americanus*), brook trout (*Salvelinus fontinalis*), pumpkinseed (*Lepomis gibbosus*), and chain pickerel (*Esox niger*) (Appendix D). All of the brook trout appeared to be native fish as evidenced by their small size and excellent fin quality. The other species are all considered tolerant macrohabitat generalists and are most likely present as a result of the low gradient nature of this reach and its proximity to the small ponds.

The *Aquatic Life Use* is assessed as support based on the presence of brook trout (*S. fontinalis*), a fluvial dependant species indicative of a stable flow regime and excellent water quality. Threats to this cold water fishery include residential development and associated activities (i.e., fertilizer and/or pesticide use, pond construction) so this use is identified with an Alert Status.

Primary and Secondary Contact Recreational and Aesthetics Uses

No objectionable conditions (e.g., color, turbidity, odors, deposits of debris/floatables/trash) were noted by DWM biologists during the backpack electrofishing survey in Miscoe Brook (MassDEP 2003).

The *Primary and Secondary Contact Recreational Uses* are not assessed due to the lack of bacteria data. The *Aesthetics Use* is assessed as support since no objectionable conditions were noted by DWM biologists.

Miscoe Brook (MA51-21) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT *
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

* Alert Status issues identified, see details in use assessment

RECOMMENDATIONS

Outreach to local landowners with regard to the need for protection of riparian zone should be conducted

Future monitoring should include expanded fish population surveys to better document the extent of the brook trout population, temperature monitoring (thermistors), and determine whether Miscoe Brook should be reclassified as B/CWF. Biomonitoring surveys should include a macroinvertebrate component as well.

WEST RIVER (MA51-11)

Location: Outlet Silver Lake, Grafton to Upton WWTP discharge, Upton (through Lake Wildwood formerly segment MA51181).
Size: 3.8 Miles
Classification: B\CWF
2008 303(d) List: Category 5

This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (pH, Organic enrichment/Low DO, Pathogens) (MassDEP 2008a).

Lake Wildwood (MA51181) will no longer be reported on as an approximately 42-acre lake segment since the estimated retention time of this waterbody is less than eight days; it will be considered a run of the river impoundment (McVoy 2006). The retention time estimate was based on the annual historical mean discharge from two stream gages in the Blackstone River Basin (01110000 and 01124500) and the normal storage volume of the dams reported by DCR in their Massachusetts Dam Safety Program Database (Socolow et al. 2004 and DCR 2002).

The upper length of this segment, which extends from Silver Lake, Grafton to the confluence with Warren Brook, is within the Miscoe-Warren-Whitehall ACEC.

Lake Wildwood (MA51181) is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Exotic species*). * denotes a non-pollutant.

NPDES (APPENDIX H, Table H2):
Upton (MAR041165)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

Low flows were observed within this segment by Blackstone River Watershed Association volunteer monitors at Glen Hills Ave in Upton on 9/10/2005, and Hartford Ave. in Upton on 7/10/2004, 8/14/2004 and 9/9/2006 (Gilpatrick 2007).

Biology

The non-native species, *Cabomba caroliniana* was observed by DWM staff in Lake Wildwood in 1998 (MassDEP 1998). Another non-native, *Myriophyllum heterophyllum*, has also been reported here (MassDEP 2008b).

The MA DFG routinely stocks the West River in Upton, Northbridge and Uxbridge with trout (MA DFG 2009).

In July 2001 MA DFG biologists conducted backpack electroshocking in the West River near Hartford Avenue in Upton (sample ID 537). The sample yielded 52 fish representing seven species including, in order of abundance, redbfin pickerel (*Esox americanus*), nine brown trout (*Salmo trutta*) (presumably stocked), tessellated darter (*Etheostoma olmstedii*), chain pickerel (*E. niger*), bluegill (*Lepomis macrochirus*), white sucker (*Catostomus commersonii*) and two wild brook trout (*Salvelinus fontinalis*) (MADFG 2008). The presence of trout and tessellated darter, two fluvial species, is indicative of a stable flow regime. MA DFG biologists noted that sampling efficiency was good. The low number of wild brook trout is of concern.

Water Chemistry

DWM staff conducted monthly in-situ and water quality monitoring in the West River at Hartford Avenue South, Upton (WR12A) on five occasions between May and October 2003. Early morning DO measurements (between 04:27 and 11:27am, n=5) ranged from 7.5 to 9.5 mg/L and the other physico-chemical monitoring data were indicative of good conditions. The maximum water temperature was 21.5°C, and 2 of the 5 measurements exceeded 20°C. The maximum TP concentration was 0.048 mg/L (Appendix B Tamul 2005).

The *Aquatic Life Use* is assessed as impaired for the 1.0 mile reach through Lake Wildwood due to the presence of non-native species (*C. caroliniana* and *M. heterophyllum*). The remaining 2.8 miles of this segment is assessed as support based on the fish population and water quality data. However, because of the low number

of trout in this cold water fishery, and the limited evidence of a reproducing brook trout population, an Alert status is identified for this segment.

Primary and Secondary Contact Recreational and Aesthetics Uses

In 2003, MassDEP DWM collected six *E. coli* samples from the West River near Hartford Ave South in Upton (WR12) during the primary contact season (Appendix B). The geometric mean of the six samples was 80 cfu/100 ml, with counts ranging from <7 to 430 cfu/100 ml. No aesthetically objectionable conditions (e.g., odors, floating scums, algal/plant growth, turbidity, objectionable deposits) were observed (MassDEP 2003).

In 2005, MassDEP DWM and CERO conducted a source tracking study to trace upstream sources of bacteria to the Harrington Pool beach, focusing on dry weather sources of bacteria upstream from the West Hill Dam flood control project. Duerring and Beaudoin (2007) reported the following:

“Source tracking activities in the West River above the Glen Avenue bridge (Station WR02) has isolated elevated bacteria source(s) to within an approximately 100 meter segment of the river. Landuse in the area immediately abutting the river is residential. Since no evidence of human sources of bacteria was detected during several sampling runs and stream walks it appears that the elevated bacteria counts may be at least partly caused by landuse practices observed on the abutting properties (horse manure storage just uphill from the river by one landowner with at least two horses and one landowner with a dog kennel directly abutting the river).”

The Blackstone River Watershed Association in conjunction with the Blackstone River Coalition recorded aesthetic observations at two sites in this segment in 2004, 2005 and 2006, monthly from April through November, as part of their ongoing volunteer water quality monitoring program (Gilpatrick 2007). At the West River site at Glen Hills Avenue in Upton, the stream was typically clear with light trash; infrequent odors (fishy, swampy), dark brown or milky colors, and foam were reported. At the West River site on Hartford Avenue in Upton, common observations included a brown/milky water column, light to medium density of trash, and odors (earthy, sewage, oily, fishy); oily sheens were noted on two events.

Since the geometric mean for the *E. coli* bacteria results meet the criteria for both primary and secondary contact recreation (126 and 630 cfu/100 ml, respectively) and no aesthetically objectionable conditions were observed by DWM staff the *Primary and Secondary Contact Recreational and Aesthetics* uses are assessed as support. An Alert status is identified for the *Primary Contact Recreational* use due to slightly elevated bacteria counts during both wet and dry weather as well as the isolated area affected by animal sources. An Alert status is also identified for the *Primary and Secondary Contact Recreational and Aesthetics* use based on the occasional observation of oily sheens, light trash, milky conditions and odors by local watershed advocates.

West River (MA51-11) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED 1.0 miles through Lake Wildwood Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism SUPPORT* 2.8 miles remainder of segment
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT*
Secondary Contact		SUPPORT*
Aesthetics		SUPPORT*

* Alert Status issues identified, see details in use assessment

RECOMMENDATIONS

Recommend additional monitoring for reproducing trout, macroinvertebrate sampling, and thermistors re thermal concerns.

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

CENTER BROOK (MA51-34)

Location: Outlet Mill Pond, Upton to confluence with West River, Upton.
Size: 2.8 Miles
Classification: B
2008 303(d) List: Category

This is a new segment so there is no prior listing in the 2008 Integrated List of Waters.

MA DFG identifies this waterbody as a "Cold Water Fishery Resource" (MA DFG 2007).

NPDES (APPENDIX H, Table H2):

Upton (MAR041165)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

In September 2003 MassDEP DWM biologists conducted backpack electrofishing in Center Brook upstream from Mendon Street in Upton (CB01, Appendix D). Habitat quality was noted to be limited most by the limited riparian vegetative zone width on both banks. There was some evidence of sand deposition originating from the road (MassDEP 2003).

Most of Center Brook lies within the potential flood storage area of the West Hill Dam Project.

Biology

In July 2000 MA DFG biologists conducted backpack electrofishing in Center Brook north of Station Street in Upton (Sample ID 100). The fish sample contained 63 individuals representing five species: tessellated darter (*Etheostoma olmstedii*), redbin pickerel (*Esox americana*), brook trout (*Salvelinus fontinalis*), white sucker (*Catostomus commersonii*), and largemouth bass (*Micropterus salmoides*) (MADFG 2008). MA DFG biologists had also conducted sampling earlier that month in the brook further downstream near West River Street (Sample ID 101). Their sample was dominated by brook trout (*S. fontinalis*), redbin pickerel (*E. Americana*), and tessellated darter (*E. olmstedii*). Brown trout (*Salmo trutta*) (stocked), bluegill (*Lepomis macrochirus*), white sucker (*C. commersonii*) and a few largemouth bass (*M. salmoides*) and individual each of chain pickerel (*E. niger*) and yellow bullhead (*Ameiurus natalis*) were collected (MA DFG 2008).

DWM biologists sampled Center Brook upstream of Mendon Street in Upton in September 2003 (CB01, Appendix D). Fish sampling efficiency was rated poor due to deep pools and muddy conditions. Fish species captured in order of abundance included tessellated darter (*E. olmstedii*), yellow bullhead (*A. natalis*), brook trout (*S. fontinalis*), redbin pickerel (*E. Americana*), largemouth bass (*M. salmoides*), and brown bullhead (*Ameiurus nebulosus*). Although DFG stocks Center Brook with trout, at least 50% of the brook trout appeared to be native fish as evidenced by their small size and excellent fin quality.

The *Aquatic Life Use* is assessed as support for Center Brook based primarily on the fish population information. The presence of tessellated darter (*E. olmstedii*) and brook trout (*S. fontinalis*) (multiple age classes) and other fluvial species, is indicative of a stable flow regime and excellent water quality. The presence of four species of macrohabitat generalists and young of the year largemouth bass (*M. salmoides*) and brown bullhead (*A. nebulosus*) is probably best explained by the large pools within the sampled reach and the presence of a number of ponds located upstream.

Primary and Secondary Contact Recreational and Aesthetics Uses

No objectionable conditions (e.g., color, turbidity, odors, deposits of debris/floatables/trash) were noted by DWM during the backpack electrofishing survey in Center Brook (MassDEP 2003).

In 2005, MassDEP DWM and CERO conducted a source tracking study to trace upstream sources of bacteria to the Harrington Pool beach, focusing on dry weather sources of bacteria upstream from the West Hill Dam flood control project. Duerring and Beaudoin (2007) reported the following:

"Results of the source tracking activities in the Center Brook subwatershed indicate that there is an intermittent source of bacteria impacting the unnamed tributary that flows into Center Brook just downstream of the Grove Street bridge crossing (Station CB07) in Upton Center. Landuse in the nearfield area draining to this tributary

is a mix of residential and commercial. Positive optical brightener results obtained in November from this stream suggest a human source of bacteria, however since the optical brightener signals were weak and were not associated with an elevated bacteria count at the time of deployment, the results are inconclusive.”

The *Primary* and *Secondary Contact Recreational Uses* are not assessed due to the current lack of validated bacteria data. Dry weather sources of bacterial contamination in the subwatershed are noted as a concern. The *Aesthetics Use* is assessed as support since no objectionable conditions were noted by DWM biologists.

Center Brook (MA51-34) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

RECOMMENDATIONS

Additional monitoring which includes benthic macroinvertebrate, fish and thermal components should be conducted. Consider reclassifying Center Brook to B/CWF.

TAFT POND BROOK (MA51-26)

Location: Headwaters, outlet Taft Pond, Upton to confluence with West River, Northbridge.
Size: 1.2 Miles
Classification: B
2008 303(d) List: Category

This is a new segment so there is no prior listing in the 2008 Integrated List of Waters.

MA DFG identifies this waterbody as a "Cold Water Fishery Resource" (MA DFG 2007).

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

Almost the entire length of Taft Pond Brook lies within the potential flood storage area of the West Hill Dam Project.

In September 2003 MassDEP DWM biologists conducted backpack electrofishing in Taft Pond Brook downstream of the sand pit access road at end of South Street in Upton (TPB01, Appendix D). Habitat quality was noted to be limited most by the lack of fast deep water habitat and a slight problem with sedimentation.

Biology

In September 2003 DWM biologists conducted backpack electrofishing in Taft Pond Brook downstream of the sand pit access road at end of South Street in Upton. Fish species captured in order of abundance included redbfin pickerel (*Esox americanus*), brown trout (*Salmo trutta*), yellow bullhead (*Ameiurus natalis*), largemouth bass (*Micropterus salmoides*), pumpkinseed (*Lepomis gibbosus*) and chain pickerel (*Esox niger*). The presence of two small brown trout (*Salmo trutta*) suggests a reproducing trout population (TPB01, Appendix D).

The *Aquatic Life Use* is not assessed because of too limited data. The presence of brown trout (*S. trutta*), an intolerant fluvial species is indicative of excellent water and habitat quality and a stable flow regime, however the overall low numbers of fish and the fact that all other species observed were macrohabitat generalists suggests potential problems in Taft Pond Brook. The corridor along much of this segment is protected since it lies within the West Hill Dam Flood Control Project.

Primary and Secondary Contact Recreational and Aesthetics Uses

No objectionable conditions (e.g., color, turbidity, odors, deposits of debris/floatables/trash) were noted by DWM biologists during the backpack electrofishing survey in Taft Pond Brook (MassDEP 2003).

The *Primary and Secondary Contact Recreational Uses* are not assessed due to the lack of quality assured bacteria data. The *Aesthetics Use* is assessed as support since no objectionable conditions were noted by DWM biologists.

Taft Pond Brook (MA51-26) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

RECOMMENDATIONS

Evaluate the potential for flow related problems in Taft Pond Brook. Future monitoring should include macroinvertebrate sampling and should also be expanded to better document the presence and extent of the reproducing brown trout population.

MISCOE BROOK (MA51-37)

Location: Perennial portion from Mendon/Upton/Northbridge corporate boundaries to the confluence with Taft Pond Brook, Northbridge/Upton.
Size: 0.7 Miles
Classification: B
2008 303(d) List: Category

This is a new segment so there is no prior listing in the 2008 Integrated List of Waters.

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

Approximately half the length of Miscoe Brook lies within the flood storage area of the West Hill Dam Project.

In September 2003 DWM biologists conducted backpack electrofishing in Miscoe Brook upstream of Oak Drive in Upton (MB01 in Upton, Appendix D). Habitat quality was severely limited by the low flow conditions encountered (most water was in standing pools); the upper reach of this segment could not be sampled due to lack of water.

Biology

In September 2003 DWM biologists conducted backpack electrofishing in Miscoe Brook upstream from Oak Drive in Upton (MB01 in Upton). Multiple age classes of brook trout (*Salvelinus fontinalis*) as well as redbin pickerel (*Esox americanus*) were collected (Appendix D).

The *Aquatic Life Use* is assessed support based primarily on the fish population information. The presence of a reproducing brook trout (*S. fontinalis*) population, which are intolerant fluvial fishes, is indicative of excellent water and habitat quality and a stable flow regime. The corridor along the lower half of this segment is protected since it lies within the West Hill Dam Flood Control Project. However, an Alert status is identified due to the no/low flow conditions encountered by DWM biologists.

Primary and Secondary Contact Recreational and Aesthetics Uses

No objectionable conditions (e.g., color, turbidity, odors, deposits of debris/floatables/trash) were noted by DWM biologists during the backpack electrofishing survey conducted in Miscoe Brook (MassDEP 2003).

The *Primary and Secondary Contact Recreational Uses* are not assessed due to the lack of quality assured bacteria data. The *Aesthetics Use* is assessed as support as no objectionable conditions were noted by DWM biologists.

Miscoe Brook (MA51-37) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

* Alert Status issues identified, see details in use assessment

RECOMMENDATIONS

Efforts to stabilize flows in Miscoe Brook are crucial to protecting this excellent cold water fishery resource. Future monitoring should include macroinvertebrates and be expanded to document the extent of this cold water fishery. It was obvious that large portions of Miscoe Brook were un-inhabitable due to very low water conditions. It should be determined what effect, if any, the local authorized water withdrawal of 0.06 MGD by Miscoe Springs Inc. Well # 1 may be having on this brook.

WEST RIVER (MA51-12)

Location: Upton WWTP discharge, Upton to confluence with Blackstone River, Uxbridge (through former segments Harrington Pool MA51197, and West River Pond MA51177).
Size: 9.3 Miles
Classification: B\WWF
2008 303(d) List: Category 5

This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Metals, Nutrients, pH, Organic enrichment/Low DO, Salinity/TDS/chlorides) (MassDEP 2008a).

Harrington Pool (West Hill Dam Impoundment) (MA51197) will no longer be reported on as an approximately one-acre waterbody based on best professional judgment. West River Pond (MA51177) will no longer be reported as an approximately 34-acre lake segment since the retention time of this waterbody was estimated at less than two days. These waterbodies will be considered run of the river impoundments (McVoy 2006). The retention time estimate was based on the annual historical mean discharge from two stream gages in the Blackstone River Basin (01110000 and 01124500) and the normal storage volume of the dam reported by DCR in their Massachusetts Dam Safety Program Database (Socolow *et al.* 2004 and DCR 2002).

Site Awaiting NPL Decision (SAND): WAUCANTUCK MILLS (FORMER)

Harrington Pool (West Hill Dam Impoundment) (MA51197) is on the 2008 Integrated List of Waters in Category 2 - Attaining Some Uses (Secondary Contact, Aesthetics); Others Not Assessed.

West River Pond (MA51177) is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Noxious aquatic plants, (Exotic species*)). * denotes a non-pollutant.

NPDES (APPENDIX H and Table H2):

Upton Wastewater Treatment Facility (MA0100196)
Town of Uxbridge (MAR041166)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

A U.S. Army Corps of Engineers (USACOE) Flood Control Project, West Hill, is located on the West River. The dam is located in Uxbridge, and the (potential) flood storage area extends into Northbridge and Upton (USACOE 2009a), 4.7 miles upstream of the dam and covering 1,025 acres (USACOE 2009b). It and numerous other projects were built to avoid the flood-related loss of lives and property associated with Hurricane Diane (August 1955), and protects Uxbridge, Woonsocket and Providence, RI and other downstream communities. Designed to handle a 100-year flood event, West Hill is a dry bed project (i.e., there is no recreation pool extending above the dam), and is operated in a run-of-river mode (except during flood control operations). The Harrington Pool, a natural widening of the West River in Northbridge, supports two public beaches on opposite sides of this natural widening of the river. The storage area in general supports a large riverine wetland system, and includes segments of Taft Pond Brook, Miscoe Brook, and Center Brook. The Army Corps web site (2009a) notes the following: *"The West River winds through some 567 acres of white pine and red oak forest, broken here and there by rolling meadows. Red maple swamps and several bogs fill the lowlands while three small brooks feed the river. Corps Rangers manage the woodlands to improve fish and wildlife habitat."*

In 2005, a prolonged period of heavy rains resulted in flooding in the Blackstone River. The West Hill Project was operated to prevent further runoff pressure from exacerbating conditions in the Blackstone (Foskett 2005b). The water level behind the dam reached 19.6 feet during this event, well below the project capacity of 27 feet. As of September 23, 2009, the highest pool of record at the West Hill project occurred in 1987, with a maximum height of 25.5 feet (Bramel 2009). For further information regarding the West Hill Dam Project, go to <http://www.nae.usace.army.mil/recreati/whd/whdnr.htm> (USACOE 2009a).

Low flow was observed within this segment by Blackstone River Watershed Association volunteer monitors at Pleasant St. and Glen Ave. in Upton on 10/9/2004, 5/14/2005, 9/9/2006, with a stagnant event observed on 10/14/2006 (Gilpatrick 2007).

The MassDEP CERO SMART program has conducted bimonthly monitoring on the West River at East Hartford Ave since March 2000 (Appendix F, Beaudoin 2004b). Habitat at this location is dominated by a riverine wetland system, with an open channel, little canopy cover, and a substrate consisting largely of aquatic plant beds (Appendix F, Beaudoin 2004b).

Biology

In 2009, the West River in Upton, Northbridge and Uxbridge was stocked with trout (MA DFG 2009).

At the West Hill flood control project in Northbridge and Uxbridge, the U.S. Army Corps of Engineers notes: “Anglers will find trout in the main river channel and bass, pickerel and horned pout in the pools... Trout and pheasant are stocked by the Massachusetts Division of Fisheries and Wildlife” (USACOE 2009a). “There is stream fishing along two miles of the West River, which the state stocks with trout. Center Brook and other streams in the project area offer native bass, pickerel, and horned pout” (USACOE 2009b).

Between August 2000 and September 2006 MA DFG biologists conducted electrofishing (backpack, barge and boat) at seven sites in this segment of the West River (MADFG 2008). The fish assemblage in this segment was a diverse mix of fluvial specialist/dependent and macrohabitat generalist species. The species composition of each sample was reflective of the habitat present at that particular sampling location. For example pool and low gradient habitats were dominated by macrohabitat generalists and lotic habitats were dominated by fluvial specialists/dependents. Examples of fluvial species present included tessellated darter (*Etheostoma olmstedi*), white sucker (*Catostomus commersonii*), common shiner (*Luxilus cornutus*), creek chubsucker (*Erimyzon oblongus*), fallfish (*Semotilus corporalis*) and in one location reproducing brook trout (*Salvelinus fontinalis*). The presence of these fishes is indicative of a stable flow regime and good water quality.

Cabomba caroliniana (fanwort) and *Myriophyllum* sp. (possibly *M. heterophyllum*) were observed in the West River Pond impoundment, Uxbridge during the 1994 and/or 1998 synoptic surveys (MassDEP 1994, 1998). In the mid 2000's, water chestnut (*Trapa natans*) was discovered. In 2006, BRWA volunteers began hand-pulling the chestnut plants in late June, timed to occur before the seed pods had matured; in August, a harvester was hired to provide further assistance. When these efforts were concluded at the end of August, over 1200 tons of weeds had been harvested (Plasse 2007). Although funding was secured for further harvesting activities in 2007, the impoundment level was too low to float the harvester, and no further removal has been conducted (Plasse 2009).

Toxicity

Effluent – This discharge to unnamed tributary of West River just upstream from the confluence.

Modified acute and chronic whole effluent toxicity tests were conducted on the Upton WWTF treated effluent between October 2002 and January 2008. Acute whole effluent toxicity to *C. dubia* was detected in two of 25 tests (LC₅₀= 58.2 and 20.31% effluent in April 2005 and April 2007 test events, respectively). Acute whole effluent toxicity was also detected in two test events conducted in May and July 2007 when survival of *C. dubia* in the whole effluent at the end of the test was 0%. During each of these two test events, acute toxicity was detected in one of the two renewal samples but not in the sample used to initiate the chronic test. The *C. dubia* CNOEC test results ranged from <6.25 to 100% effluent. CNOECs were < 98% effluent in four of the 23 valid test events. In these four tests, CNOECs were 12.5, 50, <6.25, and 6.25% effluent in the January 2003, April 2005, May and July 2007 test events, respectively. Although no acute toxicity to *P. promelas* was detected (all LC₅₀s were ≥100% effluent, n=23), chronic whole effluent toxicity to *P. promelas* was detected in 7 of the 21 valid test events. When chronic whole effluent toxicity was detected by *P. promelas* (April 2004, January 2005, April and July 2006, January, May and October 2007) CNOECs ranged from <6.25 to 50% effluent.

Water Chemistry

CERO SMART conducted bimonthly *in-situ* water quality monitoring in the West River at East Hartford Ave, Uxbridge (WR03) on 27 occasions from March 2000 through October 2004 (Appendix F, Beaudoin 2004b). Parameters measured include dissolved oxygen, percent saturation, temperature, pH, total dissolved solids and conductivity, (Appendix F). Nutrient and conventional chemistry samples, including total phosphorus, total nitrogen (or total Kjeldahl nitrogen), ammonia nitrogen, nitrate-nitrite nitrogen, total alkalinity, chlorides, hardness, total suspended solids, and turbidity were also collected. The maximum recorded temperature in this five year period was 23.5°C. Conductivity values at this reference station were the lowest in the watershed; values at Station WR03 ranged from 165 to 326 uS/cm. Mid-morning DO values ranged from 2.3 to 12.6 mg/L (values were less than 5.0 mg/L on two events), while pH ranged from 5.5 to 6.8 SU. Ammonia levels ranged from <0.02mg/L to 0.45 mg/L; 19 values (of 26) were below the method detection limit, and none exceeded the criteria.

Total phosphorus concentrations were consistently low (< 0.050 mg/L), and ranged from 0.013 to 0.074 mg/L from March 2000 to Nov 2004; only two values were >0.050 mg/L.

DWM staff also conducted early morning *in situ* and water quality monitoring at this location in the West River at East Hartford Ave, Uxbridge (WR03) on four occasions between June and October 2003. Early morning DO measurements (between 02:16 and 08:47am, n=4) ranged from 2.9 to 6.2 mg/L. It should be noted that the extremely low DO (2.9 mg/L) occurred within 24 hours of the lowest value measured by the SMART team (2.3 mg/L), which implies that this condition was associated with an isolated event. pH ranged from 5.8 to 6.5 SU. The maximum water temperature was 22.0°C while the maximum TP concentration was 0.046 mg/L (Appendix B, Tamul 2005). Although both DO and pH values were typically lower than values measured elsewhere in the watershed, this is likely due to the presence of extensive riverine wetlands in the segment above this location.

Further downstream near Hecla Street, Uxbridge, DWM staff conducted monitoring on five occasions between May and October 2003. Early morning DO measurements (between 02:34 and 09:06 am, n=5) ranged from 7.2 to 8.5 mg/L; pH ranged from 6.0 to 6.7 SU. The maximum water temperature was 22.7°C while the maximum TP concentration was 0.053 mg/L. In general, the physico-chemical monitoring data were indicative of good conditions (Appendix B, Tamul 2005).

A dry weather study of water quality in the Blackstone Watershed was conducted from 2000–2003 (Wright et al 2004). Samples were collected at 24 sites on the Blackstone, Mumford, Quinsigamond and West Rivers on four dates under dry weather conditions. Insufficient data are currently unavailable to complete the DWM external data validation process required for assessment decision.

The *Aquatic Life Use* is assessed as impaired for the 1.3 mile reach through the West River Pond impoundment due to the presence of non-native species (*Cabomba caroliniana*, *Trapa natans* and possibly *Myriophyllum* sp.). The remaining 8.0 miles of this segment are assessed as support based on the fish population and water quality data. Low DO and pH conditions are of concern, although these are likely attributable to riverine wetlands in this system. Occasional acute and/or chronic whole effluent toxicity in the Upton WWTF discharge are also noted as a concern.

Primary and Secondary Contact Recreational and Aesthetics Uses

The Rhode Island Canoe and Kayak Association (RICKA) Blackstone Valley Paddlers Club conducts trips on the West River (RICKA 2009). The West Hill Dam Flood Control Project offers many opportunities for recreation, including two public beaches on opposite sides of the half-acre Harrington Pool, Northbridge maintained by the U.S. Army Corps of Engineers (USACOE 2009b). The USACOE reports that by 2006, the project had over 14,291 swimmers, 673 boaters, and 4,314 fishermen; for further information, see <http://www.vtn.iwr.usace.army.mil/recreation/reports/lake.asp?ID=435> (USACOE 2009c).

Bacteria monitoring is conducted weekly at Harrington Pool throughout the recreation season by the Army Corps; 10 exceedences of the Bathing Beach criteria necessitated closure of the beach during the 2002, 2003 and 2004 swimming seasons (MA DPH 2003, 2004, 2005). In 2005, MassDEP DWM and CERO conducted a source tracking study to trace sources of bacteria to the Harrington Pool beach, focusing on dry weather sources of bacteria upstream from the West Hill Dam flood control project. Duerring and Beaudoin (2007) reported the following:

“two dry weather bacteria hot-spots...are most likely too far upstream to have a direct impact on bacteria counts measured at West Hill Park Beach. In addition, during the sampling period, bacteria counts at the inlet to the swimming area on the West River were consistently low during all dry weather sampling events suggesting dry weather bacteria inputs were not a problem at the beach.

Dry weather closures were far less frequent from 2005 to 2009 than in the previous five years; only 2 potential dry weather exceedences were noted in this time frame (one in June 2005, and one in July 2006) (McNally 2009).

In 2003, MassDEP DWM collected six *E. coli* samples from the West River near East Hartford Ave, Uxbridge (WR03) during the primary contact season (Appendix B). The geometric mean of the six samples was 34 cfu/100 ml, ranging from <7 to 240 cfu/100 ml. Bimonthly SMART monitoring was conducted at East Hartford Ave, Uxbridge from March 2000 through October 2004 (Appendix F, Beaudoin 2004b). Field observations indicate that, in general, turbidity was low, with little periphytic growth and a general absence of foam, sheens, odors and objectionable deposits. Aquatic macrophyte communities were both dense and diverse in this riverine wetland system (Appendix F, Beaudoin 2004b, MassDEP 2003).

Further downstream at Hecla Street, Uxbridge, the geometric mean of the six samples collected by DWM was 56 cfu/100 ml; counts ranged from 13 to 400 cfu/100 ml. In general, no aesthetically objectionable conditions (e.g., odors, oils, turbidity, growths, deposits) were observed by either DWM monitoring staff (MassDEP 2003).

The Blackstone River Watershed Association in conjunction with Blackstone River Coalition recorded aesthetic observations at four sites within this segment in 2004, 2005 and 2006, monthly from April through November, as part of their ongoing volunteer water quality monitoring program (Gilpatrick 2007). At the Pleasant Street/Glen Ave site (Upton), conditions included infrequent observations of orange/dark brown and greenish color, chlorine and sewage odors; infrequent oily sheens, milky appearance, light to heavy trash. At Mendon Road, Northbridge, aesthetic conditions were generally high, with occasional notes of light trash and sand deposition. Upstream of the Harrington Pool in Northbridge/Uxbridge, aesthetic conditions were also generally high. At the Route 16 Bridge in Uxbridge, light trash was usually noted; otherwise, aesthetics conditions were high.

As the geometric mean for the *E. coli* bacteria results meet the criteria for primary and secondary contact recreation (126 and 630 cfu/100 ml, respectively) and no/few aesthetically objectionable conditions were observed by MassDEP or BRC volunteers the *Primary* and *Secondary Contact Recreational* and *Aesthetics* uses are assessed as support.

West River (MA51-12) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED 1.3 miles through West River Pond impoundment Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism SUPPORT* 8.0 miles remainder of segment
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT
Secondary Contact		SUPPORT
Aesthetics		SUPPORT

RECOMMENDATIONS

River water should be collected upstream from the Upton WWTF facility discharge and used as dilution water in the facility's whole effluent toxicity tests. Continue to closely monitor the facility's WET toxicity test results. If acute whole effluent toxicity is detected in any of the renewal samples, physicochemical and metals analyses of these samples should be conducted. If either the frequency and/or magnitude of permit limit violations increases, a toxicity identification/toxicity reduction evaluation or additional testing (screening level) should be required to better evaluate the cause(s) of the problem.

Deploy a probe at the East Hartford Ave location to determine diurnal fluxes in DO.

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent the spread of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring is required to guard against encroachment into unaffected areas and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

Conduct aquatic macrophyte survey in late July/August to confirm species of *Myriophyllum*.

LAUREL BROOK (MA51-23)

Location: Headwaters, north of Yew Street, Douglas to confluence with Scadden Brook near the outlet of Sawmill Pond, Uxbridge (through Bazely Pond formerly segment MA51008).
Size: 3.3 Miles
Classification: B
2008 303(d) List: Category

This is a new segment so there is no prior listing in the 2008 Integrated List of Waters.

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

In September 2003 MassDEP DWM biologists conducted backpack electrofishing in Laurel Brook upstream from West Street in Uxbridge (LB01, Appendix D). Habitat quality was excellent and was noted to be limited most by scarcity of pools and deep water habitats (velocity/depth combinations). The sampling station is in the upper one third sub-watershed area and within a reach that the Laurel Brook Club has reported as being totally dewatered on a number of occasions since the construction of Blissful Meadows Country Club. Their contention is that water use and management at the golf course is having a direct impact on flows within Laurel Brook. MassDEPs Central Regional Office is working with Blissful Meadows to assess water use and to investigate the allegations (Appendix D).

Bazeley Pond, a small impoundment on lower Laurel Brook (1.1 acres), is an artificial water body listed as a reservoir (AGI 2009). With this exception, Laurel Brook consists of riverine habitat.

Biology

In October 2004 MA DFG biologists conducted backpack electrofishing in Laurel Brook upstream of Yew Street in Douglas (Sample ID 990). The fish sample contained only one white sucker (*Catostomus commersoni*), a fluvial dependant species (MADFG 2008). The fish sample collected by DWM biologists in the brook further downstream at West Street (LB01) in September 2003 also contained white sucker, two age classes of brook trout (*Salvelinus fontinalis*), and largemouth bass (*Micropterus salmoides*) (Appendix D). DFG biologists also conducted backpack electrofishing in this reach in August 2007 (Sample ID 2395). Their sample was comprised of white sucker and multiple age classes of brook trout (MADFG 2008). It should be noted that the Laurel Brook Club stocks parts of Laurel Brook with brook trout fry and there is a possibility that these fish are the result of those stockings. Brook trout and white sucker are both fluvial specialist/dependent species.

Water Chemistry

A Stowaway continuous temperature data logger was placed deployed by DWM staff in Laurel Brook at West Street on August 11, 2003 and retrieved on September 22nd 2003 (Appendix G). The 7-day mean max temperature (rolling average) exceeded the cold water standard (20 °C) on 11 of 37 (29.7% of the days within the rolling average period). The minimum observed temperature was 11.6°C, and the maximum was 23.5°C. There were no exceedences of the warm water standard (28.3 °C).

The *Aquatic Life Use* for Laurel Brook is assessed as support based on the presence of multiple ages of brook trout (*S. fontinalis*) and white sucker (*Catostomus commersonii*), both fluvial species. However it is unclear whether brook trout are reproducing naturally within Laurel Brook or are only present as a result of fry stocking. Due to the presence of cold water fish (brook trout) elevated temperatures and low conditions are noted as concerns so this use is identified with an Alert status.

Primary and Secondary Contact Recreational and Aesthetics Uses

No objectionable conditions (e.g., color, turbidity, odors, deposits of debris/floatables/trash) were noted by DWM biologists during the backpack electrofishing surveys in Laurel Brook (Appendix D).

The *Primary and Secondary Contact Recreational Uses* are not assessed due to the lack of bacteria data. The *Aesthetics Use* is assessed as support since no objectionable conditions were noted by DWM biologists.

Laurel Brook (MA51-23) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

* Alert Status issues identified, see details in use assessment

RECOMMENDATIONS

Additional fish population monitoring is recommended, however fry stocking may confound any evidence of brook trout reproduction. In light of the fact that brook trout, either stocked or naturally reproducing, are surviving in Laurel Brook, designation of this waterbody as a Cold Water Fishery should be considered. Additional temperature monitoring at multiple locations should be conducted.

Continue to investigate the source(s) of low flow in Laurel Brook.

SCADDEN BROOK (MA51-24)

Location: Headwaters, north of Davis Street, Douglas to inlet Lee Pond, Uxbridge (through Lee Reservoir formerly segment MA51086).
Size: 2.4 Miles
Classification: B
2008 303(d) List: Category

This is a new segment so there is no prior listing in the 2008 Integrated List of Waters.

Lee Reservoir is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

In September 2003 MassDEP DWM biologists conducted backpack electrofishing in Scadden Brook upstream from West Street in Uxbridge (SC01, Appendix D). Habitat quality was excellent and was noted to be limited most by scarcity of pools and deep water habitats (velocity/depth combinations), and to a lesser extent, epifaunal substrate.

Several small impoundments are found on Scadden Brook, including Lee Reservoir (owned and managed by the Uxbridge Rod and Gun Club) and Sawmill Pond (Laurel Brook Club). A stretch of the upstream brook is adjacent to the former New York, New Haven and Hartford railroad bed. The watershed is mostly forested, with a small amount of low density residential, commercial, and industrial land-use mixed in. Much of the local residential development has taken place in the last 5 to 10 years (SC01, Appendix D).

Biology

In October 2004 MA DFG biologists conducted backpack electrofishing in Scadden Brook upstream of West Street, Uxbridge (Sample ID 991). The fish sample was comprised of blacknose dace (*Rhinichthys atratulus*), white sucker (*Catostomus commersoni*) (both of which are fluvial specialist/dependent species), and a single yellow bullhead (*Ameiurus natalis*) (MADFG 2008). The fish sample collected by DWM biologists in the brook slightly downstream of the DFG (SC01) in September 2003 also contained blacknose dace, white sucker, and 3 young of year largemouth bass (*Micropterus salmoides*) (Appendix D). Both samples were dominated by fluvial species, indicating a stable flow regime. Although trout were not collected or observed, many local sportsmen from the Uxbridge Rod and Gun Club report native brook trout (*S. fontinalis*) in Scadden Brook (Appendix D).

A potential non-native macrophyte species (*Myriophyllum* sp., possibly *M. heterophyllum*) has been reported in Lee Reservoir (MassDEP 2008b).

Water Chemistry

A Stowaway continuous temperature data logger was deployed by DWM staff in Scadden Brook at West Street, Uxbridge on August 11, 2003 and retrieved on September 22nd 2003 (Appendix G). The 7-day mean maximum temperature (rolling average) exceeded the cold water standard (20°C) on 8 of 37 days (21.6% of the days within the rolling average period). The minimum observed temperature was 10.7°C, and the maximum was 21.9°C. There were no exceedences of the warm water standard (28.3°C).

The *Aquatic Life Use* for Scadden Brook is assessed as support based on the fish samples and dominance by fluvial species. This use is identified with an Alert Status in the reach through Lee Reservoir because of the potential presence of *M. heterophyllum*, a non-native aquatic macrophyte.

Primary and Secondary Contact Recreational and Aesthetics Uses

No objectionable conditions (e.g., color, turbidity, odors, and deposits of debris/floatables/trash) were noted by DWM biologists during the backpack electrofishing surveys in Scadden Brook (Appendix D).

The *Primary and Secondary Contact Recreational Uses* are not assessed due to the lack of bacteria data. The *Aesthetics Use* is assessed as support since no objectionable conditions were noted by DWM biologists.

Scadden Brook (MA51-24) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

* Alert Status issues identified, see details in use assessment

RECOMMENDATIONS

Future biomonitoring should include a more expansive search for native brook trout as well as benthic macroinvertebrate and thermal components.

Conduct aquatic macrophyte survey in late July/August to confirm species of *Myriophyllum*.

EMERSON BROOK (MA51-29)

Location: Headwaters, outlet Lee Pond, Uxbridge to confluence with the Blackstone River, Uxbridge.
Size: 1.9 Miles
Classification: B
2008 303(d) List: Category

This is a new segment so there is no prior listing in the 2008 Integrated List of Waters.

MA DFG identifies this waterbody as a "Cold Water Fishery Resource" (MA DFG 2007).

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

In September 2003 MassDEP DWM biologists conducted backpack electrofishing in Emerson Brook upstream from the Route 146S off-ramp at Chocolog Road in Uxbridge (EB01, Appendix D). Habitat quality was excellent.

Biology

DWM biologists collected fish in Emerson Brook upstream from the Rte 146 South off-ramp at Chocolog Road in Uxbridge in September 2003 (EB01, Appendix D). The sampled fish community included (in order of abundance) blacknose dace (*Rhinichthys atratulus*), fallfish (*Semotilus corporalis*), common shiner (*Luxilus cornutus*), longnose dace (*Rhinichthys cataractae*), white sucker (*Catostomus commersonii*), brook trout (*Salvelinus fontinalis*), and largemouth bass (*Micropterus salmoides*). In July 2001 MA DFG biologists conducted backpack electrofishing in Emerson Brook downstream of Rte. 146 (Sample ID 418). The study showed a similar community, with the addition of brown trout (*Salmo trutta*)(stocked). The dominance by fluvial specialist/dependent species and the presence of intolerant species (longnose dace and trout) is indicative of excellent water and habitat quality. However, the influence of historic trout stocking in the upper watershed by both the Laurel Brook Club and the Uxbridge Rod and Gun Club is unknown. Although this stream is on the DFG Coldwater Fishery Resource List and DFG biologists note that the brook trout they collected were "wild" fish, it should be noted that no young of year trout were collected or observed and all brook trout were approximately the same length.

Water Chemistry

A Stowaway continuous temperature data logger was deployed by DWM staff in Emerson Brook upstream of the Rte 146 off ramp at Chocolog Road, Uxbridge on August 11, 2003 and retrieved on September 22nd 2003 (Appendix G). The 7-day mean maximum temperature (rolling average) exceeded the cold water standard (20°C) on 19 of 37 days (51.4% of the days within the rolling average period). The minimum observed temperature was 13.2°C, and the maximum was 25.8°C. There were no exceedences of the warm water standard (28.3°C).

The *Aquatic Life Use* is assessed as support based primarily on the fish population monitoring data. The dominance by fluvial specialist/dependent species and the presence of intolerant species (longnose dace, *R. cataractae* and trout, *S. fontinalis* and *S. trutta*) is indicative of excellent water and habitat quality. If this brook is indeed a "cold water fishery" elevated temperatures are noted as a concern.

Primary and Secondary Contact Recreational and Aesthetics Uses

No objectionable conditions (e.g., color, turbidity, odors, and deposits of debris/floatables/trash) were noted by DWM biologists during the backpack electrofishing surveys in Emerson Brook (Appendix D).

The Blackstone River Watershed Association in conjunction with Blackstone River Coalition recorded aesthetic observations at two sites within this segment in 2004, 2005 and 2006, monthly from April through November, as part of their ongoing volunteer water quality monitoring program (Gilpatrick 2007). Overall, the aesthetics value at the Emerson Brook station near Quaker Highway (since renamed Lydia Taft Highway) was high; occasional light trash, slight turbidity and foam/oily sheens were noted.

The *Primary and Secondary Contact Recreational Uses* are not assessed due to the lack of bacteria data. The *Aesthetics Use* is assessed as support since no objectionable conditions were noted by DWM biologists.

Emerson Brook (MA51-29) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

RECOMMENDATIONS

Additional monitoring which includes benthic macroinvertebrate, fish and thermal components should be conducted. Evaluate whether or not natural reproduction of brook trout is occurring in Emerson Brook.

BLACKSTONE RIVER (MA51-06)

Location: From the Water Quality Monitor, Millville to the Rhode Island border west of Route 122 (Main St.), Blackstone, MA/(Harris Avenue) North Smithfield RI.
Size: 3.8 Miles
Classification: BWWF
2008 303(d) List: Category 5

This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Priority organics, Metals, Nutrients, (Flow alteration*), Pathogens, Taste, odor and color, Suspended solids, Turbidity). * denotes a non-pollutant (MassDEP 2008a).

NPDES (APPENDIX H, Table H2):

Town of Millville (MAR041138)
Town of Blackstone (MAR041093)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

In 1970, the USACOE (2009e) constructed the Blackstone River Local Protection Project near St. Paul Street, Blackstone to provide flood protection to various municipal, residential and recreational properties in this area. *"The Blackstone River Local Protection Project consists of an earthfill dike with stone slope protection 863 feet long with a maximum height of seven feet. The dike ties into a previously constructed floodwall 180 feet downstream of the St. Paul Street Bridge and blends into a railroad embankment. Two 15-inch diameter concrete culverts extend through the dike to drain interior surface water."*

Ridgewood Power has operated the 2,000 kilowatt licensed hydropower facility (FERC Project # 3023) in the village of Waterford, in the old Tupperware Mill facility, just over the Massachusetts state line in Rhode Island since January 2003 (Grader 2009). The 30-year permit was issued by FERC on 20 October 1980 to operate as a run-of-the-river facility. Water is impounded at the 'fixed height' Tupperware Dam in Blackstone, MA. Power is generated by opening turbines at the hydropower project in Rhode Island, which pulls water down through the "Power canal". This results in the reduction of flow through the Blackstone Gorge. The flow is then returned to the Blackstone River at the state line. Although their license contains no by-pass flow requirement, they are presently voluntarily spilling between 11 and 20 cfs over the dam (Grader 2001).

The Blackstone Gorge is unique in that it is the only habitat of this kind in the entire Blackstone River. Occasionally no water passes over the Rolling Dam at the head of the gorge. In 2007, river advocates noted that the gorge was becoming dry due to a lack of flow over Rolling Dam. An investigation by Ridgewood Power at their facility found that the transducer recording the water level at their head pond was broken, resulting in the lack of flow to the gorge. The problem was fixed immediately (Coffin 2007).

Biology

MA DFG conducted fish population sampling at two locations (Site IDs 303, 2212 and 299) along this segment of the Blackstone River (MA DFG 2008). Sites 303 and 2212 were located in the Tupperware Dam impoundment upstream from the gorge in Blackstone and were sampled by boat shocking in June 2001 and August 2007, respectively. Site 299 was located downstream of the low head dam near Bridge Street in Blackstone and was sampled using a barge shocker in August 2001. In the impoundment during the 2001 survey a total of 323 fish were collected, representing 10 species. The four most dominant species were white sucker (*Catostomus commersonii*), yellow perch (*Morone americana*), bluegill (*Lepomis macrochirus*) and pumpkinseed (*Lepomis gibbosus*). In 2007, a total of 132 fish were collected again representing 10 species with the same four species being dominant. The presence and dominance by macrohabitat generalist species in these samples is to be expected in light of the fact that sampling was conducted within the impoundment. The sample collected downstream from the low head dam in Blackstone in 2001 (Site 299) included a total of 76 fish (13 species). The three most dominant species included bluegill (*L. macrochirus*), white sucker (*C. commersonii*), and fallfish (*Semotilus corporalis*). Six fluvial specialists/dependent species were present and represented approximately half of the sample. In light of the fact that there is a large impoundment (Tupperware) located a short distance upstream, the presence of macrohabitat generalists at this location is not surprising.

Water Chemistry

A dry weather study of water quality in the Blackstone Watershed was conducted from 2000-2003 (Wright et al 2004). Samples were collected at 24 sites on the Blackstone, Mumford, Quinsigamond and West Rivers on four dates under dry weather conditions. Insufficient data are currently available to complete the DWM external data validation process required for assessment decision.

MassDEP staff conducted water quality and bacteria monitoring in the river upstream from the "Tupperware Dam" (Station 8) in this segment to track the UBWPAD sewage spill (described in MA51-03) on October 3rd and 6th (Beaudoin 2003, Tamul 2005). The maximum temperature was 14.0°C, the DO was 8.9 mg/L or higher, and the pH varied little (6.9 to 7.1 SU).

DWM staff conducted monthly *in situ* and water quality monitoring in the Blackstone River at Bridge Street/Canal Street (upstream of dam), Blackstone (BS19) on five occasions between May and October 2003. Early morning DO measurements (between 03:34 and 10:05 am, n=5) ranged from 7.1 to 9.7 mg/L. The maximum water temperature was 23.6°C. Ammonia concentrations were low (maximum of 0.29 mg/L), and none exceeded the criteria. The total phosphorus concentrations were all elevated (i.e., >0.05 mg/L) ranging from 0.11 to 0.23 mg/L (Appendix B Tamul 2005).

This segment of the Blackstone River is assessed as impaired for the *Aquatic Life Use* based primarily on the flow fluctuations associated with the hydropower operations and the elevated total phosphorus concentrations. Documentation of the degraded benthic macroinvertebrate community and evidence of enriched conditions in the river just upstream from this segment further corroborate this assessment decision. Sources of impairment include impacts from hydrostructure flow regulation/modification, upstream sources, and discharges from municipal separate storm sewer systems (MS4).

Fish Consumption Use

Fish were collected by DWM biologists from the Tupperware Dam impoundment of the Blackstone River in 1993 and again in 2008 and were analyzed for mercury, PCBs, and organochlorine pesticides (Maietta 2007). DPH issued a fish consumption advisory due to PCB contamination for the Blackstone River impoundment (Millville Pond Impoundment) above the Blackstone Gorge, Blackstone as follows:

"Children under 12, pregnant women and nursing mothers should refrain from consuming any fish from the Blackstone River Impoundment above the Blackstone Gorge in order to prevent exposure of developing fetuses, nursing infants and young children to PCBs, and The general public should refrain from consumption of carp and white suckers from the Blackstone River Impoundment above the Blackstone Gorge".

Based on the MA DPH fish consumption advisory due to elevated levels of PCB in edible fish filets from the Tupperware Dam impoundment ("*Blackstone River above Blackstone Gorge*"), the *Fish Consumption Use* is assessed as impaired for the upper 1.8 mile reach of this segment of the Blackstone River. The lower 2.0 mile reach of this segment is not assessed for this use.

Primary and Secondary Contact Recreational and Aesthetics Uses

There are several designated canoe trips located within this segment, as shown at <http://www.nps.gov/archive/blac/discover/getontheriver.htm> (NPS 2009).

In 2003, MassDEP DWM collected six *E. coli* samples from the Blackstone River at Bridge Street/Canal Street (upstream of dam), Blackstone (BS19) during the primary contact season (Appendix B). The geometric mean of the six samples was 106 cfu/100ml, and bacteria values ranged from 19 to 1200 cfu/100 ml (n=6). The highest count (1,200 cfu/100 ml on 23 July), representing wet weather conditions, is noted as a concern. Aesthetic conditions were noted on these surveys, and generally no problems were identified although bottom substrates were unobservable due to water depths (MassDEP 2003).

MassDEP staff conducted water quality and bacteria monitoring to track the UBWPAD sewage spill (described in MA51-03) on October 3rd and 6th (Beaudoin 2003). Date collected on October 2nd, before the spill occurred, exhibited an *E. coli* level of 250 cfu/100 ml. On October 3rd, *E. coli* at the Blackstone Gorge (above the Rolling Dam) was 38 cfu/100 ml. By October 6th, *E. coli* at this location was 2,700 cfu/100 ml.

Record levels of rainfall in October 2005 (15.65 inches) caused the Blackstone River to rise to nearly 100 times its normal volume (Larrabee 2005; NWS 2009). As a result, bar racks at the Upper Blackstone Water Pollution Abatement District became clogged, causing the release of more than 90 million gallons of raw sewage (over a

14-hour) period to the river. MassDEP conducted bacteria sampling to evaluate the impact of the release on the river. The result of the *E. coli* sample collected at the Blackstone Gorge in Blackstone was 517.2 cfu/100 ml (Connors 2005).

The Blackstone River Watershed Association in conjunction with Blackstone River Coalition recorded aesthetic observations at two sites within this segment in 2004, 2005 and 2006, monthly from April through November, as part of their ongoing volunteer water quality monitoring program (Gilpatrick 2007). At the Blackstone River site upstream of Staples Lane in Blackstone, the water column was typically clear and odor-free, with a light presence of trash noted. At the confluence of Fox Brook with the Blackstone River at Main Street in Blackstone, the water column was typically clear and odor-free, with a heavy trash presence.

The *Primary* and *Secondary Contact Recreational* and *Aesthetics* uses are assessed as support for this segment of the Blackstone River. The *Primary Contact Recreational Use* is identified with an Alert Status because of the elevated bacteria during a wet weather sampling event. Given the aesthetically objectionable conditions in the river upstream from this segment (trash/debris and effluent odors), the *Recreational* and *Aesthetics* uses are also identified with an alert status.

Blackstone River (MA51-06) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Other flow regime alterations, elevated total phosphorus Source: Impacts from hydrostructure flow regulation/modification, upstream sources, and discharges from municipal separate storm sewer systems (MS4)
Fish Consumption		IMPAIRED (upper 1.8 mile reach of Blackstone River Impoundment above the Blackstone Gorge) Cause: PCB in fish tissue Source: Unknown Suspected source: Contaminated sediments NOT ASSESSED* lower 2.0 miles
Primary Contact		SUPPORT*
Secondary Contact		SUPPORT*
Aesthetics		SUPPORT*

* Alert Status issues identified, see details in use assessment

RECOMMENDATIONS:

MA DPH should re-evaluate their fish consumption advisory due to elevated PCBs for the Blackstone River due to the fact that there are advisories on many impoundments and there are essentially no barriers to migration on the upstream side of these impoundments.

Requirements should be placed in the FERC hydropower project license at the old Tupperware Mill facility to ensure adequate flows in the river through the gorge for aquatic life.

SPRING BROOK (MA51-25)

Location: Headwaters, north of Lovell Street, Mendon to confluence with Muddy Brook, Mendon.
Size: 1.9 Miles
Classification: B
2008 303(d) List: Category

This is a new segment so there is no prior listing in the 2008 Integrated List of Waters.

This segment is listed on the Massachusetts Coldwater Fishery Resource List as established by the Massachusetts Department of Fish and Game (2007).

NPDES (APPENDIX H, Table H2):

Town of Mendon (MAR041133)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

In Sept 2003 DWM biologists conducted backpack electroshocking in Spring Brook downstream of Providence Street, Mendon (SB01). Habitat quality was limited mostly by the low flow conditions.

Biology

DWM biologists collected fish in Spring Brook further downstream of Providence Street, Mendon (SB01) in September 2003. Species captured in order of abundance included tessellated darter (*Etheostoma olmstedii*), white sucker (*Catostoma commersonii*), and multiple age classes of brook trout (*Salvelinus fontinalis*) (Appendix D). All species collected from Spring Brook are considered fluvial specialists or dependants. Brook trout are intolerant to environmental stressors and the presence of multiple age classes suggests successful reproduction and is indicative of excellent water and habitat quality.

The *Aquatic Life Use* is assessed as support due to the dominance of fluvial species and intolerant species (brook trout, *S. fontinalis*), which is indicative of excellent water and habitat quality.

Primary and Secondary Contact Recreational and Aesthetics Uses

The *Aesthetics Use* is assessed as support since no objectionable conditions were noted by DWM biologists.

Spring Brook (MA51-25) Use Summary Table

Designated Uses	Status
Aquatic Life 	SUPPORT
Fish Consumption 	NOT ASSESSED
Primary Contact 	NOT ASSESSED
Secondary Contact 	NOT ASSESSED
Aesthetics 	SUPPORT

RECOMMENDATIONS

Future monitoring should include macroinvertebrates and be expanded to document the extent of this cold water fishery. This waterbody should be given consideration for designation as a Cold Water Fishery. Temperature monitoring should also be conducted.

MILL RIVER (MA51-35)

Location: Outlet North Pond, Milford/Upton to Mendon/Blackstone corporate boundary, MA. (through former segments Fiske Millpond MA51049, Mill Pond MA51102, Hopedale Pond MA51065, and Spindleville Pond MA51158)(formerly part of MA51-10)

Size: 11.8 Miles

Classification: B\WWF

2008 303(d) List: Category 5

This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Priority organics, Metals) (MassDEP 2008a).

The following water bodies will no longer be reported as lake segments, they will be considered run of the river impoundments (McVoy 2006):

Fiske Mill Pond (MA51049), approximate size: 19 acres, approximate retention time: 3 days

Mill Pond (MA51102), approximate size: 20 acres, approximate retention time: 11 days

Hopedale Pond (MA51065), approximate size: 88 acres, approximate retention time: less than ten days

Spindleville Pond (MA51158), approximate size: 2 acres, approximate retention time: less than one day

The retention time estimates were based on the annual historical mean discharge from two stream gages in the Blackstone River Basin (01110000 and 01124500) and the normal storage volume of the dams reported by DCR in their Massachusetts Dam Safety Program Database (Socolow et al. 2004 and DCR 2002).

Fiske Mill Pond (MA51049) is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Noxious aquatic plants, (Exotic species*)). * denotes a non-pollutant.

Mill Pond (MA51102) is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed

Hopedale Pond (MA51065) is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Exotic species*). * denotes a non-pollutant.

Spindleville Pond (MA51158) is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Priority organics, Noxious aquatic plants).

WMA with surface water source(s) (APPENDIX H, Table H1):

Hopedale Country Club (21213801)

NPDES (APPENDIX H and Table H2):

Town of Milford (MAR041135)

Town of Hopedale (MAR041123)

Town of Mendon (MAR041133)

Town of Hopedale Board of Water & Sewer Commission (MA0102202)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

Low flow was observed within this segment by Blackstone River Watershed Association volunteer monitors at Fitzgerald Drive in Hopedale on 8/12/2006, and upstream of the Mill St. Bridge in Hopedale on 8/13/2005, the stream was stagnant at this same location on 9/10/2005 (Gilpatrick 2007).

Spindleville Pond is an impoundment of the Mill River in Hopedale, with a dam located at the Mill Street Bridge. Local watershed advocates have noted recurring issues there, including frequent algal blooms, floating brown clumps, and suspended white particles. In addition, an increase in aquatic plants, turbidity and fish kills were also noted (Mateleska 2004). In response, MassDEP CERO staff conducted a site visit of the reach of the Mill River between Route 16 and Mill Street in Hopedale (Beaudoin 2004a). The Mill River at Route 16 was clear, with no odors, sheens, color, foam, and low turbidity (Beaudoin 2004a). From the shore, Spindleville Pond was covered with a layer of pollen-like material, with small pockets of petroleum sheens near shore. Dense emergent vegetation was noted, including smartweed, duckweed, water meal, purple loosestrife, cattails, grasses, arrow arum, arrowhead, pondweed and rush.

MassDEP CERO staff conducted an in-lake investigation on 23 Sept 2005 and observed that Spindleville Pond near Mill Street was covered with dense aquatic macrophytes including milfoil, duckweed, water meal, arrowhead, arrow arum, cattails, pickerelweed, yellow water lily and “thick bubbling algae” (Beaudoin 2005a). In a cove behind the Laurel Woods condominium complex (on the western shore), the pond was very shallow, and an oily sheen with a slight petroleum odor was noted. Throughout Spindleville Pond, such sheens were observed in cove areas outside of the main current. In many areas of the impoundment, the water column was described as milky. Upstream of the impoundment, the Mill River was moderately milky, with an increase in trash. The “clumps” of organic material were rooted submergent vegetation that had been uprooted and colonized by algae, duckweed and water meal. At the upper end of the pond, disturbed sediments released strong effluent and petroleum odors. A subsequent investigation with MassDEP DWM staff resulted in the conclusion that the milky white suspended particles may be the calcareous skeletons of diatomaceous plankton following a die-off. At several locations on the east side of Spindleville Pond, sedimentation is occurring at a rapid rate below storm drains; emergent vegetation has colonized the deltas deposited at the end of the pipes, encroaching on historically open water areas.

Biology

In 2009, the Mill River in Milford and Mendon was stocked with trout (MA DFG 2009).

In July and August 2001 MA DFG biologists conducted electrofishing (backpack and barge) at four sites in the Mill River (MADFG 2008). The fish assemblage in the upper reach near Camp Street Extension in Milford/Upton (Sample ID 442) was poor (only two fish collected). At the sampling station near Nelson Street, Hopedale (Sample ID 450), despite good habitat, only 12 fish were collected and all but one fish were macrohabitat generalists. The sample collected near Hartford Avenue, Hopedale/Mendon (Sample ID 414) was dominated by fluvial species (tessellated darter, *Etheostoma olmstedi*, white sucker, *Catostomus commersonii* and fallfish, *Semotilus corporalis*) however sampling efficiency and numbers of fish were low. Sampling efficiencies were also noted as being less than optimal at the downstream location (North of Colonial Drive, Mendon - Sample ID 413). This site had a mix of fluvial specialist/dependent and macrohabitat generalist species, although macrohabitat generalists dominated. Noteable, however, is that American brook lamprey (*Lampetra appendix*) habitat was good although sampling efficiency for this species was poor.

A non-native species (*Myriophyllum heterophyllum*) was observed in Fiske Mill Pond during the 1994 synoptic surveys (MassDEP 1994).

Two non-native species (*Cabomba caroliniana*, *Myriophyllum heterophyllum*) were observed in Hopedale Pond during the 1998 synoptic surveys (MassDEP 1998).

Toxicity

Effluent

Modified acute and chronic whole effluent toxicity tests using *C. dubia* were conducted on the Hopedale WWTP treated effluent between February 2000 and March 2008. No acute whole effluent toxicity was detected (all LC_{50s} > 100% effluent, n=34). Chronic whole effluent toxicity results ranged from <6.25 to 100% effluent and was <57% effluent (the permit limit) in 6 of the 31 valid chronic tests (CNOEC <6.25% effluent in August 2001, CNOEC =12.5% effluent in August 2005, May and November 2006, and CNOEC =50% effluent in February 2005 and March 2006).

Water Chemistry

DWM staff conducted monthly in-situ and water quality monitoring at one site in this segment of the Mill River, at Route 16 (Mendon Street), Hopedale (ML01) on five occasions between May and October 2003. Early morning DO measurements in the river at Route 16 (between 04:23 and 11:17, n=5) ranged from 6.9 to 9.9 mg/L and the other physico-chemical monitoring data were indicative of good conditions. The maximum water temperature was 23.6°C. The total phosphorus concentrations ranged from 0.017 to 0.052 mg/L (one of the five measurements was >0.05 mg/L) (Appendix B, Tamul 2005).

The *Aquatic Life Use* is assessed as impaired for 1.8 mile combined reaches through Fiske Mill and Hopedale ponds due to the infestation with non-native aquatic macrophytes (either *M. heterophyllum* and/or *C. caroliniana*). The *Aquatic Life Use* is assessed as support for the remaining 10.0 miles of the Mill River segment based primarily on the water quality data, although this use is identified with an Alert status due to the relative scarcity of fluvial fish species (although sampling efficiencies were poor), the continuing issues with occasional chronic

toxicity associated with the Hopedale WWTP discharge and evidence of eutrophication problems in Spindleville Pond.

Fish Consumption Use

Fish were collected by DWM biologists from several sites along the Mill River in 1990 and were analyzed for metals and PCBs (Maietta 2007). MA DPH issued a fish consumption advisory due to PCB contamination for the Mill River in Hopedale as follows: *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* (MA DPH 2009).

It should be noted that PCB levels in edible fish fillets collected from Hopedale Pond in 1990 were below quantifiable levels whereas PCB levels from Spindleville Pond (approximately 1.7 miles downstream from Hopedale Pond) exceeded the MA DPH trigger level of 1.0 ppm. The current advisory on the Mill River will likely be modified to specify the reach between the outlet of Hopedale Pond and the Spindleville Impoundment Dam (Maietta 2001).

Although not included in the current advisory, it should be also be noted that elevated mercury concentrations (exceeding MA DPH trigger level of 0.5 ppm) were detected in fish from Hopedale Pond as well as a station in the Mill River in the town of Blackstone. Since the time of the original advisory for Mill River, the trigger level for mercury was lowered. The MA DPH has been notified of the apparent discrepancy between the mercury data and the current advisory (Maietta 2001).

MA DPH is currently re-evaluating the data for a potential modification to the existing advisory. Based on the elevated levels of PCB in edible fish fillets from Spindleville Pond, the *Fish Consumption Use* is assessed as impaired for the 1.7 mile length of the Mill River between the outlet of Hopedale Pond and the Spindleville Pond Dam, Hopedale. The remaining 10.1 miles in this segment are not assessed for this use, although this use is identified with an Alert status because of elevated mercury in fish collected in Hopedale Pond.

Primary and Secondary Contact Recreational and Aesthetics Uses

In 2003, MassDEP DWM collected five *E. coli* samples from one site in this segment of the Mill River, at Route 16 (Mendon Street), Hopedale (ML01) during the primary contact recreation season (Appendix B). The geometric mean of the five samples was 116 (counts ranged from 26 to 2000 cfu/100 mls). The highest count was associated with a wet weather sampling event. Generally no aesthetically objectionable conditions (e.g., odors, oils, turbidity, growths, deposits) were observed by DWM staff (MassDEP 2003).

Working with MassDEP's Central Regional Office (CERO), DWM responded to a report of objectionable color and turbidity in Spindleville Pond (Hopedale). Conditions observed included: high turbidity; strong effluent odors in the water and petroleum odors from disturbed sediments in some areas; algal blooms; dense submergent, floating and emergent aquatic vegetation; filamentous algal mats floating in the water column and attached to aquatic vegetation and the pond bottom; areas of a milky white substance suspended in the water column; sedimentation near drainage pipes; and trash (Beaudoin 2004a, 2005). A local watershed advocate has reported a small tributary on the northeast side of Spindleville Pond that conveys large slugs of foam to the Mill River (Neely 2005). The source of the foam is unknown.

The Blackstone River Watershed Association in conjunction with Blackstone River Coalition recorded aesthetic observations at four sites on this segment of the Mill River in 2004, 2005 and 2006, monthly from April through November, as part of their ongoing volunteer water quality monitoring program (Gilpatrick 2007). At Fitzgerald Drive in Hopedale, the stream was typically clear with light to heavy trash; infrequent observations included odors (swampy, rotten egg), and foam. On 7/8/2006 the presence of a boom across the river was noted; the boom was present through the end of the 2006 sampling season. At Thwing Street in Hopedale the stream was frequently noted as foamy with light trash. At the outlet of Spindleville Pond at the Mill Street Bridge in Hopedale, the water was typically dark brown with a light presence of trash; infrequent oily sheens and odors (swampy, fishy, rotten egg) were also noted. At Providence Road upstream of Deer Hill Road in Mendon, the stream was typically clear and odor-free with a light to heavy density of aquatic vegetation.

The *Primary and Secondary Contact Recreational Uses* are assessed as support. An Alert status is identified for the *Primary Contact Recreational* use due to an elevated bacteria count during a wet weather event. The *Aesthetics Use* is also assessed as support since objectionable conditions noted by DWM and CERO staff and

volunteers appear to be spatially isolated. An Alert status is applied to the *Recreational* and *Aesthetic Uses* to the river through Spindleville Pond based on the observations of objectionable conditions (colors, odors, dense algal and macrophytic growth) as well as the presence of trash throughout the segment.

Mill River (MA51-35) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED (1.8 miles, Fiske Mill and Hopedale Ponds) Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism SUPPORT*(remaining 10.0 miles)
Fish Consumption		IMPAIRED (1.7 mile reach, outlet of Hopedale Pond to outlet of Spindleville Pond, Hopedale) Cause: PCB in fish tissue Source: Unknown NOT ASSESSED* remaining 10.1 miles
Primary Contact		SUPPORT*
Secondary Contact		SUPPORT*
Aesthetics		SUPPORT*

* Alert Status issues identified, see details in use assessment

RECOMMENDATIONS

River water should be collected upstream from the Hopedale WWTP discharge and used as dilution water in the facility's whole effluent toxicity tests. The frequency of the facility's problems with chronic whole effluent toxicity (19% of their test events) is of concern although most violations occurred in 2005/2006.

Fish from Hopedale Pond and the Mill River should be collected and analyzed for mercury in edible tissues.

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

Reduce sedimentation inputs to the east side of Spindleville Pond resulting from stormwater discharges.

Conduct stream cleanups to address trash issues throughout this segment.

Conduct investigation(s) to determine the source(s) of petroleum sheens and foam.

MILL RIVER (MA51-36)

Location: From Mendon/Blackstone corporate boundary to MA/RI border, Blackstone, MA (through former segment Harris Pond MA51058)(formerly part of MA51-10)
Size: 4.4 Miles
Classification: B\WWF\TWS
2008 303(d) List: Category 5

This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Priority organics, Metals) (MassDEP 2008a).

Harris Pond will no longer be reported as a lake segment, it will be considered a run of the river impoundment (McVoy 2006):

Harris Pond (MA51058), approximate size: 93 acres, approximate retention time: 7 days

The retention time estimate was based on the annual historical mean discharge from two stream gages in the Blackstone River Basin (01110000 and 01124500) and the normal storage volume of the dam reported by DCR in their Massachusetts Dam Safety Program Database (Socolow et al. 2004 and DCR 2002).

Harris Pond (MA51058) is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Noxious aquatic plants, (Exotic species*)). * denotes a non-pollutant.

NPDES (APPENDIX H, Table H2):

Town of Blackstone (MAR041093)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

In 2009, the Mill River in Blackstone was stocked with trout (MA DFG 2009).

In July 2001 MA DFG biologists conducted electrofishing (barge) at one site in this segment of the Mill River located north of Summer Street, Blackstone (Sample ID 415) (MADFG 2008). Sampling efficiency was noted as being less than optimal. There was a mix of fluvial specialist/dependent and macrohabitat generalist species, although macrohabitat generalists dominated slightly. It should be noted that longnose dace (*Rhinichthys cataractae*) were present at this location and that this is one of the few stations in eastern Massachusetts where this species has been documented.

A non-native species (*Cabomba caroliniana*) was observed in Harris Pond during the 1998 synoptic surveys (MassDEP 1998).

Water Chemistry

DWM staff conducted monthly in-situ and water quality monitoring at Summer Street, Blackstone (BLK15-1) on five occasions between May and October 2003. All of the physico-chemical monitoring data were indicative of good conditions (n=5) although the total phosphorus concentrations were occasionally elevated (ranging from 0.027 to 0.11 mg/L with two of the five measurements >0.05 mg/L). The maximum temperature was 21.0°C (Appendix B, Tamul 2005).

USGS also conducted water quality monitoring at Summer Street in Blackstone from 2000 through 2004 (USGS 2009b). Monitoring was conducted mainly during mid-afternoon hours, and analyzed for *in situ* parameters (temperature, pH, conductivity, DO), as well as turbidity, chloride, and nutrients (ammonia and total phosphorus). All results were similar to those measured by DWM staff. Total phosphorus values ranged from 0.035 to 0.065 mg/L, with 4 values >0.05 (n=11).

The *Aquatic Life Use* is assessed as impaired for the 1.7 mile reach through Harris Pond due to the infestation with a non-native aquatic macrophyte (*C. caroliniana*). The *Aquatic Life Use* is assessed as support for the remaining 2.7 miles of this Mill River segment based primarily on the water quality data. An Alert status has been identified due to occasional elevated total phosphorus and the relatively low number of fluvial fish species.

Fish Consumption Use

Fish were collected by DWM biologists from several sites along the Mill River in 1990 and were analyzed for metals and PCBs (Maietta 2007).

Slightly elevated concentrations of mercury were detected in a sample of bluegill (*Lepomis macrochirus*) collected in the Mill River upstream of Summer Street in Blackstone. At the time these data were collected, the trigger level for mercury was 1.0 ppm; as the data did not exceed this level, no mercury advisory was issued. However, the MA DPH trigger level has been lowered to 0.5 ppm, and these data are in exceedance of the new trigger. The MA DPH has been notified of the apparent discrepancy between the mercury data and the lack of a mercury advisory for this segment (Maietta 2001).

MA DPH is currently re-evaluating the fish toxics monitoring data for a potential modification to the existing advisory. The *Fish Consumption Use* is not assessed for this segment of the Mill River but is identified with an Alert status because of elevated mercury in fish collected from the Mill River in the town of Blackstone.

Primary and Secondary Contact Recreational and Aesthetics Uses

In 2003, MassDEP DWM collected five *E. coli* samples from Summer Street, Blackstone (BLK15-1) during the primary contact recreation season (Appendix B). The geometric mean of the five samples was 154 cfu/100 ml (counts ranged from 39 to 3600 cfu/100 mls). The highest count was associated with a wet weather sampling event. Generally no aesthetically objectionable conditions (e.g., odors, oils, turbidity, growths, deposits) were observed by DWM staff (MassDEP 2003).

The Blackstone River Watershed Association in conjunction with Blackstone River Coalition recorded aesthetic observations at one site in this segment of the Mill River in 2004, 2005 and 2006, monthly from April through November, as part of their ongoing volunteer water quality monitoring program (Gilpatrick 2007). Upstream of Park Street at Saint Valati Park in Blackstone, the water column was described as clear and odor-free with light trash and aquatic vegetation present on most sampling dates.

The *Primary Contact Recreational Use* is assessed as impaired due to elevated *E. coli* bacteria. The *Secondary Contact Recreational Use* is assessed as support, although an Alert status is identified due to an elevated bacteria count during a wet weather event. The *Aesthetics Use* is also assessed as support; however the presence of light trash near Park Street is noted as a concern.

Mill River (MA51-36) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED 1.7 mile reach through Harris Pond Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism SUPPORT* remaining 2.7 miles
Fish Consumption		NOT ASSESSED*
Primary Contact		IMPAIRED Cause: Elevated <i>E. coli</i> bacteria Source: Unknown Suspected sources: Unspecified urban stormwater, waterfowl
Secondary Contact		SUPPORT*
Aesthetics		SUPPORT

* Alert Status issues identified, see details in use assessment

RECOMMENDATIONS

Fish from the Mill River should be collected and analyzed for mercury in edible tissues.

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in

unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

PETERS RIVER (MA51-18)

Location: Outlet Silver Lake, Bellingham to Rhode Island state line, Bellingham.
Size: 4.0 Miles
Classification: B
2008 303(d) List: Category 5

This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Metals, Pathogens) (MassDEP 2008a).

MA DFG identifies this waterbody as a "Cold Water Fishery Resource" (MA DFG 2007).

NPDES (APPENDIX H, Table H2):

Bellingham (MAR041091)

In June 2001 MA DFG biologists conducted backpack electrofishing in tributary in the upper Peters River subwatershed area (West of Lake Street – Sample ID 445). The fish sample was comprised of tessellated darter (*Etheostoma olmstedti*), brook trout (*Salvelinus fontinalis*)(multiple age classes), and an individual redbfin pickerel (*Esox americanus*) and chain pickerel (*Esox niger*)(MADFG 2008).

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

In June 2001 MA DFG biologists conducted backpack electrofishing at two sites along the Peters River; south of King Street, Bellingham (Sample ID 553) and near Crooks Corner Road (Sample ID 535). The fish samples were comprised of multiple age classes of brook trout (*S. fontinalis*), tessellated darter (*E. olmstedti*), white sucker (*Catostomus commersonii*), and stocked brown trout (*Salmo trutta*) at the upstream location and tessellated darter, brook trout, and redbfin pickerel (*E. americanus*) at the downstream location. American brook lampreys (*Lampetra appendix*) were also collected at both sampling locations (MA DFG 2008).

Water Chemistry

DWM staff conducted monthly *in-situ* and water quality monitoring in the Peters River at Paine Street, Bellingham (PR01) on five occasions between May and October 2003 (Appendix B). Early/mid morning DO measurements (between 03:52 and 10:40 am, n=5) ranged from 6.1 to 9.6 mg/L and the other physico-chemical monitoring data were generally indicative of good conditions. The maximum water temperature was 21.1°C. The maximum TP concentration was elevated 0.24 mg/L on one sampling date (23 July) although the other four measurements were ≤0.041 mg/L (Appendix B Tamul 2005). On the sampling date when TP was elevated, the water column was noted as being very cloudy and grayish and total suspended solids were also notably high (59 mg/L). This survey date was considered to be representative of wet weather conditions.

The *Aquatic Life Use* is assessed as support based on the water quality and fish population information. The presence of multiple age classes of brook trout (*S. fontinalis*) and the dominance by fluvial specialist/dependent species is indicative of excellent water and habitat quality. Elevated total phosphorus and suspended solids in the lower reach of the river (Paine Street) are noted as a concern.

Primary and Secondary Contact Recreational and Aesthetics Uses

In 2003, MassDEP DWM collected six *E. coli* samples from the Peters River near Paine Street in Bellingham (PR01) during the primary contact season (Appendix B). The geometric mean of the six samples was 517 cfu/100 ml. The highest count (6,200 cfu/100 ml on 23 July), representing wet weather conditions, is noted as a concern. With the exception of one sampling event (23 July when the river was highly turbid/grayish/cloudy) no aesthetically objectionable conditions (e.g., odors, oils, turbidity, growths) were observed by the sampling crews (MassDEP 2003).

A bacteria source tracking study was conducted by DWM staff along the Peters River in 2004 (Duerring *et al.* 2004). Between April and September samples were collected from three locations in the Peters River between the outlet of Silver Lake downstream to Pulaski Boulevard. *E. coli* results were generally low in this reach of the river (geometric means were all <46 cfu/100 ml). Counts ranged from 1 to 488 cfu/100 ml. The three sampling locations in the Peters River downstream from Pulaski Boulevard, however, all exhibited elevated *E. coli* bacteria (geometric means ranged from 287 to 512 cfu/100 ml) with the highest counts at the most downstream sampling location at Paine Street (counts at this site ranged from 24 to 2420 cfu/100 ml). Four of the 14 samples (29%) collected from the river at Paine Street as part of the bacteria source tracking study exceeded 1260 cfu/100 ml

(one of the secondary contact recreational use criteria). DWM staff generally did not observe objectionable conditions (e.g., odors, visual turbidity, nuisance growths of macrophytes or periphyton) during the bacteria source tracking surveys along the Peters River from April through September 2004 (MassDEP 2004). The results of the bacteria source tracking in the river are as follows (excerpt from Duerring *et al.* 2004):

Results: In the lower most section of the mainstem Peters River, E. coli counts were consistently elevated during both wet and dry weather. Stream walks and optical brightener testing did not indicate obvious potential human sources, however under an upstream bridge crossing, large numbers of pigeons, pigeon droppings and bird nests were observed. E. coli counts measured upstream of the bridge were always lower than downstream of the bridge, so elevated counts in this section of the Peters River were presumed to be, at least in part, from the birds.

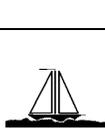
It should also be noted that sampling in Arnolds Brook, a tributary to the lower reach of the Peters River, consistently showed elevated *E. coli* counts resulting from commercial animal pens adjacent to the brook and illicit connections to the storm drain system (Duerring *et al.* 2004).

In 2006, a surcharging manhole resulted in raw sewage reaching the Peters River in Bellingham (Holland 2006). Residents noted that overflowing sewers occurred infrequently in the Pine Grove Ave/Deer Run Estates neighborhood, in which sewage wastes reached the river and nearby wetlands. The sewer pump station on Wrentham Street in Bellingham has also had repeated problems with clogging of pumps with rags (Webber 2009).

The Blackstone River Watershed Association in conjunction with Blackstone River Coalition recorded aesthetic observations at one site within this segment in 2004, 2005 and 2006, monthly from April through November, as part of their ongoing volunteer water quality monitoring program (Gilpatrick 2007). At the Peters River site downstream of Paine Street in Bellingham, the water column was generally clear and odor-free with light trash present.

The *Primary* and *Secondary Contact Recreational* uses are assessed as support in the upper 1.8 mile reach (Outlet of Silver Lake to Pulaski Boulevard in Bellingham) based on the low *E. coli* bacteria counts and the lack of objectionable conditions. The *Primary* and *Secondary Contact Recreational* uses are assessed as impaired for the lower 2.2 mile reach of the Peters River (downstream from Pulaski Boulevard to the Rhode Island State Line) because of elevated *E. coli* bacteria resulting in part from runoff from animal pens and illicit discharges to storm drains in Arnolds Brook (a tributary to this reach of the Peters River) as well as pigeon loft influence under the bridge. The occasional problems with sewer overflows (resulting in part from pump station problems) likely contribute to the problem. The *Aesthetics Use* is assessed as support based on the general lack of objectionable conditions observed by DWM staff and BRC volunteers.

Peters River (MA51-18) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT upper 1.8 miles IMPAIRED lower 2.2 miles Cause: Elevated <i>E. coli</i> bacteria Source: Illicit Connections/Hook-ups to Storm Sewers, Upstream sources (Arnolds Brook), Sanitary Sewer Overflows (Collection System Failures)
Secondary Contact		SUPPORT upper 1.8 miles IMPAIRED lower 2.2 miles Cause: Elevated <i>E. coli</i> bacteria Source: Illicit Connections/Hook-ups to Storm Sewers, Upstream sources (Arnolds Brook), Sanitary Sewer Overflows (Collection System Failures)
Aesthetics		SUPPORT

RECOMMENDATIONS

Additional monitoring (benthic macroinvertebrate, fish and thermal) should be conducted. In light of the presence of multiple age classes of brook trout (*S. fontinalis*), this waterbody should be given consideration for designation

as a Cold Water Fishery. In addition it should be noted that this river supports the American brook lamprey (*Lampetra appendix*), a native state threatened species.

Conduct additional bacteria and source tracking monitoring to identify and remediate sources contributing to elevated *E. coli* bacteria in the Peters River downstream from Polaski Boulevard in Bellingham.

ARNOLDS BROOK (MA51-32)

Location: Perennial portion only, from outlet of unnamed pond at Whitehall Way, Bellingham to confluence with Peters River, Bellingham.
Size: 1.7 Miles
Classification: B
2008 303(d) List: Category

This is a new segment so there is no prior listing in the 2008 Integrated List of Waters.

NPDES (APPENDIX H, Table H2):
Bellingham (MAR041091)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

In July 2007 MA DFG biologists conducted backpack electrofishing in Arnold Brook downstream of Pulaski Boulevard, Bellingham (Sample ID 2319). The fish sample was comprised of white sucker (*Catostomus commersoni*), brook trout (parr) (*Salvelinus fontinalis*), bluegill (*Lepomis macrochirus*), golden shiner (*Notemigonus crysoleucas*) and redfin pickerel (*Esox americanus*). The majority (24 of the 27 fish collected) were white sucker and brook trout (both of which are fluvial specialist/dependent species) (MADFG 2008). In addition, brook trout are intolerant to environmental stressors and the presence of brook trout parr suggests successful reproduction and is indicative of excellent water and habitat quality.

The *Aquatic Life Use* is assessed as support based on the fish population information. The dominance of fluvial specialist/dependent species and the presence of intolerant species (brook trout, *S. fontinalis*) is indicative of excellent water and habitat quality.

Primary and Secondary Contact Recreational and Aesthetics Uses

A bacteria source tracking study was conducted by DWM staff along Arnolds Brook in 2004 (Duerring *et al.* 2004). Samples were conducted at numerous locations from April through September. Upstream from Lizotte Drive *E. coli* results were generally low, ranging from 39 to 137 cfu/mL although few samples were collected from this reach of the brook. Many more samples were collected at sites downstream from Lizotte Drive with geometric means at sampling siting ranged from 213 to 845 cfu/100 ml. Two sites consistently showed elevated *E. coli* counts: downstream of Pulaski Boulevard and at Pine Grove Avenue. Two sources of bacteria were identified as described below (excerpt from Duerring *et al.* 2004):

Results: Elevated bacteria counts in Arnolds Brook near Pulaski Boulevard were attributed to runoff from commercial animal pens containing ducks, geese, chickens, pigs and goats that were located just upstream from the screening level sampling station. Negative optical brightener tests supported this conclusion.

Results: Source tracking staff located a stormwater pipe discharging to Arnolds Brook at Pine Grove Avenue that was contaminated with sewage presumed to be from an illicit discharge to the storm drain system from one or more residences in the upstream unsewered neighborhood. High E. coli bacteria numbers, combined with strong positive optical brightener results that confirmed the presence of laundry detergent, indicated that the bacteria were likely from human sewage input(s). Sewage fungus was also observed on the streambed below the stormwater pipe outfall.

Outcome: Frequent communication and cooperation with the Bellingham DPW was required to track the source of laundry water and sewage by intensively sampling the storm drains via manholes and bracketing suspected areas. Bellingham is continuing to survey the storm drain system using a video camera and has narrowed the source to within just a few residences.

DWM staff conducted bacteria source tracking surveys along Arnolds Brook from April through September 2004 (MassDEP 2004). Observations indicated the general absence of odors, a clear water column, and only rare occurrences of periphytic growth and aquatic macrophytes.

The *Primary and Secondary Contact Recreational Uses* are assessed as impaired for Arnolds Brook because of elevated *E. coli* bacteria. Sources include runoff from animal pens and illicit discharges to storm drains. The *Aesthetics Use* is assessed as support based on the lack of objectionable conditions (e.g., odors, turbidity, nuisance growths).

Arnolds Brook (MA51-32) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT
Fish Consumption		NOT ASESSED
Primary Contact		IMPAIRED Cause: Elevated <i>E. coli</i> bacteria Source: Illicit Connections/Hook-ups to Storm Sewers, Livestock (Grazing or Feeding Operations)
Secondary Contact		IMPAIRED Cause: Elevated <i>E. coli</i> bacteria Source: Illicit Connections/Hook-ups to Storm Sewers, Livestock (Grazing or Feeding Operations)
Aesthetics		SUPPORT

RECOMMENDATIONS

Additional monitoring (benthic macroinvertebrate, fish and thermal) should be conducted. In light of the presence of brook trout parr (*S. fontinalis*), this waterbody should be given consideration for designation as a Cold Water Fishery.

SINGLETERARY BROOK (MA51-31)

Location: Headwaters, outlet Singletary Pond, Millbury to confluence with the Blackstone River, Millbury (excluding the approximately 0.4 miles through Brierly Pond segment MA51010).
Size: 1.5 Miles
Classification: B
2008 303(d) List: Category

This is a new segment so there is no prior listing in the 2008 Integrated List of Waters.

NPDES (APPENDIX H, Table H2):
 Millbury (MAR041136)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

In September 2001 DFG biologists conducted backpack electrofishing in Singletary Brook just east of Route 146 in Millbury (sample ID 448) (MADFG 2008). Sampling resulted in the collection of 16 tessellated darter (*Etheostoma olmstedi*), two yellow bullhead (*Ameiurus natalis*) and one white sucker (*Catostomus commersonii*). Although fluvial species dominated the sample, numbers were low and habitat/water quality was described as poor.

Too limited data are available so the *Aquatic Life Use* is not assessed.

Primary and Secondary Contact Recreational and Aesthetics Uses

A bacteria source tracking study in 2004 was conducted by DWM staff in the Singletary Lake Subwatershed (Duerring *et al.* 2004). Between April and August samples were collected in Singletary Brook upstream from Harris Avenue in Millbury (n=8 sampling events) (just downstream from the outlet of Singletary Pond). *E. coli* results were generally low (counts ranged from <1 to 166 cfu/100 ml) and the geometric mean was 14 cfu/100 ml. DWM staff generally did not observe objectionable conditions (e.g., odors, visual turbidity, nuisance growths of macrophytes or periphyton) during the bacteria source tracking surveys in Singletary Brook between April through August 2004 (MassDEP 2004).

Although no bacteria or aesthetic problems were identified in the brook just downstream from the outlet of Singletary Pond, these data do not provide sufficient spatial coverage given the developed nature of the Singletary Brook subwatershed so the *Primary and Secondary Contact Recreational and Aesthetics* uses are not assessed.

Singletary Brook (MA51-31) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

GREENE BROOK (MA51-30)

Location: Headwaters, north of Linden Street, Douglas to confluence with Chockalog River, Douglas.
Size: 1.6 Miles
Classification: B
2008 303(d) List: Category

This is a new segment so there is no prior listing in the 2008 Integrated List of Waters.

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

In September 2003 MassDEP DWM biologists conducted backpack electrofishing in Greene Brook downstream from Perry Street in Douglas (GB01, Appendix D). Habitat quality was very good and was noted to be limited most by channel flow status and sediment deposition. The presence of a beaver (*Castor sp.*) dam upstream was noted as potentially contributing to low flows.

Biology

In September 2003 DWM biologists conducted backpack electrofishing in Greene Brook downstream from Perry Street in Douglas (GB01, Appendix D). The survey resulted in the collection of nine redbfin pickerel (*Esox americanus*), one golden shiner (*Notemigonus crysoleucas*), and one brown bullhead (*Ameiurus nebulosus*). All three are classified as tolerant macrohabitat generalists. In June 2006 MA DFG biologists also conducted backpack electrofishing in the brook in generally the same location (Sample ID 1574). The fish sample contained 14 individuals representing four species, redbfin pickerel (n=5), bluegill (*Lepomis macrochirus*)(n=4), fallfish (*Semotilus corporalis*)(n=4), and a golden shiner (MADFG 2008). Although the sample was dominated by macrohabitat generalists, a fluvial specialist species (fallfish), was present.

Too limited data are available so the *Aquatic Life Use* is not assessed. In light of the “optimal” instream cover for fish, the low numbers of fish and the absence of fluvial species in 2003 suggests the flow regime may be compromised by the upstream beaver activity so this use is identified with an alert status.

Primary and Secondary Contact Recreational and Aesthetics Uses

No objectionable conditions (e.g., color, turbidity, deposits) were noted by DWM or DFG biologists during the backpack electrofishing surveys in Greene Brook (Appendix D, MADFG 2008).

The *Primary and Secondary Contact Recreational Uses* are not assessed due to the lack of bacteria data. The *Aesthetics Use* is assessed as support since no objectionable conditions were noted by DWM and DFG biologists.

Greene Brook (MA51-30) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED*
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

* Alert Status issues identified, see details in use assessment

RECOMMENDATIONS

Additional monitoring (especially upstream of the beaver dam) would be helpful in more thoroughly documenting the fish community within Greene Brook (Appendix B).

CEDAR SWAMP BROOK (MA51-33)

Location: Headwaters, outlet Cedar Swamp, Uxbridge to confluence with Chockalog River, Douglas.
Size: 0.8 Miles
Classification: B
2008 303(d) List: Category

This is a new segment so there is no prior listing in the 2008 Integrated List of Waters.

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

In September 2003 MassDEP DWM biologists conducted backpack electrofishing in Cedar Swamp Brook downstream from Southeast Main Street (Douglas Pike) in Douglas (CSB01, Appendix D). Habitat quality was excellent.

Biology

In September 2003 DWM biologists conducted backpack electrofishing in Cedar Swamp Brook downstream from Southeast Main Street (Douglas Pike) in Douglas (CSB01, Appendix D). No fish were collected or observed. The water color was red and the temperature on the date of the survey was 16.5 °C. The brook drains Cedar Swamp, a large forested wetland associated with Chockalog and Cedar Swamp ponds in Uxbridge that are located a short distance upstream. The watershed near the ponds and swamp is mostly undeveloped; however, there is a new residential development just upstream from the sampled reach (Appendix D).

The *Aquatic Life Use* is assessed as impaired since no fish were observed or collected in the brook. Whether or not low flow issues during drought years and/or naturally occurring low pH (suspected) influenced the aquatic community is unknown.

Primary and Secondary Contact Recreational and Aesthetics Uses

No objectionable conditions (e.g., odors, turbidity, deposits of debris/floatables/trash) were noted by DWM biologists during the backpack electrofishing survey in Cedar Swamp Brook (Appendix D).

The *Primary and Secondary Contact Recreational Uses* are not assessed due to the lack of bacteria data. The *Aesthetics Use* is assessed as support since no objectionable conditions were noted by DWM biologists.

Cedar Swamp Brook (MA51-33) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Fishes bioassessment (absence of fish) Source: Unknown
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

TINKERVILLE BROOK (MA51-22)

Location: Perennial portion only, north of Walnut Street, Douglas to state line
Douglas, MA/Burrillville, RI.
Size: 2.3 Miles
Classification: B
2008 303(d) List: Category

This is a new segment so there is no prior listing in the 2008 Integrated List of Waters.

MA DFG identifies this waterbody as a “Cold Water Fishery Resource” (MA DFG 2007).

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

In September 2003 MassDEP DWM biologists conducted backpack electrofishing in Tinkerville Brook upstream from Hemlock Street in Douglas (Appendix D). Habitat quality was noted to be limited most by the lack of deep water habitats (limited velocity/depth combinations) and the limited riparian vegetative zone width along one bank due to the presence of a road. Some embeddedness of substrates from adjacent road runoff was also noted.

Biology

In June 2006 MA DFG biologists conducted backpack electrofishing in Tinkerville Brook near Chestnut Street in Douglas (Sample ID 1700). The fish sample contained only five individuals representing two species, two age classes of brook trout (*Salvelinus fontinalis*) and redbfin pickerel (*Esox americana*) (MADFG 2008). The fish sample collected by DWM biologists in the brook further downstream near Hemlock Street (TB01) in September 2003 also contained low numbers of brook trout and redbfin pickerel (Appendix D).

The *Aquatic Life Use* is assessed as support based on the presence of multiple ages of brook trout (*S. fontinalis*). Although the presence of what appeared to be 2-year-old brook trout is indicative of excellent water and habitat quality, the total number of fish collected (or observed) was very low for the amount of habitat available so this use is identified with an alert status.

Primary and Secondary Contact Recreational and Aesthetics Uses

No objectionable conditions (e.g., color, turbidity, odors, deposits of debris/floatables/trash) were noted by DWM or DFG biologists during the backpack electrofishing surveys in Tinkerville Brook (Appendix D, MADFG 2008).

The *Primary and Secondary Contact Recreational Uses* are not assessed due to the lack of bacteria data. The *Aesthetics Use* is assessed as support since no objectionable conditions were noted by DWM and DFG biologists.

Tinkerville Brook (MA51-22) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

* Alert Status issue identified, see details in use assessment

RECOMMENDATIONS

In light of the presence of multiple age classes of brook trout (*S. fontinalis*), this waterbody should be given consideration for designation as a Cold Water Fishery.

LAKE SEGMENTS

ALDRICH POND (MA51002)

Sutton

Location:

Size: 2 Acres

Classification: B

2008 303(d) List: Category 5

This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Noxious aquatic plants, (Exotic species*)). * denotes a non-pollutant (MassDEP 2008a).

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

Two non-native aquatic macrophyte species, *Myriophyllum heterophyllum* and *Cabomba caroliniana*, were observed in Aldrich Pond during the 1994 Blackstone River Watershed synoptic lake surveys (MassDEP 1994).

The *Aquatic Life Use* is assessed as impaired for Aldrich Pond because of the infestation with *M. heterophyllum* and *C. caroliniana*, non-native aquatic macrophytes.

Aldrich Pond (MA51002) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

ARCADE POND (MA51003)

Location: Northbridge
Size: 20 Acres
Classification: B
2008 303(d) List: Category 5

This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Noxious aquatic plants, (Exotic species*)). * denotes a non-pollutant (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):
 Northbridge (MAR041144)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

A non-native species (*Cabomba caroliniana*) was observed in Arcade Pond during the 1994 Blackstone River Watershed synoptic lake surveys (MassDEP 1994).

The *Aquatic Life Use* is assessed as impaired for Arcade Pond because of the infestation with *C. caroliniana*, a non-native aquatic macrophyte.

Arcade Pond (MA51003) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

BELL POND (MA51009)

Location: Worcester
Size: 10 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

NPDES (APPENDIX H):
Worcester (MAS010002)

DESIGNATED USE ASSESSMENT

Primary and Secondary Contact Recreational and Aesthetics Uses

There is one beach along the shoreline of Bell Pond (Bell Pond Beach) in Worcester. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the MA DPH which is required as part of the Beaches Bill. Therefore no *Primary Contact Recreational Use* assessment (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

No recent quality assured data are available so all uses are not assessed.

Bell Pond (MA51009) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Support improvement of freshwater Beaches Bill data quality and reporting.

BRIERLY POND (MA51010)

Location: Millbury
Size: 18 Acres
Classification: B
2008 303(d) List: Category 4c

This segment is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Noxious aquatic plants [5/2/2002, CN070.1 {MassDEP 2002a}], Exotic species*). * denotes a non-pollutant (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):
 Millbury (MAR041136)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

A non-native aquatic macrophyte species, *Myriophyllum heterophyllum*, was observed by DWM biologists in Brierly Pond in July 1994 (MassDEP 1994).

The *Aquatic Life Use* is assessed as impaired for Brierly Pond because of the infestation with *M. heterophyllum*, a non-native aquatic macrophyte.

Brierly Pond (MA51010) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

BURNCOAT PARK POND (MA51012)

Location: Worcester
Size: 6 Acres
Classification: B
2008 303(d) List: Category 5

This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Noxious aquatic plants, Turbidity) (MassDEP 2008a).

NPDES (APPENDIX H):
Worcester (MAS010002)

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Burncoat Park Pond (MA51012) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

BROOKLAWN PARKWAY POND (MA51195)

Location: Shrewsbury
Size: 2 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):

Shrewsbury (MAR041158)

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Brooklawn Parkway Pond (MA51195) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

CARPENTER RESERVOIR (MA51015)

Location: Northbridge
Size: 78 Acres
Classification: B
2008 303(d) List: Category 2

This segment is on the 2008 Integrated List of Waters in Category 2 - Attaining Some Uses (Secondary Contact, Aesthetics); Others Not Assessed (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):
Northbridge (MAR041144)

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Carpenter Reservoir (MA51015) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

CHASE POND (MA51017)

Location: Douglas
Size: 11 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Chase Pond (MA51017) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

CHOCKALOG POND (MA51018)

Location: Uxbridge
Size: 11 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Chockalog Pond (MA51018) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

CLARK RESERVOIR (MA51022)

Location: Sutton
Size: 29 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

A potential non-native macrophyte species (*Myriophyllum* sp., possibly *M. heterophyllum*) was observed in Clark Reservoir during the 1994 Blackstone River Watershed synoptic lake surveys (MassDEP 1994)

The *Aquatic Life Use* for this segment is not assessed but is identified with an Alert Status based on the potential presence of a non-native aquatic macrophyte species.

Clark Reservoir (MA51022) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED*
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

* Alert status issues identified, see details in use assessment.

RECOMMENDATIONS

Conduct aquatic macrophyte survey in late July/August to confirm species of *Myriophyllum*.

COES RESERVOIR (MA51024)

Location: Worcester
Size: 87 Acres
Classification: B
2008 303(d) List: Category 4c

This segment is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Exotic species*). * denotes a non-pollutant (MassDEP 2008a).

NPDES (APPENDIX H):

City of Worcester (MAS010002)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

The dam at Coes Reservoir was built in 1865 to provide water power for the Coes Wrench Factory. In 2006, soils contaminated with PCBs at the former Coes Knife Factory site (adjacent to the Coes Reservoir Dam) were removed. The dam was rebuilt as part of this project (Welsh 2006), with an additional foot in height and a widened spillway (Kush 2005).

Biology

In 2009, Coes Reservoir (referred to as Pond) was stocked with trout (MA DFG 2009).

A non-native aquatic macrophyte species (*Myriophyllum spicatum*) was observed by DWM staff in Coes Reservoir during the 1998 synoptic surveys (MassDEP 1998).

The *Aquatic Life Use* is assessed as impaired for Coes Reservoir because of the infestation with *M. spicatum*, a non-native aquatic macrophyte.

Fish Consumption Use

Fish were collected by DWM biologists from Coes Reservoir in 1998 and were analyzed for metals, PCBs and organochlorine pesticides (Maietta 2007). MA DPH did not issue a site specific fish consumption advisory based on the results of the analyses (MA DPH 2009).

The *Fish Consumption Use* is not assessed for Coes Reservoir since no site-specific fish consumption advisory was issued by MA DPH. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody.

Primary and Secondary Contact Recreational and Aesthetic Uses

There are two public beaches on Coes Reservoir (referred to as Coes Pond): Coes Pond Hillside and Coes Pond Mill Street. In 2003-2004, the Hillside Beach was open with no closures; it was closed in 2005 due to lack of funding. The Mill Street Beach had one closure in 2003, and was not open in 2004 due to geese feces on the beach, although the water quality, when tested, was acceptable (Peterson 2005).

In 2005, MassDEP DWM and CERO teamed up to track sources of pollution to area beaches with histories of closures associated with elevated bacteria levels. The Mill Street Beach, owned and operated by the City of Worcester, was selected for investigation as the Massachusetts Department of Public Health (MA DPH) documented repeated bacteria violations ranging from 249 – 1975 *E.coli*/100 ml at this beach in their 2002 and 2003 beach bacteria sampling databases (MA DPH 2003 and MA DPH 2004), and that the City closed the beach for the entire season in 2004 and 2005 (Peterson 2005). Duerring and Beaudoin (2007) report the following results and conclusions of the Mill Street Beach bacteria source tracking efforts:

“Although the Tatnuck Brook inlet to Coes Reservoir exhibited intermittent elevated bacteria counts during dry weather, none of the stations in this subwatershed tested positive for detergents or optical brighteners so it was suspected that the bacteria were likely from non-human sources such as dogs and/or ducks that were observed in the vicinity of the stations during one or more of the surveys.

According to the Worcester DPW, the drainage area to the stormdrain system for outfall CR05 is sewered and all residences and businesses have supposedly connected in. However, results clearly indicate that there is a continuous illicit dry weather input of sewage entering the stormdrain system somewhere along First Street that eventually flows into the lake via a stormdrain outfall at Station CR05. Station CR05 drains into the west side of Coes Reservoir approximately 350 meters north of the Mill Street Beach. The beach, also located along the west side of the waterbody, lies between the point where this flow enters Coes Reservoir and the Reservoir outlet. Under certain flow and wind conditions it is possible that bacteria from this outfall could impact the beach, however it is impossible to conclude a direct relationship without a detailed study of the hydrodynamics and bacteria concentrations within the waterbody.

It is well known locally that a large number of geese and ducks frequent this waterbody and are often observed in the Mill Street Beach area. Consequently, removing the sewage input into the First Street stormwater system may reduce bacterial contamination at the beach, but will likely not eliminate it.

Regardless of whether a direct relationship between beach closures and the sewage contamination documented at Station CR05 can be proven or exists at all, this illicit sewage input to Coes Reservoir should be eliminated. Removal of sewage contamination from this inflow will have a positive effect on the overall water quality of the lake by reducing potentially harmful pathogen levels and eliminating a source of nutrients. These nutrients act as “fertilizers” in the lake and can encourage excessive aquatic plant and algae growth that may further limit the recreational value and aesthetic quality of the waterbody. “

No aesthetically objectionable conditions (e.g., odors, oils, turbidity, deposits) were observed by MassDEP field sampling crews during the Bacteria Source Tracking Project in 2005 (Beaudoin 2009b). It should be noted, however, that when the water level was lowered by approximately 5 feet at Coes Reservoir in March 2006 to allow work on the dam, a large-scale pond cleanup was conducted (Croteau 2006). Sunken trash and debris recovered from the pond included two vehicles, 75-80 tires, vehicle parts, and other trash.

Since no quality assured bacteria data are available the *Primary* and *Secondary Contact Recreational Uses* are not assessed. The *Primary Contact Recreational Use* is identified with an Alert Status however because of the problems with geese/ducks and the potential influence of sewage contamination. The *Aesthetics Use* for Coes Reservoir is assessed as support based on the lack of aesthetically objectionable conditions and the recent removal of sunken debris.

Coes Reservoir (MA51024) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation, Eurasian Water Milfoil (<i>Myriophyllum spicatum</i>) Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED*
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

* Alert Status issues identified, see details in use assessment

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the

problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

Support improvement of freshwater Beaches Bill data quality and reporting.

CRANE POND (MA51030)

Location: Blackstone
Size: 1 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):

Blackstone (MAR041093)

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Crane Pond (MA51030) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

CRYSTAL LAKE (MA51031)

Location: Douglas
Size: 96 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Crystal Lake (MA51031) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

DARK BROOK POND (MA51034)

Location: Sutton
Size: 18 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

This water body is labeled as Pigeon Hill Pond on topographic maps.

NPDES (APPENDIX H, TABLE H2):

Sutton (MAR041241)

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Dark Brook Pond (MA51034) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

DARK BROOK RESERVOIR (MA51035)

Location: [South Basin] Auburn
Size: 58 Acres
Classification: B
2008 303(d) List: Category 4c

This segment is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Exotic species*). * denotes a non-pollutant (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):
 Auburn (MAR041088)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

Two non-native aquatic macrophyte species (*Najas minor* and *Myriophyllum spicatum*) was observed in Dark Brook Reservoir [South Basin] during the 1998 synoptic surveys (MassDEP 1998).

The *Aquatic Life Use* is assessed as impaired for Dark Brook Reservoir [South Basin] because of the infestation with *N. minor* and *M. spicatum*, non-native aquatic macrophytes.

Dark Brook Reservoir (MA51035) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation, Eurasian Water Milfoil (<i>Myriophyllum spicatum</i>) Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson et al. 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

DARK BROOK RESERVOIR (MA51036)

Location: [North Basin] Auburn
Size: 171 Acres
Classification: B
2008 303(d) List: Category 4c

This segment is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Exotic species*). * denotes a non-pollutant (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):
 Auburn (MAR041088)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

A non-native aquatic macrophyte species (*Myriophyllum spicatum*) was observed in Dark Brook Reservoir [North Basin] during the 1998 synoptic surveys (MassDEP 1998).

The *Aquatic Life Use* is assessed as impaired for Dark Brook Reservoir [North Basin] because of the infestation with *M. spicatum*, a non-native aquatic macrophyte.

Dark Brook Reservoir (MA51036) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation, Eurasian Water Milfoil (<i>Myriophyllum spicatum</i>) Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

DOCTORS POND (MA51194)

Location: Uxbridge
Size: 1 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Doctors Pond (MA51194) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

DOROTHY POND (MA51039)

Location: Millbury
Size: 133 Acres
Classification: B
2008 303(d) List: Category 4c

This segment is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Turbidity [5/2/2002, CN070.1 {MassDEP 2002a}], Exotic species*). * denotes a non-pollutant (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):
 Millbury (MAR041136)

In 2003, the Town of Millbury received 319 grant funding to install numerous structural stormwater treatment units to capture sediments and improve water quality in Dorothy Pond. Observations recorded after rainfall events provided evidence of sediment capture, along with anecdotal observations of reduced coloration in Dorothy Pond (Chase and SEA 2006).

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

Non-native aquatic macrophyte species, *Myriophyllum spicatum* and *Potamogeton crispus* were observed in Dorothy Pond during the 1994 Blackstone River Watershed synoptic lake surveys (MassDEP 1994). A potential non-native macrophyte species (*Myriophyllum* sp., possibly *M. heterophyllum*) has also been reported (MassDEP 2008b). *Najas minor* was observed during a 1999 field investigation by MassDEP (Beaudoin 1999).

The *Aquatic Life Use* is assessed as impaired for Dorothy Pond because of the infestation with *M. spicatum*, *P. crispus* and *N.minor*, non-native aquatic macrophytes. Infestation with a fourth potential non-native macrophyte species (*Myriophyllum* sp., possibly *M. heterophyllum*) is noted as a concern.

Fish Consumption Use

Fish were collected by DWM biologists from Dorothy Pond in 1987 and were analyzed for metals, PCBs, and an organic scan (Maietta 2007). MA DPH did not issue a site specific fish consumption advisory based on the results of the analyses (MassDEP 2009).

The *Fish Consumption Use* is not assessed for Dorothy Pond since no site-specific fish consumption advisory was issued by MA DPH. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody.

Dorothy Pond (MA51039) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation, Eurasian milfoil (<i>Myriophyllum spicatum</i>) Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Evaluate sedimentation issues from upstream activities.

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

DUDLEY POND (MA51041)

Location: Douglas
Size: 8 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):

Douglas (MAR041106)

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Dudley Pond (MA51041) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

EDDY POND (MA51043)

Location: Auburn
Size: 99 Acres
Classification: B
2008 303(d) List: Category 4c

This segment is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Noxious aquatic plants [5/2/2002, CN070.1 {MassDEP 2002a}], Exotic species*). * denotes a non-pollutant (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):
 Auburn (MAR041088)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

One non-native aquatic macrophyte species *Myriophyllum heterophyllum* was observed in Eddy Pond during the 1994 synoptic surveys (MassDEP 1994).

The *Aquatic Life Use* is assessed as impaired for Eddy Pond because of the infestation with *M. heterophyllum*, a non-native aquatic macrophyte.

Eddy Pond (MA51043) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

FISH POND (MA51047)

Location: Northbridge
Size: 8 Acres
Classification: B
2008 303(d) List: Category 5

This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Noxious aquatic plants, (Exotic species*)). * denotes a non-pollutant (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):
 Northbridge (MAR041144)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

Two non-native aquatic macrophyte species, *Myriophyllum heterophyllum* and *Cabomba caroliniana*, were observed in Fish Pond during the 1994 Blackstone River Watershed synoptic lake surveys (MassDEP 1994).

The *Aquatic Life Use* is assessed as impaired for Fish Pond because of the infestation with *M. heterophyllum* and *C. caroliniana*, non-native aquatic macrophytes.

Fish Pond (MA51047) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

FLINT POND (MA51050)

Location: [North Basin] Shrewsbury
Size: 92 Acres
Classification: B
2008 303(d) List: Category 4c

This segment is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Noxious aquatic plants [6/28/2002, CN115.0], Turbidity [6/28/2002, CN115.0], Exotic species*). * denotes a non-pollutant (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):
 Shrewsbury (MAR041158)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

Two non-native aquatic macrophyte species (*Cabomba caroliniana* and *Myriophyllum spicatum*) were observed in Flint Pond (North Basin) during the 1998 synoptic surveys (MassDEP 1998) and were noted in the 2002 and 2003 herbicide application database (MassDEP 2008b).

The *Aquatic Life Use* is assessed as impaired for Flint Pond because of the infestation with *C. caroliniana* and *M. spicatum*, non-native aquatic macrophytes.

Fish Consumption Use

Fish were collected by DWM biologists from Flint Pond in 1983 and were analyzed for dioxin. Fish were collected again from the pond by DWM biologists in 1995 and were analyzed for metals, PCBs, and organochlorine pesticides (Maietta 2007). MA DPH did not issue a site specific fish consumption advisory based on the results of the analyses (MassDEP 2009).

The *Fish Consumption Use* is not assessed for Flint Pond since no site-specific fish consumption advisory was issued by MA DPH. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody.

Flint Pond (MA51050) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation, Eurasian Water Milfoil (<i>Myriophyllum spicatum</i>) Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the

problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

FLINT POND (MA51188)

Location: [South Basin] Shrewsbury/Grafton/Worcester
Size: 173 Acres
Classification: B
2008 303(d) List: Category 4c

This segment is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Noxious aquatic plants [6/28/2002, CN115.0] {MassDEP 2002e}}, Exotic species*). * denotes a non-pollutant (MassDEP 2008a).

NPDES (APPENDIX H and Table H2):

Grafton (MAR041193)
Shrewsbury (MAR041158)
Worcester (MAS010002)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

Bonny Brook (a tributary to Flint Pond) as well as Flint Pond has been impacted by the release of hazardous materials associated with the Wyman-Gordon industrial site, Grafton. Approximately 1,400 ft² of sediments contaminated with oil will be dredged from Bonny Brook, scheduled to begin in October 2009; cleaning up Flint Pond sediments has been deemed infeasible at this time and a Temporary Solution may be forthcoming (Vigeant 2009c). Excerpts from a summary of the nature and extent of Oil and Hazardous Materials (OHM) in the affected portions of Bonny Brook and Flint Pond is provided below:

“GZA performed a Stage II Environmental Risk Characterization (ERC) for portion of Bonny Brook and Flint Pond which have been affected by historical releases of OHMs via groundwater, stormwater, and wastewater discharges to Bonny Brook. Under existing conditions, surface water within Bonny Brook and Flint Pond is not being significantly impacted; based on our current understanding of conditions within the West Side of the WG facility, there are no ongoing sources of OHMs to the brook, and in-place sediment contamination is not impacting water quality.

Concentrations of several organic and metallic OHM in sediment of the on-site portions of Flint Pond and Bonny Brook are elevated above “local conditions” concentrations, and the portion of Flint Pond with the highest contaminant levels is Bonny Brook Cove. Comparing OHM concentrations detected in Bonny Brook Cove to local conditions concentrations in Flint Pond, aluminum, chromium, copper, nickel, zinc, and polychlorinated biphenyls (PCBs) have been identified as the primary OHM associated with the MCP site.

Sediments which produce a distinct sheen on surface water when disturbed have been observed in sections of Bonny Brook and in Bonny Brook Cove. These areas meet the definition of Readily Apparent Harm (RAH) in accordance with the MCP at 310 CMR 40.0995(3)(b)(1).

The invertebrate surveys and toxicity tests strongly suggest that there has not been an impact to invertebrates in Eastern Flint Pond (i.e., the portion of the pond outside of Bonny Brook Cove) or in the upper reaches of Bonny Brook (i.e., upstream of the culvert near sample SED-38A). Therefore, it is our opinion that a condition of No Significant Risk to benthic organisms exists in the upper reaches of Bonny Brook, and within Flint Pond outside of Bonny Brook Cove.

Although results of the benthic surveys suggested that the benthic community has not been adversely affected by sediment OHM, toxicity tests within Bonny Brook Cove and at SED- 3A on Bonny Brook have resulted in significantly reduced survival of exposed organisms...In addition, the estimated dose of chromium to waterfowl in Flint Pond, and the estimated doses of aluminum to mink in Flint Pond, and aluminum, copper, and PCBs to the mink in Bonny Brook exceed doses which are known to be protective of these, or similar wildlife species.

The selection of... limited sediment removal as the most feasible remedial action alternative...was deemed least intrusive, and would mitigate the conditions of Readily Apparent Harm by removing SPH impacted sediments from Bonny Brook The exposure to the SPH impacted sediments is considered the main exposure pathway for local fish and wildlife populations; thus implementation of this action would provide immediate

positive impact to fish and wildlife. Additionally, this alternative would avoid damage to the existing environment and allow time to further assess and identify a potential feasible permanent solution.”

Biology

Three non-native aquatic macrophyte species (*Cabomba caroliniana*, *Myriophyllum heterophyllum*, and *Myriophyllum spicatum*) were observed in Flint Pond during the 1998 synoptic surveys (MassDEP 1998). Records of these species can also be found in the herbicide application database in 2002 and 2003 (MassDEP 2008b).

The *Aquatic Life Use* is assessed as impaired for Flint Pond because of the infestation with *C. caroliniana*, *M. heterophyllum*, and *M. spicatum*, non-native aquatic macrophytes. Sediment contamination is also of concern.

Fish Consumption Use

Fish were collected by DWM biologists from Flint Pond in 1988 and were analyzed for dioxin. Fish were collected again from the pond by DWM biologists in 1995 and were analyzed for metals, PCBs, and organochlorine pesticides (Maietta 2007). MA DPH did not issue a site specific fish consumption advisory based on the results of the analyses (MassDEP 2009).

The *Fish Consumption Use* is not assessed for Flint Pond since no site-specific fish consumption advisory was issued by MA DPH. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody.

Flint Pond (MA51188) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation, Eurasian Water Milfoil (<i>Myriophyllum spicatum</i>) Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

GIRARD POND (MA51053)

Location: Sutton
Size: 2 Acres
Classification: B
2008 303(d) List: Category 4c

This segment is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Exotic species*). * denotes a non-pollutant (MassDEP 2008a).

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

A non-native aquatic macrophyte species, *Cabomba caroliniana*, was observed in Girard Pond during the 1994 Blackstone River Watershed synoptic lake surveys (MassDEP 1994).

The *Aquatic Life Use* is assessed as impaired for Girard Pond because of the infestation with *C. caroliniana*, a non-native aquatic macrophyte.

Girard Pond (MA51053) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

GREEN HILL POND (MA51056)

Location: Worcester
Size: 29 Acres
Classification: B
2008 303(d) List: Category 4a

This segment is on the 2008 Integrated List of Waters in Category 4a-TMDL is Completed (Turbidity [5/2/2002, CN070.1 {MassDEP 2002a}]) (MassDEP 2008a).

NPDES (APPENDIX H):
Worcester (MAS010002)

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Green Hill Pond (MA51056) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

HALES POND (MA51057)

Location: Wrentham
Size: 4 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Hales Pond (MA51057) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

HATHAWAY POND (MA51059)

Location: Millbury/Sutton
Size: 8 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):
Millbury (MAR041136)

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Hathaway Pond (MA51059) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

HAYES POND (MA51060)

Location: Grafton
Size: 5 Acres
Classification: B
2008 303(d) List: Category 5

This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Noxious aquatic plants, (Exotic species*)). * denotes a non-pollutant (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):
 Grafton (MAR041193)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

A non-native aquatic macrophyte species, *Cabomba caroliniana*, was observed in Hayes Pond during the 1994 Blackstone River Watershed synoptic lake surveys (MassDEP 1994).

The *Aquatic Life Use* is assessed as impaired for Hayes Pond because of the infestation with *C. caroliniana*, a non-native aquatic macrophyte.

Hayes (MA51060) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

LAKE HIAWATHA (MA51062)

Location: Bellingham/Blackstone
Size: 58 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

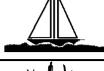
NPDES (APPENDIX H, TABLE H2):

Bellingham (MAR041091)
Blackstone (MAR041093)

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Lake Hiawatha (MA51062) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

HOLDEN RESERVOIR 1 (MA51063)

Location: Holden
Size: 124 Acres
Classification: A/PWS/ORW
2008 303(d) List: Category 2

This segment is on the 2008 Integrated List of Waters in Category 2 - Attaining Some Uses (Secondary Contact, Aesthetics); Others Not Assessed (MassDEP 2008a).

WMA:

WORCESTER DPW (registration 21234805, permit 9P321234803)

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Holden Reservoir 1 (MA51063) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Drinking Water*		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

* The MassDEP Drinking Water Program maintains current drinking water supply data.

HOLDEN RESERVOIR 2 (MA51064)

Location: Holden
Size: 52 Acres
Classification: A\PWS\ORW
2008 303(d) List: Category 2

This segment is on the 2008 Integrated List of Waters in Category 2 - Attaining Some Uses (Secondary Contact, Aesthetics); Others Not Assessed (MassDEP 2008a).

WMA:

WORCESTER DPW (registration 21234805, permit 9P321234803)

NPDES (APPENDIX H):

Worcester Department of Public Works Worcester Water Filtration Plant (MAG640052)

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Holden Reservoir 2 (MA51064) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Drinking Water*		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

* The MassDEP Drinking Water Program maintains current drinking water supply data.

RECOMMENDATION

A site visit should be conducted at the Worcester Water Filtration Plant (MAG640052) by DEP. More detailed information regarding the discharges should be collected including whether or not it is intermittent or continuous, the sampling location of the effluent monitoring, and whether or not there are any visible impacts on the receiving water (e.g., sedimentation). The new general permit for water treatment plant discharges is being developed for EPA. When this new permit becomes available, there will be limits for TRC based on available dilution rather than monitoring only requirements. Whether or not there will be monitoring requirements and /or permit limits for aluminum is unknown at this time.

HOUGHTON POND (MA51067)

Location: Uxbridge
Size: 2 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Houghton Pond (MA51067) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

HOWE POND (MA51069)

Location: Millbury
Size: 4 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):

Millbury (MAR041136)

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Howe Pond (MA51069) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

HOWE RESERVOIRS (MA51070)

Location: [East Basin] Millbury
Size: 2 Acres
Classification: B
2008 303(d) List: Category 4c

This segment is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Flow alteration*, Exotic species*). * denotes a non-pollutant (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):
 Millbury (MAR041136)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

A non-native aquatic macrophyte species, *Myriophyllum heterophyllum*, was observed in Howe Reservoirs [East Basin] during the 1994 Blackstone River Watershed synoptic lake surveys (MassDEP 1994).

The *Aquatic Life Use* is assessed as impaired for Howe Reservoirs [East Basin] because of the infestation with *M. heterophyllum*, a non-native aquatic macrophyte.

Howe Reservoirs (MA51070) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

HOWE RESERVOIRS (MA51071)

Location: [West Basin] Millbury
Size: 7 Acres
Classification: B
2008 303(d) List: Category 4a

This segment is on the 2008 Integrated List of Waters in Category 4a-TMDL is Completed (Noxious aquatic plants [5/2/2002, CN070.1 {MassDEP 2002a}]) (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):
Millbury (MAR041136)

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Howe Reservoirs (MA51071) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

HUNT POND (MA51072)

Location: Douglas
Size: 2 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):

Douglas (MAR041106)

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Hunt Pond (MA51072) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

INDIAN LAKE (MA51073)

Location: Worcester
Size: 186 Acres
Classification: B
2008 303(d) List: Category 4a

This segment is on the 2008 Integrated List of Waters in Category 4a-TMDL is Completed (Organic enrichment/Low DO and Noxious aquatic plants [6/28/2002, CN116.0 {MassDEP 2002c}]) (MassDEP 2008a).

In 2001, the Indian Lake Watershed Association (ILWA) received Section 319 funding to design and install a series of Best Management Practices (BMPs) to prevent contaminated runoff from reaching Indian Lake. A long-term weed control plan was also implemented (MassDEP 2006).

NPDES (APPENDIX H):

Worcester (MAS010002)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

On June 8th and 11th of 2004, ESS Group Inc. conducted a study of plant distribution in Indian Lake for the Indian Lake Watershed Association in conjunction with a pilot plant replacement project. Eurasian milfoil, *Myriophyllum spicatum* was found to be present in small beds along the shore (ESS Group Inc. 2006). *Myriophyllum spicatum* was reported in Indian Lake in herbicide files (MassDEP 2008b).

The *Aquatic Life Use* is assessed as impaired due to the presence of *M. spicatum*, a non-native aquatic macrophyte.

Fish Consumption Use

Fish were collected from Indian Lake by DWM biologists in 1998 and were analyzed for metals and PCBs (Maietta 2007). MA DPH did not issue a site specific fish consumption advisory based on the results of the analyses (MassDEP 2009).

The *Fish Consumption Use* is not assessed for Indian Lake since no site-specific fish consumption advisory was issued by MA DPH. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody.

Primary and Secondary Contact Recreational and Aesthetics Uses

There are two beaches along the shoreline of Indian Lake (Indian Lake Public Beach and Indian Lake Shore Park) in Worcester. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the MA DPH which is required as part of the Beaches Bill. Therefore no *Primary Contact Recreational Use* assessment (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

Indian Lake (MA51073) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation, Eurasian water milfoil (<i>Myriophyllum spicatum</i>) Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

Support improvement of freshwater Beaches Bill data quality and reporting.

IRONSTONE RESERVOIR (MA51074)

Location: Uxbridge
Size: 28 Acres
Classification: B
2008 303(d) List: Category 4c

This segment is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Exotic species*). * denotes a non-pollutant (MassDEP 2008a).

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

A non-native aquatic macrophyte species, *Cabomba caroliniana*, was observed in Ironstone Reservoir during the 1998 Blackstone River Watershed synoptic lake surveys (MassDEP 1994 and MassDEP 1998). A second potential non-native macrophyte species (*Myriophyllum* sp., possibly *M. heterophyllum*) was also noted.

The *Aquatic Life Use* is assessed as impaired for Ironstone Reservoir because of the infestation with *C. caroliniana*, a non-native aquatic macrophyte. The potential presence of *M. heterophyllum* is also noted as a concern.

Ironstone Reservoir (MA51074) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

Conduct aquatic macrophyte survey in late July/August to confirm species of *Myriophyllum*.

JENKS RESERVOIR (MA51075)

Location: Bellingham
Size: 26 Acres
Classification: B
2008 303(d) List: Category 4c

This segment is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Exotic species*). * denotes a non-pollutant (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):
 Bellingham (MAR041091)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

A non-native aquatic macrophyte species, *Myriophyllum heterophyllum*, was observed in Jenks Reservoir during the 1994 Blackstone River Watershed synoptic lake surveys (MassDEP 1994).

The *Aquatic Life Use* is assessed as impaired for Jenks Reservoir because of the infestation with *M. heterophyllum*, a non-native aquatic macrophyte.

Primary and Secondary Contact Recreational and Aesthetics Uses

There is one beach along the shoreline of Jenks Reservoir, Arcand Park. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the Massachusetts DPH, which is required as part of the Beaches Bill. Therefore, no *Primary Contact Recreational Use* assessments (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

Jenks Reservoir (MA51075) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent the spread of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring is needed to prevent spreading into unaffected areas and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread (from cuttings).

Support improvement of freshwater Beaches Bill data quality and reporting.

JOELS POND (MA51076)

Location: Uxbridge
Size: 11 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Joels Pond (MA51076) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

JOES ROCK POND (MA51077)

Location: Wrentham
Size: 12 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Joes Rock Pond (MA51077) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

JORDAN POND (MA51078)

Location: Shrewsbury
Size: 18 Acres
Classification: B
2008 303(d) List: Category 4a

This segment is on the 2008 Integrated List of Waters in Category 4a-TMDL is Completed (Turbidity [5/2/2002, CN070.1 {MassDEP 2002a}]) (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):
Shrewsbury (MAR041158)

DESIGNATED USE ASSESSMENT

Survey work was conducted on Jordan Pond as part of a restoration study for the Town of Shrewsbury (GZA 2003). Information from the survey was not used due to the timing of the survey (late fall) and the lack of appropriate data validation information.

In 2009, Jordan Pond was stocked with trout (MA DFG 2009).

The *Designated Uses* for Jordan Pond are not assessed.

Jordan Pond (MA51078) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

KETTLE BROOK RESERVOIR NO. 1 (MA51079)

Location: Leicester
Size: 11 Acres
Classification: A\PWS\ORW
2008 303(d) List: Category 2

This segment is on the 2008 Integrated List of Waters in Category 2 - Attaining Some Uses (Secondary Contact, Aesthetics); Others Not Assessed (MassDEP 2008a).

WMA:
 WORCESTER DPW (registration 21234805, permit 9P321234803)

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Kettle Brook Reservoir No. 1 (MA51079) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Drinking Water*		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

* The MassDEP Drinking Water Program maintains current drinking water supply data.

KETTLE BROOK RESERVOIR NO. 2 (MA51080)

Location: Leicester
Size: 29 Acres
Classification: A/PWS/ORW
2008 303(d) List: Category 2

This segment is on the 2008 Integrated List of Waters in Category 2 - Attaining Some Uses (Secondary Contact, Aesthetics); Others Not Assessed (MassDEP 2008a).

WMA:
 WORCESTER DPW (registration 21234805, permit 9P321234803)

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Kettle Brook Reservoir No. 2 (MA51080) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Drinking Water*		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

* The MassDEP Drinking Water Program maintains current drinking water supply data.

KETTLE BROOK RESERVOIR NO. 3 (MA51081)

Location: Paxton/Leicester
Size: 36 Acres
Classification: A\PWS\ORW
2008 303(d) List: Category 2

This segment is on the 2008 Integrated List of Waters in Category 2 - Attaining Some Uses (Secondary Contact, Aesthetics); Others Not Assessed (MassDEP 2008a).

WMA:

WORCESTER DPW (registration 21234805, permit 9P321234803)

NPDES (APPENDIX H, TABLE H2):

Paxton (MAR041148)

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Kettle Brook Reservoir No. 3 (MA51081) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Drinking Water*		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

* The MassDEP Drinking Water Program maintains current drinking water supply data.

KETTLE BROOK RESERVOIR NO. 4 (MA51082)

Location: Paxton
Size: 113 Acres
Classification: A\PWS\ORW
2008 303(d) List: Category 2

This segment is on the 2008 Integrated List of Waters in Category 2 - Attaining Some Uses (Secondary Contact, Aesthetics); Others Not Assessed (MassDEP 2008a).

WMA:
 WORCESTER DPW (registration 21234805, permit 9P321234803)
NPDES (APPENDIX H, TABLE H2):
 Paxton (MAR041148)

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Kettle Brook Reservoir No. 4 (MA51082) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Drinking Water*		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

* The MassDEP Drinking Water Program maintains current drinking water supply data.

LEESVILLE POND (MA51087)

Location: Auburn/Worcester
Size: 34 Acres
Classification: B
2008 303(d) List: Category 4c

This segment is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Nutrients [6/28/2002, CN117.0 {MassDEP 2002b}], Organic enrichment/Low DO [6/28/2002, CN117.0 {MassDEP 2002b}], Exotic species*). * denotes a non-pollutant (MassDEP 2008a).

NPDES (APPENDIX H and Table H2):

Auburn (MAR041088)
 Worcester (MAS010002)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

A non-native aquatic macrophyte species, *Cabomba caroliniana*, was observed in Leesville Pond during the 1994 Blackstone River Watershed synoptic lake surveys (MassDEP 1994).

The *Aquatic Life Use* is assessed as impaired for Leesville Pond because of the infestation with *C. caroliniana*, a non-native aquatic macrophyte.

Primary and Secondary Contact Recreational and Aesthetics Uses

During a shoreline survey conducted by the Leesville Pond Watershed and Neighborhood Association (LPWNA) with assistance from DCR Riverways in 2002 surveyors noted the presence of an algal bloom in one section of the pond. The severity was described as "covering the whole surface" (LPWNA 2002).

No bacteria and too limited recent quality assured data are available so *Primary and Secondary Contact Recreational and Aesthetic* uses are not assessed. They are identified with an Alert Status however because of concern with algal blooms.

Leesville Reservoir (MA51087) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED*
Secondary Contact		NOT ASSESSED*
Aesthetics		NOT ASSESSED*

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access

points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

LYNDE BROOK RESERVOIR (MA51090)

Location: Leicester
Size: 130 Acres
Classification: A\PWS\ORW
2008 303(d) List: Category 2

This segment is on the 2008 Integrated List of Waters in Category 2 - Attaining Some Uses (Secondary Contact, Aesthetics); Others Not Assessed (MassDEP 2008a).

WMA:

WORCESTER DPW (registration 21234805, permit 9P321234803)

NPDES (APPENDIX H, TABLE H2):

Leicester (MAR041202)

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Lynde Brook Reservoir (MA51090) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Drinking Water*		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

* The MassDEP Drinking Water Program maintains current drinking water supply data.

MANCHAUG POND (MA51091)

Location: Douglas/Sutton
Size: 365 Acres
Classification: B
2008 303(d) List: Category 5

This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Organic enrichment/Low DO, (Exotic species*)). * denotes a non-pollutant (MassDEP 2008a).

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

The Manchaug Reservoir Corporation (owner of the Manchaug Pond Dam) operated the dam to provide dilution flows at the downstream Guilford of Maine manufacturing facility. Although the Guilford of Maine facility for which a minimum flow was required has closed, there are ongoing issues with dam operations which are of concern. In the fall of 2008 (as well as many years prior), the flashboards were removed from the Manchaug Pond spillway, resulting in the alteration of vast areas of protected resources by lowering the water level approximately six feet (MassDEP 2009). Furthermore, the flashboards were not replaced in the spring, thus failing to restore the illegally altered wetlands. On April 21, 2009 MassDEP ordered the dam owner to install the flashboards and maintain the Manchaug Pond water levels according to historic practices.

Biology

A non-native species (*Potamogeton crispus*) was observed in Manchaug Pond during the 1994 Blackstone River Watershed synoptic lake surveys (MassDEP 1994). A second non-native species (*Cabomba caroliniana*) was observed in Manchaug Pond during the 1998 synoptic surveys (MassDEP 1998). A potential non-native macrophyte species (*Myriophyllum* sp., possibly *M. heterophyllum*) was also observed.

Water Chemistry

An *in-situ* profile was taken by DWM at the deep hole of Manchaug Pond on 10 September 2003. Dissolved oxygen concentrations ranged from 8.3 to <0.2 mg/L (Haque and Mattson 2007). Low dissolved oxygen levels were measured in the bottom water at depths of 6.0 m or greater which represents approximately 25% of the lake area. The depth integrated chlorophyll a concentration was 7.5 mg/m³ while the Secchi disk depth was 3.2 m. There was no evidence of phosphorus release from the sediments.

The *Aquatic Life Use* is assessed as impaired for Manchaug Pond because of the infestation with *C. caroliniana* and *P. crispus*, non-native aquatic macrophytes as well as oxygen depletion which affects approximately 25% of the lake area. The potential infestation with *M. heterophyllum* is also noted as a concern, as well as flow fluctuations associated with dam operations at the Manchaug Pond outlet.

Fish Consumption Use

Fish (largemouth bass, *Micropterus salmoides*, white perch, *Morone americana*, yellow perch, *Perca flavescens*, bluegill, *Lepomis macrochirus*, brown bullhead *Ameiurus nebulosus*) were collected by DWM biologists from Manchaug Pond in June 2008 and were analyzed for mercury (Maietta 2007). Mercury concentrations in the largemouth bass sample are of concern (Maietta et al. 2009). MA DPH has not yet evaluated the data.

The *Fish Consumption Use* is not assessed since MA DPH has not yet reviewed the data. This use is identified with an Alert Status however because of the concentrations of mercury in the largemouth bass sample (*M. salmoides*) which are of concern. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody.

Primary and Secondary Contact Recreational and Aesthetics Uses

On 10 September 2003, MassDEP DWM staff recorded field observations regarding aesthetics in Manchaug Pond. Observations included the presence of dense algae with many large clumps of suspended algae. The water had a light green tint and was described as highly turbid (Haque and Mattson 2007, MassDEP 2003).

In May 2006, Blackstone River Watershed Association volunteers, under guidance from Mass Riverways, conducted a Stream Team survey at Manchaug Pond (BRWA 2006). They noted the presence of trash, foaming brown appearance of water, lots of weeds, and petroleum sheens from recreational boating.

There are three beaches along the shoreline of Manchaug Pond (Lake Manchaug Camping in Douglas and Camp Blanchard and King's Campground in Sutton). Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the MA DPH which is required as part of the Beaches Bill. Therefore no Primary Contact Recreational Use assessment (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

The *Primary* and *Secondary Contact Recreation* and *Aesthetics* uses are not assessed for Manchaug Pond (too little data and lack of any bacteria data) but an Alert Status is identified for these uses due to the adverse conditions noted by DWM and BRWA volunteers i.e., large clumps of suspended algae, highly turbid water column, weeds, trash, and petroleum sheens.

Manchaug Pond (MA51091) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation, low dissolved oxygen Source: Introduction of non-native organism, unknown
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED*
Secondary Contact		NOT ASSESSED*
Aesthetics		NOT ASSESSED*

* Alert Status issues identified, see details in use assessment

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

Conduct aquatic macrophyte survey in late July/August to confirm species of *Myriophyllum*.

MARBLE POND (MA51093)

Location: Sutton
Size: 8 Acres
Classification: B
2008 303(d) List: Category 5

This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Noxious aquatic plants, (Exotic species*)). * denotes a non-pollutant (MassDEP 2008a).

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

A non-native aquatic macrophyte species, *Myriophyllum heterophyllum*, was observed in Marble Pond during the 1994 Blackstone River Watershed synoptic lake surveys (MassDEP 1994).

The *Aquatic Life Use* is assessed as impaired for Marble Pond because of the infestation with *M. heterophyllum*, a non-native aquatic macrophyte.

Marble Pond (MA51093) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

MARTIN STREET POND (MA51095)

Location: Douglas
Size: 3 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):

Douglas (MAR041106)

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Martin Street Pond (MA51095) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

MERRILL POND NO. 3 (MA51098)

Location: Sutton
Size: 13 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Merrill Pond No. 3 (MA51098) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

MERRILL POND NO. 4 (MA51099)

Location: Sutton
Size: 20 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Merrill Pond No. 4 (MA51099) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

MILL POND (MA51104)

Location: Upton
Size: 10 Acres
Classification: B
2008 303(d) List: Category 4c

This segment is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Exotic species*). * denotes a non-pollutant (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):
 Upton (MAR041165)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

Two non-native aquatic macrophyte species, *Cabomba caroliniana* and *Myriophyllum heterophyllum*, were observed in Mill Pond during the 1994 Blackstone River Watershed synoptic lake surveys (MassDEP 1994).

The *Aquatic Life Use* is assessed as impaired for Mill Pond because of the infestation with *C. caroliniana* and *M. heterophyllum*, non-native aquatic macrophytes.

Mill Pond (MA51104) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

MILL POND (MA51105)

Location: Shrewsbury
Size: 12 Acres
Classification: B
2008 303(d) List: Category 4a

This segment is on the 2008 Integrated List of Waters in Category 4a-TMDL is Completed (Turbidity [5/2/2002, CN070.1 {MassDEP 2002a}]) (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):
Shrewsbury (MAR041158)

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Mill Pond (MA51105) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

MISCOE LAKE (MA51106)

Location: Wrentham (size indicates portion in Massachusetts)
Size: 5 Acres
Classification: A\PWS\ORW
2008 303(d) List: Category 4c

This segment is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Exotic species*). * denotes a non-pollutant (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):
 Wrentham (MAR041175)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

Two non-native aquatic macrophyte species, *Cabomba caroliniana* and *Myriophyllum heterophyllum*, were observed in Miscoe Lake during the 1994 Blackstone River Watershed synoptic lake surveys (MassDEP 1994).

The *Aquatic Life Use* is assessed as impaired for Miscoe Lake because of the infestation with *C. caroliniana* and *M. heterophyllum*, non-native aquatic macrophytes.

Miscoe Lake (MA51106) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Drinking Water*		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

* The MassDEP Drinking Water Program maintains current drinking water supply data.

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

NEWTON POND (MA51110)

Location: Shrewsbury/Boylston
Size: 54 Acres
Classification: B
2008 303(d) List: Category 4c

This segment is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Noxious aquatic plants [5/2/2002, CN070.1 {MassDEP 2002a}], Exotic species*). * denotes a non-pollutant (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):

Boylston (MAR041095)
 Shrewsbury (MAR041158)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

Two non-native aquatic macrophyte species (*Myriophyllum heterophyllum* and *Cabomba caroliniana*) were observed in Newton Pond during the 1998 synoptic surveys (MassDEP 1998).

The *Aquatic Life Use* is assessed as impaired for Newton Pond because of the infestation with *M. heterophyllum* and *C. caroliniana*, non-native aquatic macrophytes.

Newton Pond (MA51110) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

NIPMUCK POND (MA51111)

Location: Mendon
Size: 85 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

DESIGNATED USE ASSESSMENT

Primary and Secondary Contact Recreational and Aesthetics Uses

There is one beach along the shoreline of Nipmuck Pond (Town Beach) in Mendon. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the MA DPH which is required as part of the Beaches Bill. Therefore no Primary Contact Recreational Use assessment (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

No recent quality assured data are available so all uses are not assessed.

Nipmuck Pond (MA51111) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Support improvement of freshwater Beaches Bill data quality and reporting.

NORTH POND (MA51112)

Location: Hopkinton/Milford
Size: 213 Acres
Classification: B
2008 303(d) List: Category 4c

This segment is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Exotic species*). * denotes a non-pollutant (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):

Hopkinton (MAR041124)
 Milford (MAR041135)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

Two non-native aquatic macrophyte species, *Cabomba caroliniana* and *Myriophyllum heterophyllum*, were observed in North Pond (Metcalf & Eddy 1987).

The *Aquatic Life Use* is assessed as impaired for North Pond because of the infestation with *C. caroliniana* and *M.heterophyllum*, non-native aquatic macrophytes.

Fish Consumption Use

Fish were collected by DWM biologists from North Pond in 1983 and were analyzed for dioxin (Maietta 2007). MA DPH did not issue a site specific fish consumption advisory based on the results of the analyses (MassDEP 2009).

The *Fish Consumption Use* is not assessed for North Pond since no site-specific fish consumption advisory was issued by MA DPH. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody.

North Pond (MA51112) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant

Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

NUMBER 1 POND (MA51114)

Location: Sutton
Size: 9 Acres
Classification: B
2008 303(d) List: Category 5

This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Noxious aquatic plants, Turbidity) (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):
Sutton (MAR041241)

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Number 1 Pond (MA51114) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

NUMBER 2 POND (MA51115)

Location: Sutton/Oxford
Size: 9 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):

Sutton (MAR041241)

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Number 2 Pond (MA51115) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

PEABODY POND (MA51119)

Location: Uxbridge
Size: 6 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Peabody Pond (MA51119) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

PONDVILLE POND (MA51120)

Location: Auburn/Millbury
Size: 36 Acres
Classification: B
2008 303(d) List: Category 4c

This segment is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Noxious aquatic plants [5/2/2002, CN070.1 {MassDEP 2002a}], Exotic species*). * denotes a non-pollutant (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):

Auburn (MAR041088)
 Millbury (MAR041136)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

One non-native aquatic macrophyte species, *Cabomba caroliniana*, infests Pondville Pond (MassDEP 1994). *Myriophyllum heterophyllum* has also been reported to infest the pond, however its presence is not confirmed at this time (MassDEP 2008b).

The *Aquatic Life Use* is assessed as impaired for Pondville Pond because of the infestation with *C. caroliniana*, a non-native aquatic macrophytes.

Pondville Pond (MA51120) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

Conduct aquatic macrophyte survey in late July/August to confirm species of *Myriophyllum*.

POUT POND (MA51121)

Location: Uxbridge
Size: 9 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):

Uxbridge (MAR041166)

DESIGNATED USE ASSESSMENT

Primary and Secondary Contact Recreational and Aesthetics Uses

There is one beach along the shoreline of Pout Pond (Pout Pond Beach) in Uxbridge. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the MA DPH which is required as part of the Beaches Bill. Therefore no Primary Contact Recreational Use assessment (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

No recent quality assured data are available so all uses are not assessed.

Pout Pond (MA51121) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Support improvement of freshwater Beaches Bill data quality and reporting.

POUT POND (MA51122)

Location: Boylston
Size: 14 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):

Boylston (MAR041095)

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Pout Pond (MA51122) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

PRATT POND (MA51123)

Location: Upton
Size: 39 Acres
Classification: B
2008 303(d) List: Category 4c

This segment is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Exotic species*). * denotes a non-pollutant (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):
 Upton (MAR041165)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

In 2009, Pratt Pond was stocked with trout (MA DFG 2009).

One non-native aquatic macrophyte species, *Cabomba caroliniana*, was observed in Pratt Pond during the 1994 Blackstone River Watershed synoptic lake surveys (MassDEP 1994). *Myriophyllum heterophyllum* also infests the pond (MassDEP 2008b).

The *Aquatic Life Use* is assessed as impaired for Pratt Pond because of the infestation with *C. caroliniana* and *M. heterophyllum*, non-native aquatic macrophytes.

Primary and Secondary Contact Recreational and Aesthetics Uses

There is one beach along the shoreline of Pratt Pond (Pratt Pond Beach) in Upton. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the MA DPH which is required as part of the Beaches Bill. Therefore no Primary Contact Recreational Use assessment (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

Pratt Pond (MA51123) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake

management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

Support improvement of freshwater Beaches Bill data quality and reporting.

PRATTS POND (MA51124)

Location: Grafton
Size: 4 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):

Grafton (MAR041193)

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Pratts Pond (MA51124) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

LAKE QUINSIGAMOND (MA51125)

Location: Shrewsbury/Worcester
Size: 471 Acres
Classification: B
2008 303(d) List: Category 4c

This segment is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Noxious aquatic plants [6/28/2002, CN115.0], Exotic species*). * denotes a non-pollutant (MassDEP 2008a).

NPDES (APPENDIX H and Table H2):

Eastern Point Condominium Trust (MAG250018)
Worcester (MAS010002)
Shrewsbury (MAR041158)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

In 2009, Lake Quinsigamond was stocked with trout (MA DFG 2009).

Four non-native aquatic macrophyte species were observed in Lake Quinsigamond during the 1994 Blackstone River Watershed synoptic lake surveys, including *Potamogeton crispus*, *Myriophyllum spicatum*, *Myriophyllum heterophyllum*, and *Cabomba caroliniana* (MassDEP 1994).

Water Chemistry

An *in-situ* profile was taken by DWM at the deep hole in the northern basin of Lake Quinsigamond (between the I-290 and Rte. 9 bridges) on 10 Sept 2003 (Haque and Mattson 2007). Dissolved oxygen concentrations ranged from 8.1 to 0.3 mg/L (Haque and Mattson 2007). Low dissolved oxygen levels were measured in the bottom water at depths of 6.0 m or greater which represents approximately 50% of the lake area. The depth integrated chlorophyll a concentration was 4.4 mg/m³ while the Secchi disk depth was 4.5 m. Surface water total phosphorus concentration was very low (0.005 mg/L). There was some evidence of phosphorus release from the anoxic sediments (total phosphorus was 0.042 mg/L near the bottom at a depth of approximately 25 m).

The *Aquatic Life Use* is assessed as impaired for Lake Quinsigamond because of the infestation with *P. crispus*, *M. spicatum*, *M. heterophyllum* and *C. caroliniana*, non-native aquatic macrophytes and low dissolved oxygen (affecting over half of the lake). Phosphorus release from anoxic sediments is also noted as a concern.

Fish Consumption Use

Fish were collected by DWM biologists from Lake Quinsigamond in 1996 and were analyzed for metals, PCBs and organochlorine pesticides (Maietta 2007). MA DPH did not issue a site specific fish consumption advisory based on the results of the analyses (MA DPH 2009).

The *Fish Consumption Use* is not assessed for Lake Quinsigamond since no site-specific fish consumption advisory was issued by MA DPH. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody.

Primary and Secondary Contact Recreational and Aesthetics Uses

On 10 September 2003, MassDEP DWM staff recorded field observations regarding aesthetics in Lake Quinsigamond. Observations included the presence of some trash/debris but no odors, colors or other objectionable conditions (MassDEP 2003).

On 20 July 2005 approximately 10,000 gallons of sewage reached Lake Quinsigamond following a sewer line break on Belmont St, Worcester. MassDEP CERO and DWM conducted bacteria monitoring to determine the extent of the impact from the spill. *In situ* measurements were collected at 10 in-lake stations, both up-and down-stream of the stormwater discharge (where the spill entered the lake) at the Rte. 9 Bridge. Results of the Colilert analyses from 21 July 2005 indicated that high levels of *E. coli* were collected in the Regatta Sailing Camp cove, Regatta Beach, the stormwater discharge from the storm drain under the Rte. 9 Bridge, and the mouth of Ramshorn Island Cove. Areas outside the influence of the release had bacteria levels <25 cfu/100 ml; bacteria in

affected areas ranged from 365.4 cfu/100 ml (near the UMass Lake Campus drain) to 4611 cfu/100 ml at the point where the Belmont Ave storm drain entered the lake. Samples collected from Shrewsbury (the east side of the lake) indicated that bacteria levels were well below the bathing beach standard i.e., the impacts of the spill were limited to the western lake areas. An additional round of samples was collected on 22 July 2009, when a decrease in bacteria levels was observed at all stations, and only 2 exceedances of the bathing beach standard were noted, at Regatta Beach and the storm drain. In both locations, bacteria levels had decreased by approximately an order of magnitude since the previous day (Beaudoin 2005b and Beaudoin 2005c).

There are three beaches along the shoreline of Lake Quinsigamond (Sunset, Lake Park and Regatta Point beaches) in Shrewsbury and Worcester. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the MA DPH which is required as part of the Beaches Bill. Therefore no *Primary Contact Recreational Use* assessment (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

The *Primary* and *Secondary Contact Recreational Uses* are not assessed due to the general lack of available bacteria data. An Alert status has been identified, however, based on the high bacteria levels after a sewer line break. The *Aesthetics Use* is assessed as support based on the general lack of objectionable conditions noted by DWM and CERO staff.

Lake Quinsigamond (MA51125) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation, Eurasian Water Milfoil (<i>Myriophyllum spicatum</i>), low dissolved oxygen Source: Introduction of non-native organism, unknown
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED*
Secondary Contact		NOT ASSESSED*
Aesthetics		SUPPORT

* Alert Status issues identified, see details in use assessment

RECOMMENDATIONS

Eastern Point Condominium Trust (MAG250018) should replace their flow meters to obtain accurate flow measurements.

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

Support improvement of freshwater Beaches Bill data quality and reporting.

RAMSHORN POND (MA51126)

Location: Sutton/Millbury
Size: 131 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):

Millbury (MAR041136)

Sutton (MAR041241)

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Ramshorn Pond (MA51126) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RESERVOIR NO. 4 (MA51128)

Location: Sutton
Size: 10 Acres
Classification: B
2008 303(d) List: Category 2

This segment is on the 2008 Integrated List of Waters in Category 2 - Attaining Some Uses (Secondary Contact, Aesthetics); Others Not Assessed (MassDEP 2008a).

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Reservoir No. 4 (MA51128) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RILEY POND (MA51134)

Location: Northbridge
Size: 7 Acres
Classification: B
2008 303(d) List: Category 5

This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Turbidity) (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):
Northbridge (MAR041144)

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Riley Pond (MA51134) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

LAKE RIPPLE (MA51135)

Location: Grafton
Size: 47 Acres
Classification: B
2008 303(d) List: Category 5

This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Noxious aquatic plants, (Exotic species*)). * denotes a non-pollutant (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):
 Grafton (MAR041193)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

A non-native aquatic macrophyte species, *Cabomba caroliniana*, was observed in Lake Ripple in during the 1998 Blackstone River Watershed synoptic lake surveys (MassDEP 1998). A second potential non-native macrophyte species (*Myriophyllum* sp., possibly *M. heterophyllum*) was also noted by DWM biologists.

The *Aquatic Life Use* is assessed as impaired for Lake Ripple because of the infestation with *C. caroliniana*, a non-native aquatic macrophyte. Whether or not *M. heterophyllum* is also present is noted as a concern.

Lake Ripple (MA51135) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

RIVERLIN STREET POND (MA51137)

Location: Millbury
Size: 2 Acres
Classification: B
2008 303(d) List: Category 4c

This segment is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Exotic species*). * denotes a non-pollutant (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):
 Millbury (MAR041136)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

Two non-native aquatic macrophyte species, *Myriophyllum heterophyllum* and *Potamogeton crispus*, were observed in Riverlin Street Pond during the 1994 Blackstone River Watershed synoptic lake surveys (MassDEP 1994).

The *Aquatic Life Use* is assessed as impaired for Riverlin Street Pond because of the infestation with *M. heterophyllum* and *P. crispus*, non-native aquatic macrophytes.

Riverlin Street Pond (MA51137) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

RIVULET POND (SEGMENT MA51138)

Location: Uxbridge
Segment Area: 4.2 acres
Classification: Class B

This segment is on the Massachusetts Year 2004 Integrated List of Waters – Category 4c, “Impairment Cause” - (Exotic species*) (MassDEP 2005).

NPDES (APPENDIX H, TABLE H2):
 Uxbridge (MAR041166)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

A non-native aquatic macrophyte species, *Myriophyllum heterophyllum* was observed in Rivulet Pond during the 1994 Blackstone River Watershed synoptic lake surveys (MassDEP 1994).

The *Aquatic Life Use* is assessed as impaired for Rivulet Pond because of the infestation with *M. heterophyllum*, a non-native aquatic macrophyte.

Primary and Secondary Contact Recreational and Aesthetics Uses

There is one beach along the shoreline of Rivulet Pond (Fairwoods Christian Recreation Society Beach) in Uxbridge. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the MA DPH which is required as part of the Beaches Bill. Therefore no Primary Contact Recreational Use assessment (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

Rivulet Pond (MA51138) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent the spread of invasive aquatic plants. Once the extent of the problem is determined and control practices exercised, vigilant monitoring is needed to guard spread to unaffected areas and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. Watershed and canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest times of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread (from cuttings).

Support improvement of freshwater Beaches Bill data quality and reporting.

SCHOOLHOUSE POND (MA51144)

Location: Sutton
Size: 7 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Schoolhouse Pond (MA51144) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

SEWALL POND (MA51191)

Location: Boylston
Size: 13 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):

Boylston (MAR041095)

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Sewall Pond (MA51191) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

SHIRLEY STREET POND (MA51196)

Location: Shrewsbury
Size: 19 Acres
Classification: B
2008 303(d) List: Category 4a

This segment is on the 2008 Integrated List of Waters in Category 4a-TMDL is Completed (Noxious aquatic plants [5/2/2002, CN070.1 {MassDEP 2002a}]) (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):
Shrewsbury (MAR041158)

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Shirley Street Pond (MA51196) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

SIBLEY RESERVOIR (MA51148)

Location: Sutton
Size: 25 Acres
Classification: B
2008 303(d) List: Category 4c

This segment is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Flow alteration*). * denotes a non-pollutant (MassDEP 2008a).

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Sibley Reservoir (MA51148) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

SILVER HILL POND (MA51149)

Location: Milford
Size: 6 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):
Milford (MAR041135)

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Silver Hill Pond (MA51149) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

SILVER LAKE (MA51150)

Location: Bellingham
Size: 42 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):

Bellingham (MAR041091)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

A non-native aquatic macrophyte species, *Myriophyllum heterophyllum*, is reported to be in Silver Lake (MassDEP 2008b).

The *Aquatic Life Use* is assessed as impaired for Silver Lake because of the infestation with *M. heterophyllum*, a non-native aquatic macrophyte.

Primary and Secondary Contact Recreational and Aesthetics Uses

There is one beach along the shoreline of Silver Lake (Silver Lake Beach) in Bellingham. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the MA DPH which is required as part of the Beaches Bill. Therefore no *Primary Contact Recreational Use* assessment (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

Silver Lake (MA51150) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor the invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent the spread of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring is needed to guard against infestations in unaffected areas and to ensure managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

Support improvement of freshwater Beaches Bill data quality and reporting.

SILVER LAKE (MA51151)

Location: Grafton
Size: 25 Acres
Classification: B
2008 303(d) List: Category 4c

This segment is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Flow alteration*). * denotes a non-pollutant (MassDEP 2008a).

This segment is located within the Miscoe, Warren and Whitehall ACEC.

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

A potential non-native macrophyte species (*Myriophyllum* sp., possibly *M. heterophyllum*) was observed in Silver Lake during the 1994 and 1998 Blackstone River Watershed synoptic lake surveys (MassDEP 1994 and MassDEP 1998).

In 2001, the Grafton Conservation Commission recommended a 3-year plan for herbicide application to Silver Lake to eliminate invasive aquatic plant growth in the beach area at the southern end of the lake. A 2004 report by the Grafton Community Preservation Committee noted that a weed barrier had been installed at Silver Lake (Grafton CPC 2009). The barrier was still in place in 2008 (Zwicker 2009).

The *Aquatic Life Use* for Silver Lake is not assessed but is identified with an Alert Status based on the potential presence of a non-native aquatic macrophyte species.

Primary and Secondary Contact Recreational and Aesthetics Uses

There is one beach along the shoreline of Silver Lake (Silver Lake Beach) in Grafton. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the MA DPH which is required as part of the Beaches Bill. Therefore no *Primary Contact Recreational Use* assessment (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

Silver Lake (MA51151) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED*
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

* Alert Status issues identified, see details in use assessment

RECOMMENDATIONS

Conduct aquatic macrophyte survey in late July/August to confirm species of *Myriophyllum*.

Support improvement of freshwater Beaches Bill data quality and reporting.

SINGLETERARY POND (MA51152)

Location: Sutton/Millbury
Size: 342 Acres
Classification: B
2008 303(d) List: Category 4c

This segment is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Exotic species*). * denotes a non-pollutant (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):

Millbury (MAR041136)
Sutton (MAR041241)

The Town of Millbury, Town of Sutton, and the Lake Singletary Watershed association received Section 319 funding in 2003 to install BMPs to reduce sedimentation and nutrient loading into the lake (MassDEP 2006).

A bacteria source tracking study was conducted by DWM staff in the Singletary Pond Subwatershed in 2004 (Duerring *et al.* 2004). The small lot sizes, steep slopes, and poor soil types found in the developed areas along the northwest and eastern shoreline created concern regarding pollution from septic system failures. The results of the surveys were as follows:

Source tracking activities did not locate any dry weather sources of bacteria in the tributaries to Lake Singletary. Out of 70 E. coli samples collected over the season only 5 were elevated and these were collected during wet weather. Field reconnaissance was conducted in the subwatersheds of the stations with occasional elevated wet weather bacteria counts and no obvious non-point sources were observed, with the exception of evidence of animal activity along the stream (particularly dogs, deer and beavers).

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

The non-native macrophyte species (*Myriophyllum spicatum*) was observed in Singletary Pond during the 1998 Blackstone River Watershed synoptic lake surveys (MassDEP 1998). A second non-native species, *M. heterophyllum*, was noted by ACT on herbicide applications (MassDEP 2008b).

In 2009, Singletary Lake was stocked with trout (MA DFG 2009).

The *Aquatic Life Use* is assessed as impaired for Singletary Pond because of the infestation with *M. spicatum* and *M. heterophyllum*, non-native aquatic macrophytes.

Primary and Secondary Contact Recreational and Aesthetics Uses

There is one beach along the shoreline of Singletary Pond (Camp Marion Town Beach) in Sutton. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the MA DPH which is required as part of the Beaches Bill. Therefore no Primary Contact Recreational Use assessment (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

Singletary Pond (MA51152) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation, Eurasian water milfoil (<i>Myriophyllum spicatum</i>) Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

Support improvement of freshwater Beaches Bill data quality and reporting.

SLAUGHTERHOUSE POND (MA51153)

Location: Millbury/Sutton
Size: 10 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):
Millbury (MAR041136)

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Slaughterhouse Pond (MA51153) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

SOUTHWICK POND (MA51157)

Location: Leicester/Paxton
Size: 42 Acres
Classification: A\PWS\ORW
2008 303(d) List: Category 4a

This segment is on the 2008 Integrated List of Waters in Category 4a-TMDL is Completed (Noxious aquatic plants [5/2/2002, CN070.1 {MassDEP 2002a}]) (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):

Leicester (MAR041202)
 Paxton (MAR041148)

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Southwick Pond (MA51157) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Drinking Water*		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

* The MassDEP Drinking Water Program maintains current drinking water supply data.

STEVENS POND (MA51159)

Location: Sutton
Size: 85 Acres
Classification: B
2008 303(d) List: Category 4c

This segment is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Exotic species*). * denotes a non-pollutant (MassDEP 2008a).

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

A non-native aquatic macrophyte species, *Cabomba caroliniana*, was observed in Stevens Pond during the 1994 Blackstone River Watershed synoptic lake surveys (MassDEP 1994).

The *Aquatic Life Use* is assessed as impaired for Stevens Pond because of the infestation with *C. caroliniana*, a non-native aquatic macrophyte.

Primary and Secondary Contact Recreational and Aesthetics Uses

In May 2006, Blackstone River Watershed Association volunteers, under guidance from the Riverways Program, conducted a Stream Team survey in Steven’s Pond (BRWA 2006). They noted the presence of trash, strong smell of dead fish, and low water levels.

Too limited recent quality assured data are available so the *Primary and Secondary Contact Recreational and Aesthtetic* uses are not assessed.

Stevens Pond (MA51159) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent the spread of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring is needed to guard against infestations in unaffected areas and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. Watershed and canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread (from cuttings).

STONEVILLE RESERVOIR (MA51161)

Location: Auburn
Size: 60 Acres
Classification: B
2008 303(d) List: Category 2

This segment is on the 2008 Integrated List of Waters in Category 2 - Attaining Some Uses (Secondary Contact, Aesthetics); Others Not Assessed (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):
Auburn (MAR041088)

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Stoneville Reservoir (MA51161) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

STUMP POND (MA51162)

Location: Oxford
Size: 20 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Stump Pond (MA51162) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

SUTTON FALLS (MA51163)

Location: Sutton
Size: 10 Acres
Classification: B
2008 303(d) List: Category 5

This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Turbidity) (MassDEP 2008a).

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Water Chemistry

DWM staff collected a sample for nutrient analysis from above the dam at Suttons Falls on 10 Sept 2003 (Haque and Mattson 2007). Total phosphorus concentration was 0.048 mg/L. Surveyors noted a very dense green algal bloom in the water.

Too limited data are available to assess the Aquatic Life Use, but an Alert Status is applied due to the very dense algal bloom.

Primary and Secondary Contact Recreational and Aesthetic Uses

On 10 Sept 2003, MassDEP DWM recorded field observations regarding aesthetics in Sutton Falls above the dam in Sutton. Observations included an ongoing very dense green algae bloom, as well as 10% coverage of the pond by duckweed. The water was brown and highly turbid (Haque and Mattson 2007, MassDEP 2003).

There is one beach along the shoreline of Sutton Falls (Sutton Falls Camp Beach) in Sutton. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the MA DPH which is required as part of the Beaches Bill. Therefore no Primary Contact Recreational Use assessment (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

The *Primary and Secondary Contact Recreation and Aesthetics Uses* are not assessed due to too little data, but an Alert Status is applied due to the adverse conditions noted on the single survey conducted.

Sutton Falls (MA51163) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED*
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED*
Secondary Contact		NOT ASSESSED*
Aesthetics		NOT ASSESSED*

* Alert Status issues identified, see details in use assessment

RECOMMENDATIONS

Support improvement of freshwater Beaches Bill data quality and reporting.

SWANS POND (MA51164)

Location: Sutton/Northbridge
Size: 32 Acres
Classification: B
2008 303(d) List: Category 4c

This segment is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Exotic species*). * denotes a non-pollutant (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):
 Northbridge (MAR041144)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

A non-native aquatic macrophyte species, *Myriophyllum heterophyllum*, was observed in Swans Pond during the 1994 Blackstone River Watershed synoptic lake surveys (MassDEP 1994).

The *Aquatic Life Use* is assessed as impaired for Swans Pond because of the infestation with *M. heterophyllum*, a non-native aquatic macrophyte.

Swans Pond (MA51164) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

TAFT POND (MA51165)

Location: Upton
Size: 11 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

A non-native aquatic macrophyte species, *Myriophyllum heterophyllum*, infests the pond (MassDEP 2008b).

The *Aquatic Life Use* is assessed as impaired for Taft Pond because of the infestation with *M. heterophyllum*, a non-native aquatic macrophyte.

Taft Pond (MA51165) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

TINKER HILL POND (MA51167)

Location: Auburn
Size: 37 Acres
Classification: B
2008 303(d) List: Category 4c

This segment is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Exotic species*). * denotes a non-pollutant (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):
 Auburn (MAR041088)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

One non-native aquatic macrophyte species (*Najas minor*) was observed in Tinker Hill Pond during the 1998 synoptic surveys (MassDEP 1998). *Myriophyllum sp.* was also noted although not confirmed as *M. heterophyllum*.

The *Aquatic Life Use* is assessed as impaired for Tinker Hill Pond because of the infestation with *N. minor*, a non-native aquatic macrophyte. A second potential non-native macrophyte species (*Myriophyllum sp.*, possibly *M. heterophyllum*) needs confirmation.

Tinker Hill Pond (MA51167) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

Conduct aquatic macrophyte survey in late July/August to confirm species of *Myriophyllum*.

TOWN FARM POND (MA51168)

Location: Sutton
Size: 6 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Town Farm Pond (MA51168) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

TUCKERS POND (MA51169)

Location: Sutton
Size: 26 Acres
Classification: B
2008 303(d) List: Category 4c

This segment is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Exotic species*). * denotes a non-pollutant (MassDEP 2008a).

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

A non-native species (*Myriophyllum heterophyllum*) was observed in Tuckers Pond during the 1998 synoptic surveys (MassDEP 1998).

The *Aquatic Life Use* is assessed as impaired for Tuckers Pond because of the infestation with *M. heterophyllum*, a non-native aquatic macrophyte.

Tuckers Pond (MA51169) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

WAITE POND (MA51170)

Location: Leicester
Size: 48 Acres
Classification: B
2008 303(d) List: Category 4a

This segment is on the 2008 Integrated List of Waters in Category 4a-TMDL is Completed (Metals [12/20/2007NEHgTMDL]) (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):
Leicester (MAR041202)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

A potential non-native macrophyte species (*Myriophyllum* sp., possibly *M. heterophyllum*) was observed Waite Pond during the 1998 Blackstone River Watershed synoptic lake surveys (MassDEP 1998).

The *Aquatic Life Use* for this segment is not assessed but is identified with an Alert Status based on the potential presence of a non-native aquatic macrophyte species.

Fish Consumption Use

Fish were collected from Waite Pond by DWM biologists in 1993 and were analyzed for metals, PCBs, and organochlorine pesticides (Maietta undated). Based on these data DPH issued a fish consumption advisory due to mercury contamination for Waite Pond, Leicester as follows: “*Children under 12, pregnant women, women of childbearing age who may become pregnant and nursing mothers should refrain from consuming any fish from Waite Pond in order to prevent exposure of developing fetuses, nursing infants and young children to mercury. The general public should limit consumption of all fish species from Waite Pond to two meals per month*” (MA DPH 2009).

The *Fish Consumption Use* for Waite Pond is assessed as impaired because of elevated mercury which resulted in the DPH fish consumption advisory.

Waite Pond (MA51170) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED*
Fish Consumption		IMPAIRED Cause: Mercury Source: Atmospheric Deposition - toxics
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

* Alert Status issues identified, see details in use assessment.

RECOMMENDATIONS

Further confirmation of *Myriophyllum* sp. when flowering heads are evident.

WALLUM LAKE (MA51172)

Location: Douglas
Size: 138 Acres
Classification: BTWS
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

Note: Wallum Lake is a 252 acre waterbody, however only 138 acres lie within MA. In 2009, Wallum Lake was stocked with trout (MA DFG 2009).

DESIGNATED USE ASSESSMENT

Fish Consumption Use

Fish were collected by DWM biologists from Wallum Lake in 1996 and were analyzed for metals, PCBs and organochlorine pesticides (Maietta 2007). MA DPH did not issue a site specific fish consumption advisory based on the results of the analyses (MA DPH 2009).

The *Fish Consumption Use* is not assessed for Wallum Lake since no site-specific fish consumption advisory was issued by MA DPH. All applicable statewide fish consumption advisories issued by MA DPH due to mercury contamination apply to this waterbody.

Primary and Secondary Contact Recreational and Aesthetics Uses

There are two beaches along the shoreline of Wallum Lake (Wallum Lake Beach and Wallum Lake Terrace Beach) in Douglas. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the MA DPH which is required as part of the Beaches Bill. Therefore no Primary Contact Recreational Use assessment (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

No recent quality assured data are available so all uses are not assessed.

Wallum Lake (MA51172) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Support improvement of freshwater Beaches Bill data quality and reporting.

WELSH POND (MA51176)

Location: Sutton
Size: 8 Acres
Classification: B
2008 303(d) List: Category 5

This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Noxious aquatic plants, (Exotic species*)). * denotes a non-pollutant (MassDEP 2008a).

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

A non-native aquatic macrophyte species, *Myriophyllum heterophyllum*, was observed in Welsh Pond in July 1994 (MassDEP 1994).

The *Aquatic Life Use* is assessed as impaired for Welsh Pond because of the infestation with *M. heterophyllum*, a non-native aquatic macrophyte.

Welsh Pond (MA51176) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

WHITIN RESERVOIR (MA51179)

Location: Douglas
Size: 342 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

DESIGNATED USE ASSESSMENT

Primary and Secondary Contact Recreational and Aesthetics Uses

There is one beach along the shoreline of Whitin Reservoir (Breezy Picnic Grounds) in Douglas. Currently there is uncertainty associated with the accurate reporting of freshwater beach closure information to the MA DPH which is required as part of the Beaches Bill. Therefore no Primary Contact Recreational Use assessment (either support or impairment) decisions are being made using Beaches Bill data for this waterbody.

No recent quality assured data are available so all uses are not assessed.

Whitin Reservoir (MA51179) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Support improvement of freshwater Beaches Bill data quality and reporting.

WHITINS POND (MA51180)

Location: Northbridge/Sutton
Size: 162 Acres
Classification: B
2008 303(d) List: Category 4c

This segment is on the 2008 Integrated List of Waters in Category 4c - Impairment Not Caused by a Pollutant (Exotic species*). * denotes a non-pollutant (MassDEP 2008a).

This pond is locally known as Meadow Pond.

NPDES (APPENDIX H, TABLE H2):

Northbridge (MAR041144)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Habitat and Flow

In addition to drinking water, Whitinsville Water Company (WWC) sold water by the 10,000 gallon truckload to Ocean State Power (OSP) (Luttrell 1999). OSP operates a 500 megawatt (MW) gas-fired electric generating plant in Burrillville, RI; the facility utilizes wet cooling processes, which require 2.7 MGD of water. Under conditions of adequate flow in the Blackstone River, OSP obtains cooling water directly from the mainstem, but below a minimum flow in Woonsocket (102 cfs), OSP must obtain water for cooling processes elsewhere to continue generating. At times, this water was drawn from Whitins Pond. Between 2 June and 2 August 1999 the WWC sold 23 million gallons to OSP.

Biology

A non-native species (*Cabomba caroliniana*) was observed in Whitins Pond during the 1998 synoptic surveys (MassDEP 1998). A second potential non-native macrophyte species (*Myriophyllum* sp., possibly *M. heterophyllum*) was also observed but requires confirmation when flowering heads are present.

The *Aquatic Life Use* is assessed as impaired for Whitins Pond because of the infestation with *C. caroliniana*, a non-native aquatic macrophyte. The potential infestation with *M. heterophyllum* is also noted as a concern.

Whitins Pond (MA51180) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should

consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

Conduct aquatic macrophyte survey in late July/August to confirm species of *Myriophyllum*.

WINDLE POND (MA51184)

Location: Grafton/Shrewsbury
Size: 4 Acres
Classification: B
2008 303(d) List: Category 3

This segment is on the 2008 Integrated List of Waters in Category 3 - No Uses Assessed (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):

Grafton (MAR041193)
Shrewsbury (MAR041158)

DESIGNATED USE ASSESSMENT

No recent quality assured data are available so all uses are not assessed.

Windle Pond (MA51184) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

WOODBURY POND (MA51185)

Location: Sutton
Size: 5 Acres
Classification: B
2008 303(d) List: Category 5

This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Noxious aquatic plants, (Exotic species*)). * denotes a non-pollutant (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):

Sutton (MAR041241)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

Two non-native aquatic macrophyte species, *Myriophyllum heterophyllum* and *Cabomba caroliniana*, were observed in Woodbury Pond during the 1994 Blackstone River Watershed synoptic lake surveys (MassDEP 1994).

The *Aquatic Life Use* is assessed as impaired for Woodbury Pond because of the infestation with *Myriophyllum heterophyllum* and *Cabomba caroliniana*, non-native aquatic macrophytes.

Woodbury Pond (MA51185) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

WOOLSHOP POND (MA51186)

Location: Millbury
Size: 5 Acres
Classification: B
2008 303(d) List: Category 5

This segment is on the 2008 Integrated List of Waters in Category 5 - Waters Requiring a TMDL (Noxious aquatic plants, Turbidity, (Exotic species*)). * denotes a non-pollutant (MassDEP 2008a).

NPDES (APPENDIX H, TABLE H2):
 Millbury (MAR041136)

DESIGNATED USE ASSESSMENT

Aquatic Life Use

Biology

A non-native aquatic macrophyte species, *Potamogeton crispus* was observed in Woolshop Pond during the 1994 Blackstone River Watershed synoptic lake surveys (MassDEP 1994).

The *Aquatic Life Use* is assessed as impaired for Woolshop Pond because of the infestation with *P. crispus*, a non-native aquatic macrophyte.

Woolshop Pond (MA51186) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Non-native aquatic macrophyte infestation Source: Introduction of non-native organism
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

Continue to monitor for the presence of invasive non-native aquatic vegetation and determine the extent of the infestation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas, including downstream from the site, and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and their responsibility to prevent spreading these species. The watershed/canoe/kayak groups should consider seeking volunteers to provide outreach on preventing the spread of exotic invasive plants at popular access points during the busiest weekends of the summer. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson *et al.* 2004) should also be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used for many species because of the propensity for these invasive species to reproduce and spread vegetatively (from cuttings).

REFERENCES

- Beaudoin, T. 1999. unpublished field notes and photographs from CERO investigations. Environmental Scientist. MassDEP, Bureau of Resource Protection, Worcester, MA.
- Beaudoin, T. 22 May 2000. unpublished field notes from bathymetric survey conducted on Salisbury Pond. Environmental Scientist. MassDEP, Bureau of Resource Protection, Worcester, MA.
- Beaudoin, T. 2003. unpublished field notes and data from monitoring conducted on the Blackstone River following a large sewage spill at the UBWPAD facility on 2 October 2003. Environmental Scientist. MassDEP, Bureau of Resource Protection, Worcester, MA.
- Beaudoin, T. 2004a. unpublished field notes from Mill River, Hopedale investigation conducted on 19 Aug 2004. Environmental Scientist. MassDEP, Bureau of Resource Protection, Worcester, MA.
- Beaudoin, T. 2004b. unpublished field notes and data from Blackstone Watershed monitoring by the SMART program, March 2000 through October 2004. Environmental Scientist. MassDEP, Bureau of Resource Protection, Worcester, MA.
- Beaudoin, T. 2005a. unpublished field notes from Spindleville Pond, Hopedale in-lake investigation conducted on 23 Sept 2005. Environmental Scientist. MassDEP, Bureau of Resource Protection, Worcester, MA.
- Beaudoin, Therese. 2005b. *RE: Lake Quinsigamond*. MassDEP, Bureau of Resource Protection. Email to MaryJude Pigsley. MassDEP, Worcester, MA. 25 July 2005.
- Beaudoin, Therese. 2005b. *L. Quinsigamond monitoring results*. MassDEP, Bureau of Resource Protection. Email to LeeDillard Adams and other staff. MassDEP, Worcester, MA. 25 July 2005.
- Beaudoin, T. 11 April 2006. unpublished field notes and photographs from site visit conducted on Salisbury Pond, Worcester, MA. Environmental Scientist. MassDEP, Bureau of Resource Protection, Worcester, MA.
- Beaudoin, T. 6 June 2008a. unpublished field notes and photographs from site visit conducted on Poor Farm Brook, Worcester/Shrewsbury, MA. Environmental Scientist. MassDEP, Bureau of Resource Protection, Worcester, MA.
- Beaudoin, T. 2008b. Unpublished memorandum to P. Anderson and R. Kimball Massachusetts Department of Environmental Protection, Worcester, MA dated 1 October 2008. *Dunn's Brook Sewerage Break*. Massachusetts Department of Environmental Protection, Bureau of Resource Protection, Worcester, MA.
- Beaudoin, T. 2009a. unpublished field notes and data from Blackstone Watershed monitoring by the SMART program. 25 July 2007 through 29 July 2009. Environmental Scientist. MassDEP, Bureau of Resource Protection, Worcester, MA.
- Beaudoin, T 2009b. *Aesthetics observations during Coes Reservoir Bacteria Source Tracking Project*. Environmental Scientist. MassDEP, Bureau of Resource Protection, Worcester, MA.
- Belsito, Ray. 2009. Mass DEP, Bureau of Waster Prevention. *Greenwood Street Landfill question*. Email to Therese Beaudoin. Environmental Scientist. MassDEP, Bureau of Resource Protection, Worcester, MA.
- Boynton, Donna. 2009. *Officials buoyed by news of \$1.2M Fisherville grant*. In the Worcester Telegram and Gazette. 27 Aug 2009.
- Boynton, Donna. 2003. *Official details treatment plant power failure; Blackstone wastewater spill*. In the Worcester Telegram and Gazette. 9 October 2003.
- Bramel, Viola. 2009. *Questions West Hill*. United States Army Corps of Engineers (USACOE). Email to Therese Beaudoin. Environmental Scientist. MassDEP, Bureau of Resource Protection, Worcester, MA. 23 Sept 2009.
- BRC. 2004-2008. unpublished data from the Blackstone River Coalition (BRC) Volunteer Water Quality Monitoring Program. Worcester, MA.

BRWA 2006. *Shoreline Survey Report and Action Plan, Mumford River*. Blackstone River Watershed Association. Uxbridge, MA.

Buckley, J. 2009. Personal communication re various headwater streams in Worcester. City of Worcester. Sewer Operations Division. To Therese Beaudoin. Environmental Scientist. MassDEP, Bureau of Resource Protection, Worcester, MA. 20 Aug 2009.

Center for Watershed Protection (CWP). 1998. *Rapid Watershed Planning Handbook*. For the U.S. EPA. Ellicott City, MD.

Chase, J., and S E A Consultants Inc. 2006. *Dorothy Pond Stormwater Management/Remediation Plan Final Report 04-03/319*. Prepared for Town of Millbury MA, Massachusetts Department of Environmental Protection and the U.S. Environmental Protection Agency, Region 1.

Child, Nick. 2001. *RE: Investigations in Salisbury Pond*. MassDEP CERO Bureau of Waste Site Cleanup, Emergency Response. Worcester, MA. Email to Therese Beaudoin. Environmental Scientist. MassDEP, Worcester, MA. 7 Aug 2001.

City of Worcester. 2000 [Online]. *Open Space and Recreation Plan*. Worcester, MA. Available: <http://www.ci.worcester.ma.us/reports/OSRPlan.pdf> .

Coffin, Peter. 2007. *Blackstone River Fluctuations*. Blackstone River Coalition Coordinator. Email to Therese Beaudoin Environmental Scientist. MassDEP, Bureau of Resource Protection, Worcester, MA. 18 Aug 2007.

Connors, Susan. (susan.connors@state.ma.us) 2005. *Blackstone Bacteria*. Massachusetts Department of Environmental Protection, Bureau of Resource Protection, Worcester, MA. Email to Therese Beaudoin, Massachusetts Department of Environmental Protection, Bureau of Resource Protection, Worcester, MA, dated 19 October 2005.

Connors, Susan. 2010. *Re: Cook Allen Brook comments*. Email to Laurie Kennedy, Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA. 27 January 2010.

Croteau, Scott J. 2006. *Junk cleared from Coes; Dam repairs reveal debris*. In the Worcester Telegram and Gazette. 31 Mar 2006.

DFG. 2009 [Online]. 16 Sept 2009. *Massachusetts Department of Fish and Game Office of Fishing and Boating Access. Table of FBA facilities*. Available at: http://www.mass.gov/dfwele/pab/pab_facilities.htm.

Donovan, Kathleen. 2009. *Re: Cook Pond*. Worcester Conservation Commission. Email to Therese Beaudoin Environmental Scientist. MassDEP, Bureau of Resource Protection, Worcester, MA. 6 Oct 2009.

Duerring, C., S. Connors, and S. Tamul. 2004. *Bacteria Source Tracking Pilot Study Summary Report*. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

Duerring and Beaudoin. 2007. *2005 Beach Bacteria Source Tracking Project*. Technical Memorandum #TM-S-26. DWM Control Number: CN 227.5. MassDEP, Worcester, MA. Sept 2007.

ESS Group Inc. 2006. *Plant Replacement Pilot Program, Indian Lake Worcester, MA*. ESS Group Inc., East Providence, RI. Available: http://www.ilwa.org/IndianLake_Final.pdf. 40p.

Farren, Elizabeth, Hawley, Harmonie, and Michael Paonessa. 2001. *Salisbury Pond Sediment Dredging Feasibility Study*. Major Qualifying Project Report for Worcester Polytechnic Institute. Worcester, MA.

Foskett, Steven H., Jr. 2005a. *New treatment plant boasts improvements*. In the Worcester Telegram and Gazette. 29 Dec 2005.

Foskett, Steven H., Jr. 2005b. *Flooding near West Hill Dam part of a plan*. In the Worcester Telegram and Gazette. 23 October 2005.

Foskett, Steven H., Jr. 2004. *Grant helps Douglas with project*. In the Worcester Telegram and Gazette. 26 April 2004.

Foskett, Steven H., Jr. 2001. *Runoff sends silt into Coal Mine Brook*. In the Worcester Telegram and Gazette. 6 August 2001.

Gilpatrick, T. 2007. Personal Communication. *Volunteer Water Quality Monitoring Raw Data 2004-2006*. Blackstone River Coalition. Worcester. MA.

Gomez and Sullivan 2003. *Mumford River Low Flow Study Final Report*. Gomez and Sullivan Engineers and Environmental Scientists, Weare, NH. Prepared for the Massachusetts Executive Office of Environmental Affairs Watershed Initiative. Boston, MA.

Grader, Melissa. 2009. *Ridgewood Power at the former Tupperware hydropower facility, Blackstone, Massachusetts*. US Fish and Wildlife Service. Email to Therese Beaudoin Environmental Scientist. MassDEP, Bureau of Resource Protection, Worcester, MA. 17 Sept 2009.

Grafton CPC. 2009 [Online]. *Community Preservation Program and Plan*. 14 December 2004. Available: http://www.town.grafton.ma.us/Public_Documents/GraftonMA_Committees/Community%20Preservation%20Committee/CPC_Master_Plan_041214.pdf

GWLT. 2009 [Online]. *Bovenzi Park opens in city; Leominster man donates acreage*. In The Worcester Telegram and Gazette. 17 Jan 2005. reprinted in The Greater Worcester Land Trust (GWLT) newsletter. Available: <http://gwlt.org/bovznws1.html>.

GZA. 2008. *Phase IV Remedy Implementation Plan. Bonny Brook. Wyman Gordon Facility. 244 Worcester Street. North Grafton, Massachusetts. RTN-2-0535*. Prepared by GZA GeoEnvironmental, Inc. Norwood, MA. Prepared for Wyman Gordon Company. North Grafton, MA.

GZA. 2003. *Jordon Pond Restoration Study: Pond Management Plan*. Prepared for the Town of Shrewsbury, MA by GeoEnvironmental Inc. Norwood, MA. Available: http://www.shrewsbury-ma.gov/health/jordan_toc.asp#4.

Haque, A. and Dr. Mark Mattson. 2007. *Baseline Lake Survey 2003 Technical Memo*. TM-S-16. DWM CN 205.0 23 October 2007. Worcester, MA.

Hartley, Richard. 2009. *RE: Species observed in a fish kill on the Blackstone River, Worcester 08/27/02*. Aquatic biologist. MA Division of Fisheries & Wildlife. Email to Therese Beaudoin. Environmental Scientist. MassDEP, Bureau of Resource Protection, Worcester, MA. 7 Oct 2009.

Hartley, Richard. 2002. unpublished memo. *RE: Chlorine related fish kill on the Blackstone River, Worcester 08/27/02*. Aquatic biologist. MA Division of Fisheries & Wildlife. To Eric Arvedon. Environmental Engineer. MassDEP, Boston, MA. 10 Sept 2002.

Harvey, E. and A. Singler. 30 Nov 2004. Unpublished summary of shoreline surveys conducted on Beaver Brook, Blackstone River mainstem, Mill River, Mumford River, West River. Blackstone River Watershed Association, Uxbridge, MA and the Commonwealth of Massachusetts Dept. of Fish and Game Riverways Program, Boston, MA.

Holland, Rick. 2006. *Residents riled over regular sewage spills*. In The Milford Daily News. 6 April 2006.

Kearns, Margaret. 2005. Unpublished memo. *Poor Farm Brook stream flow data summary*. 10 Aug 2005. Massachusetts Department of Fish and Game Riverways Programs. Boston, MA.

Kennelly, John R. 2005. Letter to Grafton Conservation Commission, Grafton, MA, dated 25 October 2005. Re: Fisherville Pond, Grafton. Chief of Planning, U.S. Army Corps of Engineers. Engineer/Planning Division, Concord, MA.

Kickham, B. 2009. *FW: Poor Farm Brook Aquatic Life Use draft for review*. Massachusetts Department of Environmental Protection. Email to Laurie Kennedy, MassDEP, Bureau of Resource Protection, Division of Watershed Management, Worcester, MA dated 15 December 2009.

Kimball, Robert. 11 April 2006. unpublished Pollution Complaint (General Information) form. Water Pollution Control section chief. MassDEP, Worcester, MA.

Konvalinka, Linda. 2006. *Gas/oil smell*. Email to Therese Beaudoin. Environmental Scientist. MassDEP, Bureau of Resource Protection, Worcester, MA. 17 July 2006.

Kush, Bronislaush B. 2005. *Dam repairs relieve Coes Reservoir area; Cleanup, minipark planned in PCBs-rich parcel*. In the Worcester Telegram and Gazette. 31 Dec 2005.

Larrabee, John. 2005. *Valley starts mopping up*. In the Woonsocket Call. 17 Oct 2005.

LPWNA 2002. *Watershed Survey Final Report and Action Plan: Leesville Pond/Kettle Brook – Middle River Watershed*. Leesville Pond Watershed and Neighborhood Association, Auburn, MA.

Lilyestrom, Betty. 2004. *City reservoir guards irk Leicester*. In the Worcester Telegram and Gazette. 13 May 2004.

Lilyestrom, Betty. 2009. *Task force: Waite Pond property values at stake*. In the Worcester Telegram and Gazette. 23 Feb 2009.

Luttrell, Martin. 2001. *Sewer pipe break fouls brook, lake*. In the Worcester Telegram and Gazette. 26 March 2001.

Luttrell, Martin. 1999. *Power plants can't go with the flow; as river levels drop, utilities must truck in some of water supply*. In The Worcester Telegram and Gazette. 20 Aug 1999.

MA DFG 2007. *Massachusetts Coldwater Fishery Resource List, January 29, 2007*. Massachusetts Department of Fish and Game, Division of Fisheries & Wildlife, Westborough, MA.

Maietta, R.J. undated. *Blackstone River Fish Toxics Monitoring 1993*. Massachusetts Department of Environmental Protection, Office of Watershed Management. Grafton, MA.

Maietta, R.J. 2001. Personal Communication. *Discussion with M. Celona MA DPH regarding Mill River Fish Consumption Advisory*. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

Maietta, R.J. 2007. *1983-2007 Fish Toxics Monitoring Survey List*. CN270.2. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

Maietta, R. J., J. Ryder, and R.F. Chase. 2009. *Draft 2008 Fish Toxics Monitoring Public Request and Year 2 Monitoring Surveys Report*. Massachusetts Department of Environmental Protection, Division of Watershed Management and Environmental Analysis. Worcester and Lawrence, MA.

MassDEP 1994. Open file. *Synoptic lake survey field sheets 1994 – Blackstone River Watershed Lakes*. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

MassDEP 1998. Open file. *Synoptic lake survey field sheets 1998 – Blackstone River Watershed Lakes*. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

MassDEP 2002a. *Total Maximum Daily Loads of Phosphorus for Selected Northern Blackstone Lakes*. CN70.1. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

MassDEP 2002b. *Total Maximum Daily Load of Phosphorus for Leesville Pond, Auburn-Worcester, MA (MA51087)*. CN117. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

MassDEP 2002c. *Total Maximum Daily Load of Phosphorus for Indian Lake, Worcester, MA (MA51073)*. CN116. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

MassDEP 2002d. *Total Maximum Daily Load of Phosphorus for Salisbury Pond, Worcester, MA (MA51142)*. CN114. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

- MassDEP 2002e. *Total Maximum Daily Load of Phosphorus for Lake Quinsigamond & Flint Pond, Grafton, MA (MA51087)*. CN115. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.
- MassDEP 2003. Open file. *Water Quality monitoring field sheets rivers and lakes*. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.
- MassDEP 2004. Open file. *BST monitoring field sheets rivers and lakes*. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.
- MassDEP 2005. Open file. *BST monitoring field sheets rivers and lakes - 2005*. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.
- MassDEP. 2006. *Section 319 Nonpoint Source Program Indicative Project Summaries, Ffy 2002 – 2006*. Massachusetts Executive Office of Environmental Affairs. Boston, MA, Division of Watershed Management. Worcester, MA.
- MassDEP. 2008a. *Massachusetts Year 2008 Integrated List of Waters Final Listing of the Condition of Massachusetts' Waters Pursuant to Sections 303(d) and 305(b) of the Clean Water Act*. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.
- MassDEP. 2008b. Open Files. *Herbicide license applications 2000 -2008*. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.
- MassDEP. 2008c. Open files. *TOXTD Toxicity Test Results – Blackstone River Watershed facilities*. Massachusetts Department of Environmental Protection, Bureau of Resource Protection, Division of Watershed Management. Worcester, MA.
- MassDEP. April 2009. *Unilateral Administrative Order, Wetlands/Sutton Manchaug Pond Torrey Street*. UAO-CE-09-6W002. April 21, 2009. Massachusetts Department of Environmental Protection, Bureau of Resource Protection, Central Regional Office. Worcester, MA
- MassDFG. 2009b [Online]. Mass Wildlife. Massachusetts Department of Fish and Game. Division of Fisheries and Wildlife. *Trout Stocked Waters: 2009*. Retrieved 15 Oct 2009 from http://www.mass.gov/dfwele/dfw/recreation/fishing/trout/trout_waters_cd.htm
- MA DFG. 2008. *Fish Population Database 1998-2008*. Massachusetts Department of Fish and Game, Division of Fisheries and Wildlife, Westborough, MA.
- MA DFG. 2007. *Massachusetts Coldwater Fisheries Resource List*. 27 Jan 2007. Massachusetts Department of Fish and Game, Division of Fisheries and Wildlife, Westborough, MA.
- MA DPH. 2003. *Marine and Freshwater Beach Testing in Massachusetts 2002 Season*. Massachusetts Department of Public Health, Environmental Toxicology Program. Boston, MA.
- MA DPH. 2004. *Marine and Freshwater Beach Testing in Massachusetts. Annual Report, 2003 Season*. Massachusetts Department of Public Health, Center for Environmental Health. Boston, MA.
- MA DPH. 2005. *Marine and Freshwater Beach Testing in Massachusetts. Annual Report, 2004 Season*. Massachusetts Department of Public Health, Center for Environmental Health. Boston, MA.
- MA DPH. 2006. *Marine and Freshwater Beach Testing in Massachusetts. Annual Report, 2005 Season*. Massachusetts Department of Public Health, Center for Environmental Health. Boston, MA.
- MA DPH. 2009a. *Freshwater Fish Consumption Advisory List – October 2009*. Massachusetts Department of Public Health. Boston, MA. Accessible at: http://www.mass.gov/Eeohhs2/docs/dph/environmental/exposure/fish_consumption_advisory_list.pdf
- MA DPH. 2009b. *Massachusetts Department Of Public Health Reminds Consumers Of State Fish Advisory – June 3, 2009*. Massachusetts Department of Public Health, Bureau of Environmental Health Assessment, Boston, MA. (Press release online @

http://www.mass.gov/?pageID=eohhs2pressrelease&L=4&L0=Home&L1=Government&L2=Departments+and+Divisions&L3=Department+of+Public+Health&sid=Eeohhs2&b=pressrelease&f=090603_fish_advisory&csid=Eeohhs2)

Mateleska, Karen (Karen_Mateleska@nps.gov) 2004. *Hopedale concern*. 6 Aug 2004. Email to Donna Williams, Massachusetts Audubon Society and Therese Beaudoin. Environmental Scientist. MassDEP, Bureau of Resource Protection, Worcester, MA.

MBTF. Mill Brook Task Force. 2005. Progress Report Form from July 1, 2005 to September 30, 2005 (unpublished). Salisbury Pond Resource Restoration Project. Project No. 00-12/319. Worcester, MA.

McNally, Nancy. 2009. U.S. Army Corps of Engineers, New England District, Concord, MA. Email to Therese Beaudoin. Environmental Scientist. MassDEP, Bureau of Resource Protection, Worcester, MA.

MEPA. 2005. *Beaver Brook Culvert Replacement and Day-Lighting Project*. Environmental Notification Form. EOEA No. 13512.

Metcalf & Eddy. 1987. *Final Report to Town of Hopkinton on Diagnostic Feasibility Study of North Pond Hopkinton MA*. Wakefield, MA.

Monahan, John J. 2009. *Stimulus boosts 35-acre cleanup; Fisherville project to get \$1.2 M*. In the Worcester Telegram and Gazette. 26 Aug 2009.

Monahan, John J. 2004a. *Fouling of pond brings fines; Institute Park is beneficiary*. In the Worcester Telegram and Gazette. 15 Feb 2004.

Monahan, John J. 2004b. *Sewer plant draws fine; Blackstone was polluted*. In the Worcester Telegram and Gazette. 29 April 2004.

Monahan, John J. 2004c. *Carwash fined for dumping onto brook's banks*. In the Worcester Telegram and Gazette. 31 March 2004.

Monahan, John J. 2004d. *Stop toxic flow, DEP tells city; State rejects claims that landfill is not polluting*. In the Worcester Telegram and Gazette. 24 February 2004.

Monahan, John J. 2002. *Fish found dead in city stream*. In the Worcester Telegram and Gazette. 30 July 2002.

Monahan, John J. 2001. *No action is taken against company*. In the Worcester Telegram and Gazette. 27 March 2001.

Moraff, K. 2009. Letter dated 4 May 2009 to Laurie Burt, Commissioner Massachusetts Department of Environmental Protection. *Re: 2008 Clean Water Act Section 303(d) List Approval*. U.S. Environmental Protection Agency Office of Ecosystem Protection, Boston, MA.

Neely, D (donaneely1@comcast.net) 2005. *Re: Foam in stream discharging to Spindleville Pond, Hopedale*. Advocate, Blackstone River Watershed Association, Uxbridge, MA. Email to Therese Beaudoin. Environmental Scientist. Massachusetts Department of Environmental Protection, Bureau of Resource Protection, Worcester, MA dated 16 Feb 2005.

Nemeth, Robert Z. 21 June 2009. [Online]. *Polishing a city jewel*. In the Worcester Telegram and Gazette. Available: <http://www.telegram.com/article/20090621/COLUMN22/906210349/1020>.

NEIWPC. 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.neiwpc.org/mercury/mercury-docs/FINAL%20Northeast%20Regional%20Mercury%20TMDL%20Fact%20Sheet.pdf>.

NPS. 2009 [Online]. 16 Sept 2009. *John H. Chaffee Blackstone River Valley National Heritage Corridor Commission. Get on the river*. <http://www.nps.gov/archive/blac/discover/getontheriver.htm>

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.

NWS. 2009 [Online]. 8 Oct 2009. *Preliminary Monthly Climate Data*. National Oceanic and Atmospheric Administration. National Weather Service (NWS) Forecast Office. Available: <http://www.weather.gov/climate/index.php?wfo=box>.

Peterson, Robert J. 2005. Letter to Therese Beaudoin, Environmental Scientist, Massachusetts Department of Environmental Protection, Bureau of Resource Protection, Worcester, MA dated 28 November 2005. Re: Public beach bacteria data. City of Worcester, Department of Health and Human Services, Public Health Division, Worcester, MA.

Plasse, Jim (james.plasse@earthlink.net) 2009. *Water chestnuts in the West River*. Blackstone River Watershed Association, Uxbridge, MA. Email to Therese Beaudoin, Massachusetts Department of Environmental Protection, Bureau of Resource Protection, Worcester, MA dated 17 September 2009.

Plasse, Jim. 2007. *West River Water Chestnut Management Plant: Quality Assurance Project Plan*. Blackstone River Watershed Association. Uxbridge, MA

Plumb, Taryn. 2005. *Worcester 'oversight' angers residents; brook project claims land in backyards*. In the Worcester Telegram and Gazette. 21 Nov 2005.

RICKA. Rhode Island Canoe and Kayak Organization 2009 [Online]. *Blackstone Valley Paddle Club. Paddle the Blackstone... Paddle Through History*. Available: <http://www.ricka-flatwater.org/bv%20facts.htm>.

Tamul, S. 2005. *Technical Memorandum Blackstone River Watershed 2003 DWM Water Quality Monitoring Data*. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA.

UBWPAD et al. 2008. unpublished memorandum from Upper Blackstone Water Pollution Abatement District (UBWPAD), UMass Amherst and Camper, Dresser and McKee (CDM). *Blackstone River HSPF Model; Model Files and Calibration Viewer*. To MADEP, USEPA and Blackstone River Monitoring Groups. 2 June 2008.

USACOE. 2009a [Online]. 16 Sept 2009. *West Hill Dam, Uxbridge, Massachusetts*. United States Army Corps of Engineers (USACOE). Available: <http://www.nae.usace.army.mil/recreati/whd/whdnr.htm>.

USACOE. 2009b [Online]. 16 Sept 2009. *Water Resources, West Hill Dam*. United States Army Corps of Engineers (USACOE). Available: <http://www.nae.usace.army.mil/water/topic.asp?mytopic=fdwesthill>.

USACOE. 2009c [Online]. 16 Sept 2009. *West Hill Dam, Uxbridge, Massachusetts: Value to the Nation*. United States Army Corps of Engineers (USACOE). Available: <http://www.vtn.iwr.usace.army.mil/recreation/reports/lake.asp?ID=435>.

USACOE. 2009d [Online]. 6 Oct 2009. *Water Resources: Blackstone River, Millbury*. United States Army Corps of Engineers (USACOE). Available: <http://www.nae.usace.army.mil/water/topic.asp?mytopic=shoreblackstone>.

USACOE. 2009e [Online]. 6 Oct 2009. *Water Resources: Blackstone River*. United States Army Corps of Engineers (USACOE). Available: <http://www.nae.usace.army.mil/water/topic.asp?mytopic=lppblackstone>.

USACOE. 2009f [Online]. 6 Oct 2009. *Update Report for Massachusetts*. United States Army Corps of Engineers (USACOE). Available: <http://www.nae.usace.army.mil/news/ma.pdf>.

U. S. EPA. 1999. *1999 Update of Ambient Water Quality Criteria for Ammonia*. U.S. Environmental Protection Agency, Office of Water and Office of Science and Technology, Washington, D.C. and Office of Research and Development, Duluth, MN.

USGS. 2009a [Online]. 24 Nov 2009. USGS 01109730 Blackstone River, W. Main St., at Millbury, MA. Available: <http://waterdata.usgs.gov/nwis/uv?01109730>.

USGS. 2009b [Online]. 22 Dec 2009. USGS 01112262 Mill River at Summer Street Near Blackstone, MA. Available: http://nwis.waterdata.usgs.gov/nwis/qwdata?site_no=01112262&agency_cd=USGS&begin_date=2000-03-29&end_date=&format=html_table&inventory_output=0&rdb_inventory_output=file&date_format=YYYY-MM-DD&rdb_compression=file&qw_sample_wide=0&submitted_form=b

Vigeant, Paul. 2009a. *Hazardous waste sites along the Blackstone River*. MassDEP, Bureau of Waste Site Cleanup. Worcester, MA. Email to Therese Beaudoin. Environmental Scientist. MassDEP CERO. 7 Oct 2009.

Vigeant, Paul. 2009b. *Fisherville Mill, Grafton. RTN 2-0206. Proposed Treatment Train Components of the Blackstone Canal Stormwater Treatment System*. MassDEP, Bureau of Waste Site Cleanup. Worcester, MA. Email to Therese Beaudoin. Environmental Scientist. MassDEP CERO. 14 Oct 2009.

Vigeant, Paul. 2009c. *Hazardous waste sites along the Blackstone River*. MassDEP, Bureau of Waste Site Cleanup. Worcester, MA. Email to Therese Beaudoin. Environmental Scientist. MassDEP CERO. 8 Oct 2009.

Webber, M. 2009. Open file. *Bellingham wastewater collection system inspection notes- spring 2009*. Massachusetts Department of Environmental Protection, Bureau of Resource Protection, Wastewater Program, Worcester, MA.

Weinstein M.J., Kennedy, L.E., Cononna-Romano J., and Beaudoin T. 2001. *Blackstone River Basin 1998 Water Quality Assessment Report*. Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.

Welsh, Lisa D. 2006. *Dedication celebrates rebuilt dam; Plan for Coes Pond includes a playground*. In The Worcester Telegram and Gazette. 2 Oct 2006.

Williamson, Chet. 2009 [Online]. *Who pulled the plug on Cook's Pond?* 27 Aug 2008. Available at: <http://www.worcestermagazine.com/content/view/3130/>.

Williamson, Danielle M. 2003. *Construction runoff affecting brook; Plantation Towers silt still clogs stream; Coal Mine Brook clogged by sediment*. In the Worcester Telegram and Gazette. 12 Oct 2003.

Wright, R., Viator, O., Michaelis, B. 2004. *Dry Weather Water Quality Sampling and Modeling Blackstone River Feasibility Study Phase 1: Water Quality Evaluation and Modeling of the MA Blackstone River*. Civil and Environmental Engineering, University of Rhode Island, Kingston, RI.

Zwicker, Jane. 2009 [Online]. *Minutes of the Grafton Conservation Commission*. 6 May 2008. Available: http://www.town.grafton.ma.us/Public_Documents/GraftonMA_Conservation/Minutes/Minutes%202008/05-06-08.pdf