

## INTRODUCTION

The Massachusetts Watershed Initiative is a collaborative effort between state and federal environmental agencies, municipal agencies, citizens, non-profit groups, businesses and industries in the watershed.

The mission is to improve water quality conditions and to provide a framework under which the restoration and/or protection of the watershed's natural resources can be achieved. Implementation of this project is underway in a process known as the "Watershed Approach". The five-year cycle of the Watershed Approach, as illustrated in Figure 4, provides the management structure to carry out the mission. This report presents the current assessment of water quality conditions in the Parker River Watershed. The assessment is based on information that has been researched and developed by the Massachusetts Department of Environmental Protection (MA DEP) through the first three years (information gathering, monitoring, and assessment) of the five-year cycle in partial fulfillment of MA DEP's federal mandate to report on the status of the Commonwealth's waters under the Federal Water Pollution Control Act (commonly known as the Clean Water Act).

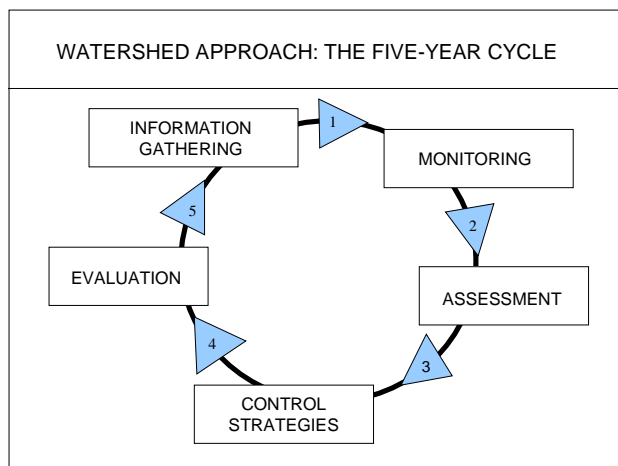


Figure 4. Five-Year Cycle of the Watershed

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. Under Section 305(b) of the Federal Clean Water Act, MA DEP must submit a statewide report every two years to the EPA, which describes the status of water quality in the Commonwealth. The most recent 305(b) report is the *Commonwealth of Massachusetts Summary of Water Quality 2000* (MA DEP 2000). The 305(b) statewide report is based on the compilation of information for the Commonwealth's 27 watersheds. The 305(b) report compiles data from a variety of sources, and provides an evaluation of water quality, progress made towards maintaining and restoring water quality, and the extent to which problems remain at the statewide level. At the watershed level, instream biological, habitat, physical/chemical, toxicity data and other information are evaluated to assess the status of water quality conditions. This analysis follows a standardized process described below (Assessment Methodology).

## ASSESSMENT METHODOLOGY

### WATER QUALITY CLASSIFICATION

The Massachusetts Surface Water Quality Standards (SWQS) designate the most sensitive uses for which the surface waters of the Commonwealth shall be enhanced, maintained and protected; prescribe minimum water quality criteria required to sustain the designated uses; and include provisions for the prohibition of discharges (MA DEP 1996). These regulations should undergo public review every three years. The surface waters are segmented and each segment is assigned to one of the six classes described below. Each class is identified by the most sensitive and therefore, governing, water uses to be achieved and protected. Surface waters may be suitable for other beneficial uses, but shall be regulated by the Department of Environmental Protection to protect and enhance the designated uses.

#### Inland Water Classes

1. **Class A** – These waters are designated as a source of public water supply. To the extent compatible with this use they shall be an excellent habitat for fish, other aquatic life and wildlife, and suitable for primary and

*secondary contact recreation. These waters shall have excellent aesthetic value. These waters are designated for protection as Outstanding Resource Waters (ORW's) under 314 CMR 4.04(3).*

2. **Class B** – *These waters are designated as a habitat for fish, other aquatic life, and wildlife, and for primary and secondary contact recreation. Where designated they shall be suitable as a source of water supply with appropriate treatment. They shall be suitable for irrigation and other agricultural uses and for compatible industrial cooling and process uses. These waters shall have consistently good aesthetic value.*
3. **Class C** – *These waters are designated as a habitat for fish, other aquatic life and wildlife, and for secondary contact recreation. These waters shall be suitable for the irrigation of crops used for consumption after cooking and for compatible industrial cooling and process uses. These waters shall have good aesthetic value.*

### **Coastal and Marine Classes**

4. **Class SA** – *These waters are designated as an excellent habitat for fish, other aquatic life and wildlife and for primary and secondary recreation. In approved areas they shall be suitable for shellfish harvesting without depuration (Open Shellfishing Areas). These waters shall have excellent aesthetic value.*
5. **Class SB** – *These waters are designated as a habitat for fish, other aquatic life and wildlife and for primary and secondary contact recreation. In approved areas they shall be suitable for shellfish harvesting with depuration (Restricted Shellfishing Areas). These waters shall have consistently good aesthetic value.*
6. **Class SC** – *These waters are designated as a habitat for fish, other aquatic life, and wildlife and for secondary contact recreation. They shall also be suitable for certain industrial cooling and process uses. These waters shall have good aesthetic value.*

The CWA Section 305(b) water quality reporting process is an essential aspect of the Nation's water pollution control effort. It is the principal means by which EPA, Congress, and the public evaluate existing water quality, assess progress made in maintaining and restoring water quality, and determine the extent of remaining problems. In so doing, the states report on waterbodies within the context of meeting their designated uses (described above in each class). Each class is identified by the most sensitive and, therefore, governing, water uses to be achieved and protected. These uses include: *Aquatic Life, Fish Consumption, Drinking Water, Primary and Secondary Contact Recreation, Shellfishing and Aesthetics*. Three subclasses of Aquatic Life are also designated in the standards: Cold Water Fishery (capable of sustaining a year-round population of cold water aquatic life, such as trout), Warm Water Fishery (waters that are not capable of sustaining a year-round population of cold water aquatic life), and Marine Fishery (suitable for sustaining marine flora and fauna).

The SWQS, summarized in Table 2, prescribes minimum water quality criteria to sustain the designated uses. Furthermore, these standards describe the hydrological conditions at which water quality criteria must be met (MA DEP 1996). In rivers, the lowest flow conditions at and above which criteria must be met are the lowest mean flow for seven consecutive days to be expected once in ten years (7Q10). In artificially regulated waters, the lowest flow conditions at which criteria must be met are the flow equal or exceeded 99% of the time on a yearly basis or another equivalent flow that has been agreed upon. In coastal and marine waters and for lakes the most severe hydrological condition is determined by MA DEP on a case-by-case basis.

The availability of appropriate and reliable scientific data and technical information is fundamental to the 305(b) reporting process. It is EPA policy (EPA Order 5360.1 CHG 1) that any organization, performing work for or on behalf of EPA, establishes a quality system to support the development, review, approval, implementation, and assessment of data collection operations. To this end, MA DEP describes its Quality System in an EPA-approved Quality Management Plan to ensure that environmental data collected or compiled by the Agency are of known and documented quality and are suitable for their intended use. For external sources of information, MA DEP requires the following: 1. an appropriate *Quality Assurance Project Plan* including a laboratory Quality Assurance /Quality Control (QA/QC) plan, 2. use of a state certified lab (certified in the applicable analysis), 3. data management QA/QC are described, and 4. the information be documented in a citable report.

Table 2. Summary of Massachusetts Surface Water Quality Standards (MA DEP 1996). *Note: Italics are direct quotations.*

Dissolved Oxygen	<p><u>Class A, BCWF*, SA:</u> <math>\geq 6.0</math> mg/L and <math>\geq 75\%</math> saturation unless background conditions are lower</p> <p><u>Class BWWF**, SB:</u> <math>\geq 5.0</math> mg/L and <math>\geq 60\%</math> saturation unless background conditions are lower</p> <p><u>Class C:</u> Not <math>\leq 5.0</math> mg/L for more than 16 of any 24 –hour period and not <math>\leq 3.0</math> mg/L anytime unless background conditions are lower; levels cannot be lowered below 50% saturation due to a discharge</p> <p><u>Class SC:</u> Not <math>\leq 5.0</math> mg/L for more than 16 of any 24 –hour period and not <math>\leq 4.0</math> mg/L anytime unless background conditions are lower; and 50% saturation; levels cannot be lowered below 50% saturation due to a discharge</p>
Temperature	<p><u>Class A:</u> <math>\leq 68^{\circ}\text{F}</math> (<math>20^{\circ}\text{C}</math>) and <math>\Delta 1.5^{\circ}\text{F}</math> (<math>0.8^{\circ}\text{C}</math>) for Cold Water and <math>\leq 83^{\circ}\text{F}</math> (<math>28.3^{\circ}\text{C}</math>) and <math>\Delta 1.5^{\circ}\text{F}</math> (<math>0.8^{\circ}\text{C}</math>) for Warm Water. Note: temperatures are maximum mean monthly</p> <p><u>Class BCWF:</u> <math>\leq 68^{\circ}\text{F}</math> (<math>20^{\circ}\text{C}</math>) and <math>\Delta 3^{\circ}\text{F}</math> (<math>1.7^{\circ}\text{C}</math>) due to a discharge</p> <p><u>Class BWWF:</u> <math>\leq 83^{\circ}\text{F}</math> (<math>28.3^{\circ}\text{C}</math>) and <math>\Delta 3^{\circ}\text{F}</math> (<math>1.7^{\circ}\text{C}</math>) in lakes, <math>\Delta 5^{\circ}\text{F}</math> (<math>2.8^{\circ}\text{C}</math>) in rivers</p> <p><u>Class C, SC:</u> <math>\leq 85^{\circ}\text{F}</math> (<math>29.4^{\circ}\text{C}</math>) nor <math>\Delta 5^{\circ}\text{F}</math> (<math>2.8^{\circ}\text{C}</math>) due to a discharge</p> <p><u>Class SA:</u> <math>\leq 85^{\circ}\text{F}</math> (<math>29.4^{\circ}\text{C}</math>) nor a maximum daily mean of <math>80^{\circ}\text{F}</math> (<math>26.7^{\circ}\text{C}</math>) and <math>\Delta 1.5^{\circ}\text{F}</math> (<math>0.8^{\circ}\text{C}</math>)</p> <p><u>Class SB:</u> <math>\leq 85^{\circ}\text{F}</math> (<math>29.4^{\circ}\text{C}</math>) nor a maximum daily mean of <math>80^{\circ}\text{F}</math> (<math>26.7^{\circ}\text{C}</math>) and <math>\Delta 1.5^{\circ}\text{F}</math> (<math>0.8^{\circ}\text{C}</math>) between July through September and <math>\Delta 4.0^{\circ}\text{F}</math> (<math>2.2^{\circ}\text{C}</math>) between October through June</p>
pH	<p><u>Class A, BCWF, BWWF:</u> 6.5 – 8.3 SU and <math>\Delta 0.5</math> outside the background range.</p> <p><u>Class C:</u> 6.5 – 9.0 SU and <math>\Delta 1.0</math> outside the naturally occurring range.</p> <p><u>Class SA, SB:</u> 6.5 – 8.5 SU and <math>\Delta 0.2</math> outside the normally occurring range.</p> <p><u>Class SC:</u> 6.5 – 9.0 SU and <math>\Delta 0.5</math> outside the naturally occurring range.</p>
Fecal Coliform Bacteria	<p><u>Class A:</u> an arithmetic mean of <math>&lt; 20</math> organisms /100mL in any representative set of samples and <math>&lt; 10\%</math> of the samples <math>&gt; 100</math> organisms/100mL.</p> <p><u>Class B:</u> a geometric mean of <math>&lt; 200</math> organisms /100mL in any representative set of samples and <math>&lt; 10\%</math> of the samples <math>&gt; 400</math> organisms /100mL. (This criterion can be applied on a seasonal basis at the discretion of the MA DEP.)</p> <p><u>Class C:</u> a geometric mean of <math>&lt; 1000</math> organisms /100ml, and <math>&lt; 10\%</math> of the samples <math>&gt; 2000</math> organisms/100 mL.</p> <p><u>Class SA:</u> approved Open Shellfish Areas: a geometric mean (MPN method) of <math>&lt; 14</math> organisms/100 mL and <math>&lt; 10\%</math> of the samples <math>&gt; 43</math> organisms/100mL (MPN method).</p> <p>Waters not designated for shellfishing: <math>&lt; a</math> geometric mean of 200 organisms in any representative set of samples, and <math>&lt; 10\%</math> of the samples <math>&gt; 400</math> organisms /100mL. (This criterion can be applied on a seasonal basis at the discretion of the MA DEP.)</p> <p><u>Class SB:</u> approved Restricted Shellfish Areas: <math>&lt; a</math> fecal coliform median or geometric mean (MPN method) of 88 organisms/100mL and <math>&lt; 10\%</math> of the samples <math>&gt; 260</math> organisms /100mL (MPN method).</p> <p>Waters not designated for shellfishing: <math>&lt; a</math> geometric mean of 200 organisms in any representative set of samples, and <math>&lt; 10\%</math> of the samples <math>&gt; 400</math> organisms /100mL. (This criterion can be applied on a seasonal basis at the discretion of the MA DEP.)</p> <p><u>Class SC:</u> <math>&lt; a</math> geometric mean of 1000 organisms/100mL and <math>&lt; 10\%</math> of the samples <math>&gt; 2000</math> organisms/100ml.</p>
Class A criteria applied to the Drinking Water Use	
Class B criteria applied to Primary and Secondary Contact Recreation Uses	
Solids	<p><u>All Classes:</u> <i>These waters shall be free from floating, suspended, and settleable solids in concentrations or combinations that would impair any use assigned to each class, that would cause aesthetically objectionable conditions, or that would impair the benthic biota or degrade the chemical composition of the bottom.</i></p>
Color and Turbidity	<p><u>All Classes:</u> <i>These waters shall be free from color and turbidity in concentrations or combinations that are aesthetically objectionable or would impair any use.</i></p>
Oil & Grease	<p><u>Class A, SA:</u> <i>Waters shall be free from oil and grease, petrochemicals and other volatile or synthetic organic pollutants.</i></p> <p><u>Class SA:</u> <i>Waters shall be free from oil and grease and petrochemicals.</i></p> <p><u>Class B, C, SB, SC:</u> <i>Waters shall be free from oil and grease, petrochemicals that produce a visible film on the surface of the water, impart an oily taste to the water or an oily or other undesirable taste to the edible portions of aquatic life, coat the banks or bottom of the water course or are deleterious or become toxic to aquatic life.</i></p>
Taste and Odor	<p><u>Class A, SA:</u> <i>None other than of natural origin.</i></p> <p><u>Class B, C, SB, SC:</u> <i>None in such concentrations or combinations that are aesthetically objectionable, that would impair any use assigned to each class, or that would cause tainting or undesirable flavors in the edible portions of aquatic life.</i></p>
Aesthetics	<p><u>All Classes:</u> <i>All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.</i></p>
Toxic Pollutants (EPA 19 November 1999)	<p><u>All Classes:</u> <i>All surface waters shall be free from pollutants in concentrations or combinations that are toxic to humans, aquatic life or wildlife... The division shall use the recommended limit published by EPA pursuant to 33 USC 1251, 304(a) as the allowable receiving water concentrations for the affected waters unless a site-specific limit is established.</i></p>
Nutrients	<p><i>Shall not exceed the site-specific limits necessary to control accelerated or cultural eutrophication.</i></p>

\*Class BCWF = Class B Cold Water Fishery, \*\* Class BWWF = Class B Warm Water Fishery,  $\Delta$  criterion (referring to a change from ambient) is applied to the effects of a permitted discharge.

EPA provides guidelines to the States for making their use support determinations (EPA 1997). The determination of whether or not a waterbody supports each of its designated uses is a function of the type(s), quality and quantity of available current information. Although data/information older than five years are usually considered “historical” and used for descriptive purposes, they can be utilized in the use support determination provided they are known to reflect the current conditions. While the water quality standards (Table 2) prescribe minimum water quality criteria to sustain the designated uses, numerical criteria are not available for every indicator of pollution. Best available guidance in the literature may be applied in lieu of actual numerical criteria (e.g., freshwater sediment data may be compared to *Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario* 1993 by D. Persaud, R. Jaagumagi and A. Hayton). Excursions from criteria due to solely “naturally occurring” conditions (e.g., low pH in some areas) do not constitute violations of the standards.

Each designated use within a given segment is individually assessed as 1) **support**, 2) **partial support**, or 3) **non-support**. The term **threatened** is used when a use is fully supported but may not support the use within two years because of adverse pollution trends or anticipated sources of pollution. When too little current data/information exists or no reliable data are available the use is **not assessed**. In this report, however, if there is some indication that water quality impairment may exist, which is not “naturally occurring”, the use is identified with an “Alert Status”. Detailed guidance for assessing the status of each use follows in the Designated Uses Section of this report. It is important to note, however, that not all waters are assessed. Many small and/or unnamed ponds, rivers, and estuaries are currently **unassessed**; the status of their designated uses has never been reported to EPA in the Commonwealth’s 305(b) report nor is information on these waters maintained in the Waterbody System (WBS) database.

## DESIGNATED USES

The Massachusetts Surface Water Quality Standards designate the most sensitive uses for which the surface waters of the Commonwealth shall be enhanced, maintained and protected. Each of these uses is briefly described below (MA DEP 1996):

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

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

## AQUATIC LIFE USE

This use is suitable for sustaining a native, naturally diverse, community of aquatic flora and fauna. The results of biological (and habitat), toxicological, and chemical data are integrated to assess this use. The nature, frequency, and precision of the MA DEP's data collection techniques dictate that a weight of evidence be used to make the assessment, with biosurvey results used as the final arbiter of borderline cases. The following chart provides an overview of the guidance used to assess the status (support, partial support, non-support) of the *Aquatic Life Use*:

<b>Variable</b> (#) - Indicates reference provided at the end of the designated use section	<b>Support</b> – Data available clearly indicates support. Minor excursions from chemical criteria (Table 2) may be tolerated if the biosurvey results demonstrate support.	<b>Partial Support</b> – Uncertainty about support in the chemical or toxicity testing data, or there is some minor modification of the biological community. Excursions not frequent or prolonged.	<b>Non-Support</b> – There are frequent or severe violations of chemical criteria, presence of acute toxicity, or a moderate or severe modification of the biological community.
<b>BIOLOGY</b>			
Rapid Bioassessment Protocol (RBP) II or III (4)	Non-Impaired	Slightly Impaired	Moderately or Severely Impaired
Fish Community (4)	Best Professional Judgment (BPJ)	BPJ	BPJ
Habitat and Flow (4)	BPJ	BPJ	Dewatered streambed due to artificial regulation or channel alteration
Macrophytes (4)	BPJ	Exotic plant species present, but not dominant, BPJ	Exotic plant species dominant, BPJ
Plankton/ Periphyton (4)	No algal blooms	Occasional algal blooms	Persistent algal blooms
<b>TOXICITY TESTS</b>			
Water Column/Ambient (4)	>75% survival either 48 hr or 7-day exposure	>50 - ≤75% survival either 48 hr or 7-day exposure	≤50% survival either 48 hr or 7-day exposure
Effluent (4)	Meets permit limits	(NOTE: if limit is not met, the stream is listed as threatened for 1.0 river mile downstream from the discharge.)	
Sediment (4)	>75% survival	>50 - ≤75% survival	≤50% survival
<b>CHEMISTRY- WATER</b>			
DO (3, 6)	Criteria (Table 2)	Criteria exceeded in 11-25% of measurements.	Criteria exceeded >25% of measurements.
pH (3, 6)	Criteria (Table 2)	Criteria exceeded in 11-25% of measurements.	Criteria exceeded >25% of measurements.
Temperature (3, 6) <sup>1</sup>	Criteria (Table 2) <sup>1</sup>	Criteria exceeded in 11-25% of measurements.	Criteria exceeded >25% of measurements.
Turbidity (4)	Δ 5 NTU due to a discharge	BPJ	BPJ
Suspended Solids (4)	25 mg/L max., Δ10 mg/L due to a discharge	BPJ	BPJ
Nutrients (3) Phosphate-P (4)	Table 2, (Site-Specific Criteria; Maintain Balanced Biocommunity, no pH/DO violations)	BPJ	BPJ
Toxic Pollutants (3, 6) Ammonia-N (3, 4) <sup>2</sup> Chlorine (3, 6) <sup>3</sup>	Criteria (Table 2) 0.254 mg/L NH <sub>3</sub> -N <sup>2</sup> 0.011 mg/L TRC <sup>3</sup>	BPJ	Criterion is exceed in > 10% of samples.
<b>CHEMISTRY – SEDIMENT</b>			
Toxic Pollutants (5) <sup>4</sup>	≤ L-EL <sup>4</sup> , Low Effect Level	One pollutant between L-EL and S-EL	One pollutant ≥ S-EL (severe)
Nutrients (5)	≤ L-EL	Between L-EL and S-EL	≥ S-EL
Metal Normalization to Al or Fe (4)	Enrichment Ratio ≤ 1	Enrichment Ratio >1 but ≤10	Enrichment Ratio ≥10
<b>CHEMISTRY- EFFLUENT</b>			
Compliance with permit limits (4)	In-compliance with all limits	NOTE: If the facility does not meet their permit limits, the information is used to threaten one river mile downstream from the discharge.	
<b>CHEMISTRY-TISSUE</b>			
PCB – whole fish (1)	≤500 µg/kg wet weight	BPJ	BPJ
DDT (2)	≤14.0 µg/kg wet weight	BPJ	BPJ
PCB in aquatic tissue (2)	≤0.79 ng TEQ/kg wet weight	BPJ	BPJ

<sup>1</sup>maximum daily mean T in a month (minimum six measurements evenly distributed over 24-hours) less than criterion, <sup>2</sup>Ammonia levels for pH of 9.0, actual "criterion" varies with pH and is evaluated case-by-case. <sup>3</sup>The minimum quantification level for TRC is 0.05 mg/L.

<sup>4</sup>For the purpose of this report, the S-EL for total PCB in sediment (which varies with TOC content) with 1% TOC is 5.3 ppm while a sediment sample with 10% TOC is 53 ppm.

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

## **FISH CONSUMPTION USE**

Pollutants shall not result in unacceptable concentrations in edible portions of marketable fish or for the recreational use of fish, other aquatic life or wildlife for human consumption. The assessment of this use is made using the most recent list of Fish Consumption Advisories issued by the Massachusetts Executive Office of Health and Human Services, Department of Public Health (MDPH), Bureau of Environmental Health Assessment (MDPH 2001a). The MDPH list identifies waterbodies where elevated levels of a specified contaminant in edible portions of freshwater species poses a health risk for human consumption. Hence, the Fish Consumption Use is assessed as non-support in these waters.

In July 2001, MDPH issued new consumer advisories on fish consumption and mercury contamination. The MDPH "...is advising pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age to refrain from eating the following marine fish; shark, swordfish, king mackerel, tuna steak and tilefish. In addition, MDPH is expanding its previously issued statewide fish consumption advisory which cautioned pregnant women to avoid eating fish from all freshwater bodies due to concerns about mercury contamination, to now include women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age (MDPH 2001b)."

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

MDPH's statewide advisory does not include fish stocked by the state Division of Fisheries and Wildlife or farm-raised fish sold commercially. Because of the statewide advisory, however, no waters can be assessed as support or partial support for the *Fish Consumption Use*. The following is an overview of the guidance used to assess the status (support, partial support, non-support) of the *Fish Consumption Use*.

<b>Variable (#)</b> - Indicates reference provided at the end of the designated use section	<b>Support</b> – No restrictions or bans in effect	<b>Partial Support</b> – A "restricted consumption" fish advisory is in effect for the general population or a sub-population that could be at potentially greater risk (e.g., pregnant women, and children	<b>Non-Support</b> – A "no consumption" advisory or ban in effect for the general population or a sub-population for one or more fish species; or there is a commercial fishing ban in effect
MDPH Fish Consumption Advisory List (8,12)	Not applicable, precluded by statewide advisory (Hg)	Not applicable	Waterbody on MDPH Fish Consumption Advisory List

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

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

## **DRINKING WATER USE**

The term *Drinking Water Use* denotes those waters used as a source of public drinking water. These waters may be subject to more stringent regulation in accordance with the Massachusetts Drinking Water Regulations (310 CMR 22.00). They are designated for protection as Outstanding Resource Waters (ORW) in 314 CMR 4.04(3). MA DEP's Drinking Water Program (DWP) has primacy for implementing the provisions of the federal Safe Drinking Water Act (SDWA). Except for suppliers with surface water sources for which a waiver from filtration has been granted (these systems also monitor surface water quality) all public drinking water supplies are monitored as finished water (tap water). Monitoring includes the major categories of contaminants established in the SDWA: bacteria, volatile and synthetic organic compounds, inorganic compounds and radionuclides. The DWP maintains current drinking supply monitoring data. The status of the supplies is currently reported on a statewide basis to EPA in the 305(b) report. Below is EPA's guidance to assess the status (support, partial support, non-support) of the drinking water use.

<b>Variable</b> (#) - Indicates reference provided at the end of the designated use section	<b>Support</b> – No closures or advisories (no contaminants with confirmed exceedances of maximum contaminant levels, conventional treatment is adequate to maintain the supply).	<b>Partial Support</b> – Is one or more advisories or more than conventional treatment is required	<b>Non-Support</b> – One or more contamination-based closures of the water supply
Drinking Water Program (DWP) Evaluation	See note below	See note below	See note below

Note: While this use is not assessed in this report, information on drinking water source protection and finish water quality is available at <http://www.state.ma.us/dep/brp/dws/dwshome.htm> and from the Parker River Watershed's public water suppliers.

## **SHELLFISHING USE**

This use is assessed using information from the Department of Fisheries, Wildlife and Environmental Law Enforcement's Division of Marine Fisheries (DMF). A designated shellfish growing area is an area of potential shellfish habitat. Growing areas are managed with respect to shellfish harvest for direct human consumption, and comprise at least one or more classification areas. The classification areas are the management units, and range from being approved to prohibited (listed below) with respect to shellfish harvest. Shellfish areas under management closures are *not assessed*.

<b>Variable</b> (#) - Indicates reference provided at the end of the designated use section	<b>Support</b> – SA Waters—Approved <sup>1</sup> SB Waters— Approved <sup>1</sup> , Conditionally Approved <sup>2</sup> or Restricted <sup>3</sup>	<b>Partial Support</b> – SA Waters— Conditionally Approved <sup>2</sup> , Restricted <sup>3</sup> , or Conditionally Restricted <sup>4</sup> SB Waters—Conditionally Restricted <sup>4</sup>	<b>Non Support</b> – SA Waters—Prohibited <sup>5</sup> SB Waters— Prohibited <sup>5</sup>
Division of Marine Fisheries Shellfish Project Classification Area Information (11)	Reported by DMF	Reported by DMF	Reported by DMF

<sup>1</sup> **Approved** - "...open for harvest of shellfish for direct human consumption subject to local rules and regulations..." An approved area is open all the time and closes only due to hurricanes or other major coastwide events.

<sup>2</sup> **Conditionally Approved** - "...subject to intermittent microbiological pollution..." During the time the area is open, it is "...for harvest of shellfish for direct human consumption subject to local rules and regulations..." A conditionally approved area is closed some of the time due to runoff from rainfall or seasonally poor water quality. When open, shellfish harvested are treated as from an approved area.

<sup>3</sup> **Restricted** - area contains a "limited degree of pollution." It is open for "harvest of shellfish with depuration subject to local rules and state regulations" or for the relay of shellfish. A restricted area is used by DMF for the relay of shellfish to a less contaminated area.

<sup>4</sup> **Conditionally Restricted** - "...subject to intermittent microbiological pollution..." During the time area is restricted, it is only open for "the harvest of shellfish with depuration subject to local rules and state regulations." A conditionally restricted area is closed some of the time due to runoff from rainfall or seasonally poor water quality. When open, only soft-shell clams may be harvested by specially licensed diggers (Master/Subordinate Diggers) and transported to the DMF Shellfish Purification Plant for depuration (purification).

<sup>5</sup> **Prohibited** - Closed for harvest of shellfish.

## PRIMARY CONTACT RECREATION USE

This use is suitable for any recreational or other water use in which there is prolonged and intimate contact with the water with a significant risk of ingestion of water (1 April to 15 October). These include, but are not limited to, wading, swimming, diving, surfing and water skiing. The chart below provides an overview of the guidance used to assess the status (support, partial support, non-support) of the *Primary Contact Recreation Use*.

<b>Variable</b> (#) - Indicates reference provided at the end of the designated use section	<b>Support</b> – Criteria are met, no aesthetic conditions that preclude the use	<b>Partial Support</b> – Criteria exceeded intermittently (neither frequent nor prolonged), marginal aesthetic violations	<b>Non-Support</b> – Frequent or prolonged violations of criteria, formal bathing area closures, or severe aesthetic conditions that preclude the use
Fecal Coliform Bacteria (3, 9) *	Criteria met OR <u>Dry Weather Guidance</u> <5 samples--<400/100mL maximum <u>Wet Weather Guidance</u> Dry weather samples meet and wet samples <2000/100mL	Guidance exceeded in 11-25% of the samples OR <u>Wet Weather</u> Dry weather samples meet and wet samples >2000/100mL	Guidance exceeded in > 25% of the samples
pH (3, 6)	Criteria exceeded in ≤10 % of the measurements	Criteria exceeded in 11-25% of the measurements	Criteria exceeded in >25% of the measurements
Temperature (3)	Criteria met	Criteria exceeded 11-25% of the time	Criteria exceeded 25% of the time
Color and Turbidity (3, 6)	BPJ, Δ 5 NTU (due to a discharge) exceeded in ≤10 % of the measurements	BPJ, Guidance exceeded in 11-25% of the measurements	BPJ, Guidance exceeded in >25% of the measurements
Secchi disk depth (10) **	Lakes - ≥1.2 meters (≥ 4')	Infrequent excursions from the guidance	Frequent and/or prolonged excursions from the guidance
Oil & Grease (3)	Criteria met	BPJ, criteria exceeded 11-25% of the time	BPJ, criteria exceeded >25% of the time
Aesthetics (3) Biocommunity (4)**	No nuisance organisms that render the water aesthetically objectionable or unusable, BPJ; Cover of macrophytes < 50% within any portion of the lake area at maximum extent of growth.	BPJ, Cover of macrophytes 50-75% within any portion of the lake area at maximum extent of growth.	BPJ, Cover of macrophytes >75 within any portion of the lake area at maximum extent of growth.

Note: Excursions from criteria due to natural conditions are not considered impairment of use.

\* Fecal coliform bacteria interpretations require additional information in order to apply this use assessment guidance. Small/limited datasets require an evaluation of survey conditions (i.e., interpretation of the amount of precipitation received in the subject region immediately prior to sampling and streamflow conditions) to determine whether the fecal coliform bacteria results are representative of dry or wet weather/storm water runoff conditions. When larger data sets are available, the frequency of standards/guidance exceedances is calculated.

\*\*Any portion of a lake exhibiting impairment of the *Primary Contact Recreation Use* (swimmable) because of macrophyte cover and/or transparency (Secchi disk depth) is assessed as either partial or non-support. If no fecal coliform bacteria data are available and the lake (entirely or in part) met the transparency (Secchi disk depth) and aesthetics guidance, this use is not assessed.

## SECONDARY CONTACT RECREATION USE

This use is suitable for any recreation or other water use in which contact with the water is either incidental or accidental. These include, but are not limited to, fishing, boating and limited contact incident to shoreline activities. Following is an overview of the guidance used to assess the status (support, partial support, non-support) of the *Secondary Contact Recreation Use*.

<b>Variable (#)</b> - Indicates reference provided at the end of the designated use section	<b>Support</b> – Criteria are met, no aesthetic conditions that preclude the use	<b>Partial Support</b> – Criteria exceeded intermittently (neither frequent nor prolonged), marginal aesthetic violations	<b>Non-Support</b> – Frequent or prolonged violations of criteria, or severe aesthetic conditions that preclude the use
Fecal Coliform Bacteria (4) *	<u>Dry Weather Guidance</u> <5 samples--<2000 cfu/100mL maximum >5 samples--<1000 cfu/100mL geometric mean ≤ 10% samples ≥2000 cfu/100mL <u>Wet Weather Guidance</u> Dry weather samples meet and wet samples <4000 cfu/100mL	<u>Wet Weather Guidance</u> Dry weather samples meet and any wet samples >4000 cfu/100mL	Criteria exceeded in dry weather
Oil & Grease (3)	Criteria met	Criteria exceeded 11-25% of the time, BPJ	Criteria exceeded >25% of the time, BPJ
Aesthetics (3) Biocommunity (4) **	No nuisance organisms that render the water aesthetically objectionable or unusable, BPJ; Cover of macrophytes < 50% within any portion of the lake area at maximum extent of growth.	BPJ, Cover of macrophytes 50-75% within any portion of the lake area at maximum extent of growth.	BPJ, Cover of macrophytes >75 within any portion of the lake area at maximum extent of growth.

Note: Excursions from criteria due to natural conditions are not considered impairment of use.

\* Fecal coliform bacteria interpretations require additional information in order to apply this use assessment guidance. Small/limited datasets require an evaluation of survey conditions (i.e., interpretation of the amount of precipitation received in the subject region immediately prior to sampling and streamflow conditions) to determine whether the fecal coliform bacteria results are representative of dry or wet weather/storm water runoff conditions. When larger data sets are available, the frequency of standards/guidance exceedances is calculated.

\*\* In lakes if no fecal coliform data are available, macrophyte cover is the only criterion used to assess the *Secondary Contact Recreation Use*.

For the *Primary* and *Secondary Contact Recreation Uses* the following steps are taken to interpret the fecal coliform bacteria results:

1. Identify the range of fecal coliform bacteria counts,
2. Calculate the geometric mean (monthly, seasonally, or on dataset), (Note: the geometric mean is only calculated on datasets with >5 samples collected within a 30-day period.)
3. Calculate the % of sample results exceeding 400 cfu/100mL,
4. Determine if the samples were collected during wet or dry weather conditions (review precipitation and streamflow data)
  - Dry weather can be defined as: No/trace antecedent (to the sampling event) precipitation that causes more than a slight increase in stream flow.
  - Wet weather can be defined as: Precipitation antecedent to the sampling event that results in a marked increase in stream flow.
5. Apply the following to interpret dry weather data:
  - ≤10% of the samples exceed criteria (step 2 and 3, above) - assess as Support,
  - 11-25% of the samples exceed criteria (step 2 and 3, above) - assess as Partial Support,
  - >25% of the samples exceed criteria (step 2 and 3, above) - assess as Non-Support.
6. Apply the following to interpret wet weather data:
  - Dry weather samples meet criteria and all wet samples ≤4000 cfu/100mL - assess as Support,
  - Dry weather samples meet criteria and any wet samples >4000 cfu/100mL - assess as Partial Support.

## AESTHETICS USE

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

<b>Variable</b> (#) - Indicates reference provided at the end of the designated use section	<b>Support</b> – 1. No objectionable bottom deposits, floating debris, scum, or nuisances; 2. No objectionable odor, color, taste or turbidity, or nuisance aquatic life	<b>Partial Support</b> – Objectionable conditions neither frequent nor prolonged	<b>Non-Support</b> – Objectionable conditions frequent and/or prolonged
Aesthetics (3)* Visual observation (4)	Criteria met	BPJ (spatial and temporal extent of degradation)	BPJ (extent of spatial and temporal degradation)

\* For lakes, the aesthetic use category is generally assessed at the same level of impairment as the more severely impaired recreational use category (*Primary* or *Secondary Contact*).

### Designated Use References

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# PARKER RIVER WATERSHED DESCRIPTION AND CLASSIFICATION

## DESCRIPTION

The Parker River Watershed and Coastal Drainage Area (Figure 5) lies between the Merrimack and Ipswich River Watersheds in northeastern Massachusetts. All or parts of nine communities lie within the 82 square mile watershed; Boxford, Georgetown, Groveland, Ipswich, Newbury, Newburyport, North Andover, Rowley, and West Newbury. The Parker River Watershed and Coastal Drainage Area is generally rural-residential in nature, with minor industrial development mostly confined to the headwaters of the Little River tributary.

The Parker River is the largest tributary to Plum Island Sound. It is formed at the confluence of two unnamed brooks in a wetland area in west Boxford. The river flows generally in a northeasterly direction through several small ponds and extensive wetland areas in the towns of Boxford, Georgetown, Groveland, and Newbury.

In Newbury, the Parker River becomes tidal with the last nine miles of the river subject to the rise of the tide. The Parker River flows through extensive coastal wetlands to its mouth where it empties into Plum Island Sound. The Parker River National Wildlife Refuge is located at the mouth of the Parker River. This refuge consists of 4,650 acres of sand dunes, salt marsh, freshwater marsh, and glacial upland. Also included in the refuge are six miles of ocean beach along the eastern side of Plum Island.

The Parker River is approximately 23 miles long, and has an average discharge into Plum Island Sound of 97.2 cfs. From the source to its mouth, the Parker River falls a total of 95 feet, of which 36 feet are taken up by the six dams located on the river. The United States Geological Survey (USGS) maintains one gaging station (No. 01101000) on the Parker River at Byfield (town of Newbury) which has provided continuous daily discharge records since 1945. The mean flow of the Parker River at this site (drainage area of 21.3 mi<sup>2</sup>) is 37.2 cfs (Socolow *et. al* 2000). The estimated seven-day mean low flow, with a recurrence interval of 10 years, is 0.163 at this gage (USGS 1998).

Plum Island Sound also receives the flow from Plum Island River and several of its small tributaries (Pine Island Creek and Jericho Creek). The northern extent of the Plum Island River is hydrologically connected to the Merrimack River Watershed at extreme high tides. Under these conditions, water passes over the "high sandy" sandbar and into Pine Island Creek, Newbury. On the next tide cycle, these waters leave Pine Island Creek and flow southward thus connecting the Merrimack River Basin to the Parker River Watershed via the Plum Island River (Gaines and Carr 1992). From the southwest Plum Island Sound is fed by the Rowley and Eagle Hill river systems, as well as the Ipswich River. Plum Island Sound then flows into Ipswich Bay.

There are 37 named streams in the Parker River Watershed that have been assigned SARIS (Stream and River Information System) code numbers (Halliwell *et al.* 1982). These streams and rivers flow an estimated 76 miles. Seventeen ponds/impoundments totaling 322.6 acres (the term "ponds" will hereafter be used to include both) have been identified and assigned Pond and Lake Information System (PALIS) code numbers in the Parker River Watershed (Ackerman 1989 and MA DEP 2001a). The total area of estuarine waters in the Parker River Watershed is approximately 14.3 square miles. [Note: A variety of sources have been used to determine the river length, and pond and estuarine area including the WBS database, diagnostic/feasibility studies, and 1:25,000 MassGIS datalayers. Future plans are to base all size determinations on the most accurate MassGIS datalayers available.]

According to climate statistics collected by the National Oceanic and Atmospheric Administration (NOAA), 1999 was the driest growing season on record in several Northeast states including Massachusetts. Additionally, streamflow data collected by the U.S. Geological Survey showed that the average monthly stream flows in June were lower than have been recorded in decades. Data from 30 USGS streamflow

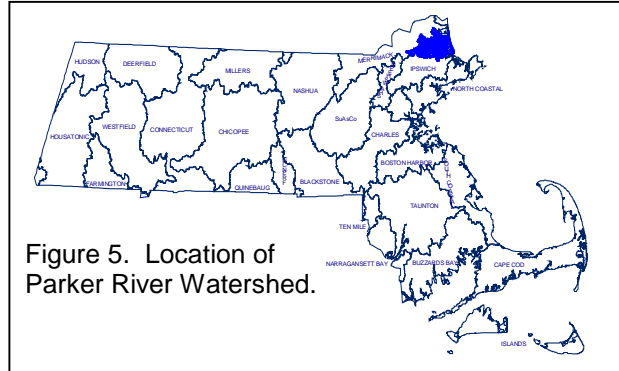


Figure 5. Location of Parker River Watershed.

stations, each having more than 40 years of measurements, showed the lowest average flow recorded for June at ten of the stations. Of these ten stations, seven are in eastern Massachusetts. At the Ipswich River South Middleton station, the previous recorded low for June was 7.36 cfs in 1966. The 1999 low flow measurement for June was 6.55 cfs - 11% lower (USGS 5 June 2001).

## CLASSIFICATION

Consistent with the National Goal Uses of “fishable and swimmable waters”, the classification of waters in the Parker River Watershed and tributaries to and including Plum Island Sound (listed as part of the Merrimack River Basin), according to the SWQS, include the following (MA DEP 1996):

### Class A

- Bull Brook Reservoir, Reservoir to outlet in Ipswich and those tributaries thereto (PWS)
- Dow Brook Reservoir, Reservoir to outlet in Ipswich and those tributaries thereto (PWS)

### Class SA

- Parker River, tidal portion and tributaries thereto (outstanding resource water - ORW)
- Mill River, tidal portion and tributaries thereto (ORW)
- Eagle Hill River, entire length and tributaries thereto (ORW)
- Third Creek, entire length (ORW)
- Roger Island River, entire length and tributaries thereto (ORW)
- Rowley River, entire length and tributaries thereto (ORW)
- Egypt River, entire length and tributaries thereto (ORW)
- Mud Creek, entire length and tributaries thereto (ORW)

And tributaries to and including Plum Island Sound (listed in the Merrimack River Basin):

- Plum Island River, entire length (ORW)
- Plum Island Sound (ORW)
- Pine Island Creek and Jericho Creek (ORW)

### Class B

- Parker River, source to tidal portion (High Quality Water)
- Mill River, source to tidal portion and tributaries thereto (ORW)
- Freshwater portions of Eagle Hill River, Third Creek, Roger Island River, Rowley River, Egypt River, and Mud Creek.

And tributaries to Plum Island Sound (listed in the Merrimack River Basin):

- Pine Island Creek and Jericho Creek.

The designation of ORW is applied to those waters with exceptional socio-economic, recreational, ecological and/or aesthetic values (Rojko *et al.* 1995). ORWs have more stringent requirements than other waters because the existing use is so exceptional or the perceived risk of harm is such that no lowering of water quality is permissible. ORWs include certified vernal pools, all designated Class A Public Water Supplies, and may include surface waters found in National Parks, State Forests and Parks, Areas of Critical Environmental Concern (ACECs) and those protected by special legislation (MA DEM 1993). Wetlands that border ORWs are designated as ORWs to the boundary of the defined area.

The Parker River/Essex Bay ACEC includes 25,500 acres of barrier beach, dunes, salt marsh, and waterbodies. Plum Island and Castle Neck are two of the relatively few major, undeveloped barrier beaches in the Commonwealth. They are over 10 miles in length combined, with most of the area protected under public or private management. More than 10,000 acres of salt marsh make this the largest salt marsh system north of Long Island, New York.

Included within the ACEC is the 4662-acre Parker River National Wildlife Refuge, known as an important site on the Atlantic Fly-way Migration route. More than 60 bird species breed here, including the rare seaside sparrow and the least tern. Over 300 species of birds have been sighted in this area, including 75 rare species. During the spring and fall migrations, concentrations of up to 25,000 ducks and 6000 Canadian Geese have been noted. Waters of the ACEC contain vast amounts of shellfish and host some

of the largest anadromous fish runs of alewives and smelt on the North Shore. Other protected open space within the Parker River/Essex Bay ACEC includes the Crane Reservation, Crane Wildlife Refuge, and Plum Island State Park (MA DEM 2000).

Unlisted waters in the Parker River Watershed/Plum Island Sound Coastal Drainage Area, not otherwise designated in the SWQS, are *Class B, High Quality Waters*, for inland waters and *Class SA, High Quality Waters*, for coastal and marine waters. According to the SWQS, where fisheries designations are necessary, they shall be made on a case-by-case basis.

## **SUMMARY OF EXISTING CONDITIONS AND PERCEIVED PROBLEMS**

The following is excerpted from the unpublished Draft Parker River Watershed 1994 Assessment, which was based on water quality survey data collected by MA DEP (formerly Department of Environmental Quality Engineering) in the Parker River Watershed in 1975, 1978, 1984 and 1994 (Beskenis 1996).

[From its headwaters in Boxford, the Parker River flows sluggishly through approximately four miles of wetland where enhanced primary production and subsequent decomposition of organic matter result in downstream oxygen depletion and slight nutrient enrichment. This natural phenomenon is clearly demonstrated by water quality data, which consistently exhibits low dissolved oxygen concentration and elevated instream nitrogen and phosphorus concentrations. It is important to note that despite the increase of dissolved nutrients that leach out of the wetland areas along the Parker River, instream ammonia nitrogen and phosphorus concentrations are slightly lower than those in rivers and streams in Massachusetts that are impacted by point sources of pollution. The total phosphorus concentrations in particular showed very low values along the river.

Immediately downstream from these wetlands the Parker River flows through two ponds (i.e., Rock and Pentucket), which act as nutrient sinks. In these large ponds primary producers convert dissolved nitrogen and phosphorus to biomass, which, in turn, is assimilated by heterotrophic organisms. Decomposition products (e.g., nutrients) are not carried downstream as in the free-flowing segments of the Parker River, but settle to the bottom where they are incorporated into the sediments.

Downstream from the outlet of Pentucket Pond, the Parker River flows freely for approximately seven miles before it is impounded by a dam at Central Street in Newbury. Although the river continues to drain extensive wetland areas, reparation characteristics are such that dissolved oxygen concentrations remain consistently higher than in the wetland segment upstream from Rock Pond. Nevertheless, dissolved oxygen depletion to concentrations below the Class B standard is not unusual.

Several tributaries of the Parker River have been impacted by nonpoint sources of pollution as evidenced by one or more of the following: low dissolved oxygen concentrations, elevated nutrient levels and relatively high fecal coliform counts. These tributaries include Penn and Wheeler (and its tributary Jackman) brooks, Cart Creek, and the Mill and Little rivers. A Section 319 nonpoint source project (No. 94-07) was awarded to the Massachusetts Audubon Society to address the nonpoint sources of pollution in the Mill River Subwatershed.]

The Clean Water Act Section 303(d) requires states to identify those waterbodies that are not meeting Surface Water Quality Standards. Table 3 identifies the waterbodies in the Parker River Watershed/Plum Island Sound Coastal Drainage Area that are on the 1998 Massachusetts Section 303(d) list of waters (MA DEP 1999a). Additionally, all freshwaters in Massachusetts are technically (by default) listed in 1998 as 303(d) waters with mercury as the associated stressor/pollutant due to the 1994 MDPH Interim Freshwater Fish Consumption Advisory. This Interim Freshwater Fish Consumption Advisory was aimed at pregnant women only; the general public was not considered to be at risk from fish consumption. MDPH's interim advisory does not include fish stocked by the state Division of Fisheries and Wildlife or farm-raised fish sold commercially (MDPH 1994).

Table 3. 1998 303(d) list of waters in the Parker River Watershed

1998 303(d) Listed Waterbody			Cause of Impairment
Eagle Hill	MA91-06	Headwaters near Town Farm Road, Ipswich to the mouth at Plum Island Sound	Pathogens
Paine Creek	MA91-03	Headwaters to confluence with Eagle Hill River	Pathogens
Rowley River	MA91-05	Confluence with Egypt River and Muddy Run to mouth at Plum Island Sound	Pathogens
Parker River	MA91-02	Central Street to mouth at Plum Island Sound, Newbury	Pathogens
Parker River*	MA91-01	Source in Boxford to Central Street, Newbury	Flow alteration
Baldpate Pond	MA91001	Boxford	Noxious aquatic plants
Central Street Pond	MA91003	Rowley	Noxious aquatic plants
Crane Pond	MA91004	Groveland	Noxious aquatic plants
Lower Mill Pond	MA91008	Rowley	Noxious aquatic plants
Sperrys Pond	MA91013	Boxford	Noxious aquatic plants
State Street Pond	MA91014	Newburyport	Noxious aquatic plants
Upper Mill Pond	MA91015	Rowley	Noxious aquatic plants
Wilson Pond	MA91017	Rowley	Noxious aquatic plants
Plum Island River**	MA91-15 (MA84A-23)	From Chances Island to mouth at Plum Island Sound	Pathogens
Plum Island Sound**	MA91-12 (MA84A-24)	Includes Ipswich Bay	Pathogens

\*needs confirmation (additional data collection is necessary to confirm the presence of impairment) \*\* Listed in the Merrimack River basin

Between 1991 and 1994 the Massachusetts Audubon Society conducted water quality sampling, shoreline/source identification and land use research in the Plum Island Sound (including the Mill River subwatershed) as part of a Massachusetts Bays Program Minibays project (Buchsbaum *et al.* 1996). Water quality data identified that contaminated storm water runoff and septic system effluent are the major nonpoint sources of contamination to the Plum Island Sound watershed. This study indicated that storm water runoff contained contaminants from roadways, parking lots, lawn fertilizers, and animal waste. Additionally septic systems were identified as a major contributor of contaminants due to systems that are failing/leaking; inadequately sized, sited or designed; and in need of pumping repair or replacement.

## SOURCES OF INFORMATION

Multiple local, state and federal agencies provided information used in the water quality assessment of the Parker River Watershed. Within the MA DEP information was obtained from three programmatic bureaus: Bureau of Resource Protection (BRP, see below), Bureau of Waste Prevention (industrial wastewater discharge information) and the Bureau of Waste Site Cleanup (hazardous waste site cleanup information). Specifically, the BRP Division of Watershed Management (DWM) Watershed Planning Program provided water quality, habitat assessment, biological data, and pond synoptic survey data. The MA DEP Northeast Regional Office, Parker River Watershed Team, MA DEP DWP and the DWM Watershed Permitting Program (Water Management Act, and National Pollutant Discharge Elimination System permits) provided water withdrawal and wastewater discharge permit information. [Note: The BRP DWP evaluates the status of the *Drinking Water Use* and this information is, therefore, not provided in this assessment report.]

Projects funded through various MA DEP grant and loan programs also provide valuable information that may be used in the water quality assessment report. A summary of these projects for the Parker River Watershed is provided in Appendix D.

The USGS, as part of their National Water-Quality Assessment (NAWQA) Program in the New England Coastal Basins study unit (Maine, Massachusetts, New Hampshire, and Rhode Island) initiated a New England Coastal Basin (NECB) Mercury Study in 1999 when the results of their National Mercury Pilot Study showed some of the highest mercury concentrations in the country were in the NECB study area (USGS August 2000). The dominant source of mercury identified in the NECB study area was

atmospheric deposition. In collaboration with USGS's Toxics Substances Hydrology Program (an extension of the National Mercury Pilot Study) and Urban Land Use Gradient Study (part of the NAWQA program), USGS collected sediment, water, and/or fish for total and/or methyl mercury analysis from 22 streams north of Boston in 1999 and 30 sites in the NECB in 2000. The Parker River at Byfield was sampled by USGS in July 1999 (sediment and water column). These data, however, are not yet available.

In 1994, MDPH issued a statewide *Interim Freshwater Fish Consumption Advisory* for mercury (MDPH 1994). This precautionary measure was aimed at pregnant women only; the general public was not considered to be at risk from fish consumption. The advisory encompasses all freshwaters in Massachusetts therefore the *Fish Consumption Use* cannot be assessed as support. In July 2001, MDPH issued a new, more inclusive, fish consumption advisory for both fresh and salt waters in the Commonwealth (MDPH 2001b). Currently, there are two site-specific fish consumption advisories for water bodies in the Parker River Watershed (Rock and Pentucket ponds) because of elevated mercury concentrations in fishes (MDPH 2001a).

The Division of Marine Fisheries (DMF) Shellfish Management Program maintains information used to classify (e.g., approved, conditionally approved, prohibited) their shellfish management areas. These classifications are subsequently used to regulate the harvesting of various shellfish (DFWELE 2000). DMF shellfish management areas include acreage in the Parker River Watershed not specifically addressed (i.e., designated as a segment) in this report. Appendix E includes the complete listing of DMF shellfishing closures as of October 2000 in the Parker River/Plum Island Sound Coastal Drainage Area.

DMF conducts fecal coliform bacteria sampling as part of their sanitary surveys by which shellfish growing area classifications are assigned. These surveys also include shellfish species identification, habitat location, relative abundance and documentation of related fisheries. A shoreline survey is conducted to identify pollution sources and evaluate potential impacts with the understanding that hydrographic characteristics may influence contaminant distribution and removal over the growing area. Supplementary analysis may be required for naturally occurring pathogens (i.e. *Vibrio* spp.), marine biotoxins (i.e. Paralytic Shellfish Poisoning) as well as hazardous wastes in growing areas with a known history of contamination by these harmful substances.

Sanitary surveys must be repeated at least every twelve years for growing areas classified other than Prohibited (Kennedy 2001). However, survey information is kept current as well as updated through annual and triennial reports and classifications are maintained with extensive monitoring. A growing area classification may be downgraded and management plans amended, based on the findings of annual and triennial reviews. Classification upgrades can only be made based on the findings of a full sanitary survey. Specifically, sanitary surveys on waters in the Parker River Watershed were conducted during dry weather conditions, while the areas were open to digging.

In addition to state and federal agencies, regional, local and citizen monitoring groups in the watershed management process provided valuable data/information which may be used to indicate areas of degraded water quality, as well as causes and sources of contamination. The Parker River Clean Water Association (PRCWA) is a community non-profit organization dedicated to promoting the restoration and protection of the waters and environment of the Parker River and Plum Island Sound watersheds (PRCWA 19 November 2000).

PRCWA volunteers monitor approximately 20 sites within the watershed on a regular basis. These monitoring locations include five stations on the freshwater segment of the Parker River (Baily Lane, Mill Street, Thurlow Street, River Street and Central Street); one station on the estuarine segment of the Parker River (Newbury Docks); three stations on the Little River (Parker Street, Hanover Street, Newman Road); two stations on the Mill River (Glenn Mills and Governor Dummer Academy); one station on Ox Pasture Brook (Fenno Drive); one station on the Rowley River (Rowley Town Docks); and various tributaries in the Parker River Watershed. This monitoring is conducted under an EPA-approved Quality Assurance Project Plan (QAPP) that calls for all volunteer monitors to participate in training sessions for field collection and QA/QC procedure. Their sampling season typically runs from April through November and the results are published in the Parker River Watch Annual Report (PRCWA 1999). This report is

given to conservation commissions in Parker River watershed communities and placed in local libraries. The association also engages in more detailed sampling of identified trouble spots. Variables monitored include: flow, fecal coliform bacteria, turbidity, dissolved oxygen and selected nutrients (PRCWA 19 November 2000).

In conjunction with the Essex County Sportsmen Association, Massachusetts Audubon Society, Essex County Greenbelt Association, and the Great Marsh Fish Team, PRCWA helps to maintain fish ladders on the Parker River and conducts yearly anadromous fish counts from April to May in an effort to estimate population size, time of migration, and duration of migration (PRCWA 19 November 2000).

As a result of issues identified by the Massachusetts Audubon Society during their 1991-1995 water quality sampling, shoreline/source identification and land use research on the Plum Island Sound an EPA/MA DEP funded 319(h) Non-point Source Competitive grant was awarded to Massachusetts Audubon Society. This project was designed to address storm water and septic system problems by implementing three programs (Leahy 1998):

- Storm water management program to treat roadway and agricultural runoff
- Septic system management program
- Public education program

The Massachusetts Audubon Society conducted a nonpoint source pollution study in the Mill River subwatershed from January 1995 through June 1998 (Leahy 1998). This project was funded through MA DEP under a Section 319(h) Nonpoint Source Competitive Grant to assist the Town of Rowley in its efforts to upgrade water quality in the subwatershed by incorporating storm water best management practices (BMPs), regulating nonpoint sources of pollution and through public education. As part of this project, a StormTreat™ System was installed in the Ox Pasture Brook subwatershed in Rowley. This installation, completed in July 1997, consisted of six sedimentation chambers and a constructed wetland. Additionally, fecal coliform bacteria samples were collected from 16 stations on the Mill River and its tributaries at approximately two week intervals from July through December 1995 and May through December 1996 with occasional samples taken in the winter months (both wet and dry). In 1997 more intensive sampling was conducted in the Ox Pasture Brook.

The Plum Island Ecosystem (PIE) research site, located on the Northern Massachusetts coast, is part of the National Science Foundation's (NSF) Long-Term Ecological Research (LTER) Network. PIE-LTER research was conducted by scientists from the Ecosystems Center at the Marine Biological Laboratory, the University of South Carolina, the Massachusetts Audubon Society, the Wells National Estuarine Research Reserve, and the University of New Hampshire. From 1992-1996, researchers from the Ecosystems Center were funded by the NSF Land Margin Ecosystems Research program in Plum Island. Water column sampling is conducted at 27 stations between the Center Street Dam and the mouth at Plum Island Sound (MBL 2001).

The Merrimack Valley Planning Commission (MVPC) in cooperation with PRCWA, DMF, the United States Department of Agriculture Natural Resources Conservation Service and the towns of Newburyport and Newbury conducted a nonpoint source pollution assessment in the Little River subwatershed from April 1999 through April 2000 (MVPC 2000a). This project was funded by MA DEP under a Section 604(b) Water Quality Management Planning Program grant to identify areas and sources of elevated levels fecal coliform bacteria and to develop land use management recommendations. Twenty-seven sites were sampled (9–Little River; 17–Little River tributaries; 1–Parker River) for fecal coliform bacteria in the Little River subwatershed with 90% of the 300 samples collected during dry weather conditions.

The MVPC also prepared a Pentucket Pond storm water assessment summary jointly funded by a Coastal Zone Management/Coastal Pollutant Remediation grant, MVPC, and the Town of Georgetown to identify, map and characterize significant storm water discharges into the pond; to estimate drainage areas and peak flow rates associated with these discharges; and develop recommendations and preliminary design for storm water best management practices – BMPs (MVPC 2000b). Shoreline surveys of Pentucket Pond, during both wet and dry weather conditions, identified 14 known or potential surface discharge sites (i.e., drainage ditches, culverts, parking lots, and discharge pipes).

Site-specific evaluations of other water quality issues in the Parker River Watershed related to either wastewater discharges and/or water withdrawals were conducted either through field investigations (where resources could be allocated) or through the review of discharge monitoring reports (DMRs) and annual water withdrawal reports submitted by the permittees. Water withdrawal and wastewater discharge permit information was provided by the MA DEP Northeast Regional Office, Parker River Watershed Team and the DWM Watershed Permitting Program (Water Management Act - WMA and National Pollutant Discharge Elimination System –NPDES).

The Parker River Watershed has two NPDES permitted dischargers (Hogan 2001). Governor Dummer Academy (MA0030350) operates a wastewater treatment plant to treat wastes from residences and normal daily operations of the facility. The treatment facility consists of an equalization basin, an aeration basin, clarification, ultra-violet disinfection, sand filtration, and sludge disposal (sand drying bed). The average flow from the facility is 13,000 gallons per day (gpd). The design capacity is 30,000 gpd. The discharge flows to a small intermittent brook that flows under Route US 1 and into the tidal portion of the Mill River, a tributary to the Parker River. The permit was issued on 2 September 1996 and will expire on 2 September 2001.

Governor Dummer Academy (MA0030350) submits whole effluent toxicity testing discharge monitoring reports to EPA and MA DEP as required by their NPDES permit. Data from these whole effluent toxicity reports are maintained by DWM in a database entitled TOXTD (Toxicity Testing Data). Information from the reports includes: survival of test organisms exposed to ambient river water (used as dilution water), physicochemical analysis (e.g., hardness, alkalinity, pH, total suspended solids) of the dilution water, and the whole effluent toxicity test results. Data from April 1997 to July 2000 were reviewed and summarized (ranges) for use in the assessment of current water quality conditions in the Parker River Watershed.

The Town of Georgetown operates a water treatment plant (MAG640048) that periodically discharges filter backwash to the Parker River. This discharge is covered under a general permit issued by EPA (MAG640048) and MA DEP (BRP WM 13). The permit limits the discharge as follows: flow = 2,000 gpd; total suspended solids = 30 mg/L; settleable solids = 0.1 mL/L; and pH = 6-9 SU. The permit was issued on 1 February 2001.

Additionally, the towns of Georgetown and Groveland are required to obtain a general NPDES storm water permit. EPA is currently writing this general permit (with input from MA DEP) and a draft is scheduled to be available for internal review by the end of 2001. The final version of the Phase II storm water permit will be issued by December 2002. Permit applications from the towns must be submitted to EPA by March 2003 and coverage under the permit begins with the application (Scarlet 2001).

## TOTAL MAXIMUM DAILY LOADS (TMDL)

As part of the Federal Clean Water Act states are required to develop TMDL for lakes, rivers, and coastal waters not meeting the states surface water quality standards as indicated by the states 303d list of impaired waters. A TMDL is the greatest amount of a pollutant that a waterbody can accept and still meet standards. Further information on the 303d list and the TMDL program are available on the MA DEP website at: <http://www.dep.state.ma.us/dep/brp/wm/wmpubs.htm>.

There are eight ponds in the Parker River Watershed on the 1998 303(d) list. The cause of impairment for all eight ponds is noxious aquatic plants (Table 3). A single draft TMDL for Total Phosphorus is being developed for **Central Street Pond** (MA91003), Rowley; **Crane Pond** (MA91004), Groveland; **Lower Mill Pond** (MA91008), Rowley; **Sperrys Pond** (MA91013), Boxford; **State Street Pond** (MA91014), Newburyport; **Upper Mill Pond** (MA91015), Rowley; **Wilson Pond** (MA91017), Rowley (MA DEP 2001b). This draft TMDL will be available for public comment and the final revised version is scheduled to be submitted to EPA by the end of 2001 (Mattson 2001). An individual TMDL will be developed for **Baldpate Pond** (MA91001).

## OBJECTIVES

This report summarizes information generated in the Parker River Watershed through *Year 1* (information gathering in 1998) and *Year 2* (environmental monitoring in 1999) activities established in the "Five-Year Cycle" of the Watershed Initiative. Surveys conducted by DWM in 1999 were limited to benthic macroinvertebrates, habitat assessments, and fish toxics monitoring. The benthic macroinvertebrate data are provided in Appendix C: a technical memorandum entitled *1999 DEP DWM Technical Memorandum* (TM-91-1). Together with other sources of information (identified in each segment assessment), the status of water quality conditions of rivers, ponds and estuaries in the Parker River Watershed was assessed in accordance with EPA's and MA DEP's use assessment methods. Not all waters in the Parker River Watershed are included in the MA DEP/EPA Waterbody System database or this report.

The objectives of this water quality assessment report are to:

1. evaluate whether or not surface waters in the Parker River Watershed, defined as segments in the WBS database, currently support their designated uses (i.e., meet surface water quality standards),
2. identify water withdrawals (habitat quality/water quantity) and/or major point (wastewater discharges) and nonpoint (land-use practices, storm water discharges, etc.) sources of pollution that may or are impairing water quality,
3. identify the presence or absence of any exotic macrophytes in ponds,
4. identify waters (or segments) of concern that require additional data to fully assess water quality conditions,
5. recommend additional monitoring needs and/or remediation actions in order to better determine the level of impairment or to improve/restore water quality, and
6. provide information to the Parker River Watershed Team for use in its annual and 5-year watershed action plans.

## REPORT FORMAT

### **RIVERS AND ESTUARIES**

The rivers assessed in the Parker River Watershed are presented in the *River Segment Assessments* section of this report (Figure 6). The order of river segments follows the Massachusetts Stream Classification Program (Halliwell *et al.* 1982) hierarchy. River segments are organized hydrologically (from most upstream to downstream) and tributary segments follow after the river segment into which they discharge. Each river segment assessment is formatted as follows:

#### **SEGMENT IDENTIFICATION**

Name, Waterbody identification number (WBID), location, length, classification.

Sources of information: coding system (waterbody identification number e.g., MA91-01) used by MA DEP to reference the stream segment in databases such as 305(b) and 303(d), and the classification (MA DEP 1996).

#### **SEGMENT DESCRIPTION**

Major land-use estimates (top three uses for the subwatershed excluding "open water") and other descriptive information.

Sources of information: USGS topographical maps, and land use statistics from a GIS analysis using the MassGIS land use coverage developed at a scale of 1:25,000 and based on aerial photographs taken in 1999 (UMass Amherst 1999).

#### **SEGMENT LOCATOR MAP**

Major waterbody locations, segment origin and termination points, and segment subwatershed (gray shaded).

Sources of information: Data layers published through MassGIS including the Hydrography (1:25,000) datalayer (MassGIS 2000).

#### **WATER WITHDRAWALS AND WASTEWATER DISCHARGE PERMIT INFORMATION**

Water withdrawals and NPDES wastewater discharges (when provided)

Sources of information: WMA Database Printout (LeVangie 2001, O'Keefe 2001); open permit files located in Worcester and Wilmington DEP Offices (MA DEP 2001b and c).

#### **USE ASSESSMENT**

Aquatic Life, Fish Consumption, Shellfishing, Drinking Water (where applicable – see note below), Primary Contact Recreation, Secondary Contact Recreation, and Aesthetics.

Sources of information include: DWM 1999 Survey data (Appendix B and Appendix C); DEP DWM Toxicity Testing Database "TOXTD"; The MDPH Freshwater Fish Consumption Advisory List (MDPH 2001a) was used to assess the *Fish Consumption Use* and the DMF Shellfish status report was used to assess the *Shellfishing Use* (DFWELE 2000). Where other sources of information were used to assess designated uses, citations are included.

[Note: Although the *Drinking Water Use* itself was not assessed in this water quality assessment report, the Class A waters were identified.]

#### **SUMMARY**

Use summary table (uses, status, causes and sources of impairment).

#### **RECOMMENDATIONS**

Additional monitoring and implementation needs.

### **PONDS**

The ponds assessed in the Parker River Watershed, identified with their Waterbody System Identification (WBID) code numbers, are listed alphabetically in the Ponds Segment Assessments section of this report (Figure 7). Pond assessments were based on information gathered during DWM 1994 synoptic pond surveys, as well as pertinent information from other sources (e.g., abutters, herbicide applicators, diagnostic/feasibility studies, MDPH, etc.). These pond surveys focused on observations of water quality and quantity (e.g., water level, sedimentation, etc.), the presence of native and non-native aquatic plants (both distribution and areal cover) and presence/severity of algal blooms (MA DEP 1994). In cases where it is best professional judgment that conditions have not changed since the 1994 surveys, these data were used for assessment purposes. Fish consumption advisory information was obtained from the MDPH to assess the *Fish Consumption Use* (MDPH 2001a). Although the *Drinking Water Use* was not assessed in this water quality assessment report, the Class A waters were identified. Information on drinking water source protection and finish water quality is available at the MDPH web site and from the Parker River Watershed's public water suppliers.