APPENDIX A

TAUNTON RIVER WATERSHED

DWM YEAR 2001 WATER QUALITY MONITORING DATA

Technical Memorandum TM-62-6

DWM Control Number: 94.1

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
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Introduction

Water quality sampling in the Taunton River Basin was conducted in 2001 to gather information that would help address the Massachusetts Division of Watershed Management's (DWM) program objectives. The DWM sampling plan matrix for the Year Two monitoring is presented in Table 1. Sampling components at river stations included: *in-situ* Hydrolab™ measurements, physico-chemical and nutrient sampling, as well as, biological sampling which included benthic macroinvertebrate, periphyton (attached algae), and fish sampling. Pre-dawn dissolved oxygen sampling was performed in July followed by additional water quality sampling (i.e., nutrients, bacteria and other physico-chemical parameters) in August and September. Surveys for the development of total maximum daily loads (TMDL) were conducted at six lakes and ponds. Each sampling component - except for the lakes and biological sampling that are described in separate technical memoranda - is described in the sections that follow.

Project Objectives

Previous monitoring and assessment of waterbodies in the Taunton River Watershed identified segments that had lost one or more of their potential uses because of degraded water quality or habitats. These uses include: Primary and Secondary Contact Recreation, Aquatic Life, and Aesthetics (MA DEP, 1996). Several of these segments now appear on the Commonwealth's 303d list of impaired waters with the causes of the problems listed, if known.

The goals and objectives of the 2001 Taunton River sampling were delineated in a Quality Assurance Project Plan (QAPP) (MA DEP, 2001d) and included:

1. Re-assess segments that are on the 303d list for pathogens with the possibility that water quality improvements could lead to their removal from the list.

2. Conduct water quality testing and biological/habitat assessment of the Satucket River system and its tributary, Stump Brook, which flows from Monponsett Pond.

3. Re-assess segments that are on the 303d list for DO/organic enrichment and try to define the spatial extent of contamination.

4. Sample waterbodies that are listed as unassessed in the Taunton River 1996 assessment report to learn if they are meeting water quality standards.

5. Attempt to locate sources of bacterial contamination using *Escherichia coli* and use of optical brightener or fluorescent whitening agents.

6. Examine nutrient impacts from two wastewater treatment plants in the Taunton River Basin: the Brockton POTW and the Mansfield POTW. Measure changes in nitrogen and phosphorus concentrations, algal communities and production, and the macroinvertebrate communities above and below the POTWs.

7. Provide data to support the development of TMDL's for 6 lakes in the Taunton River Basin.

8. Assist the EPA in compliance monitoring of 1 or 2 wastewater treatment plants in the basin.

9. Sample fish from two lakes to determine the safety of fish consumption from these waterbodies.

Field and Analytical Methods

Location descriptions, dates and parameters for the Taunton River water quality sampling program are included in Table 1. Figure 1 presents an overview of the station locations throughout the Taunton River Basin, while Figure 1a contains the station locations in the Wading, Rumford, Canoe and Three Mile River subwatersheds. The Satucket River subwatershed sampling locations are included in Figure 1b and the Assonet River subwatershed sampling stations are depicted in Figure 1c.

The parameters included in the sampling were: *in-situ* Hydrolab ™ measurements (dissolved oxygen, percent saturation, pH, conductivity, temperature and total dissolved solids), physico-chemical (total suspended solids total alkalinity, total hardness, chlorides and conductivity) and nutrient (nitrate-N, ammonia-N, total phosphorus) sampling. Physico-chemical and nutrient samples were transported on ice to the Wall Experiment Station (WES), the Department's analytical laboratory in Lawrence, Massachusetts, where they were analyzed in accordance with the laboratory's SOP (MA DEP, 2001a). The specific analytical methods employed are presented in Table 2.

The water quality sampling procedures are included in the publication: CN 001.1 *Sample Collection Techniques for DWM Surface Water Quality Monitoring* (MA DEP, 2001b). The SOP document CN 004.1 (MA DEP, 2001c) outlines the standard operating procedures for the Hydrolab™. The quality control and assurance components are included in *Quality Assurance Project Plan for Year 2001 Watershed Assessments of the Farmington, Westfield, Concord, Taunton and South Coastal Basins* (MA DEP, 2001d) and *Quality Assurance Project Plan for 2001 Benthic Macroinvertebrate Biomonitoring and Habitat Assessment* (MA DEP, 2001e).

Field sheets, raw data files, chain of custody forms, lab reports, and other forms of data used in this report are managed and maintained by DEP DWM in the *Water Quality Access Database* in Worcester, MA. Several people are involved in the validation of the water quality data which includes data entry, quality control checks, analysis for outlier and blank contamination, duplicates, precision and holding time violations as well as project level review. The project level review is completed by the project coordinator, as identified in the QAPP for the Taunton River (MADEP, 2001d). The coordinator reviews the data for reasonableness, completeness and acceptability; see CN 149.0 MA DEP (2004) for more detail regarding DWM data validation of 2001Taunton data.

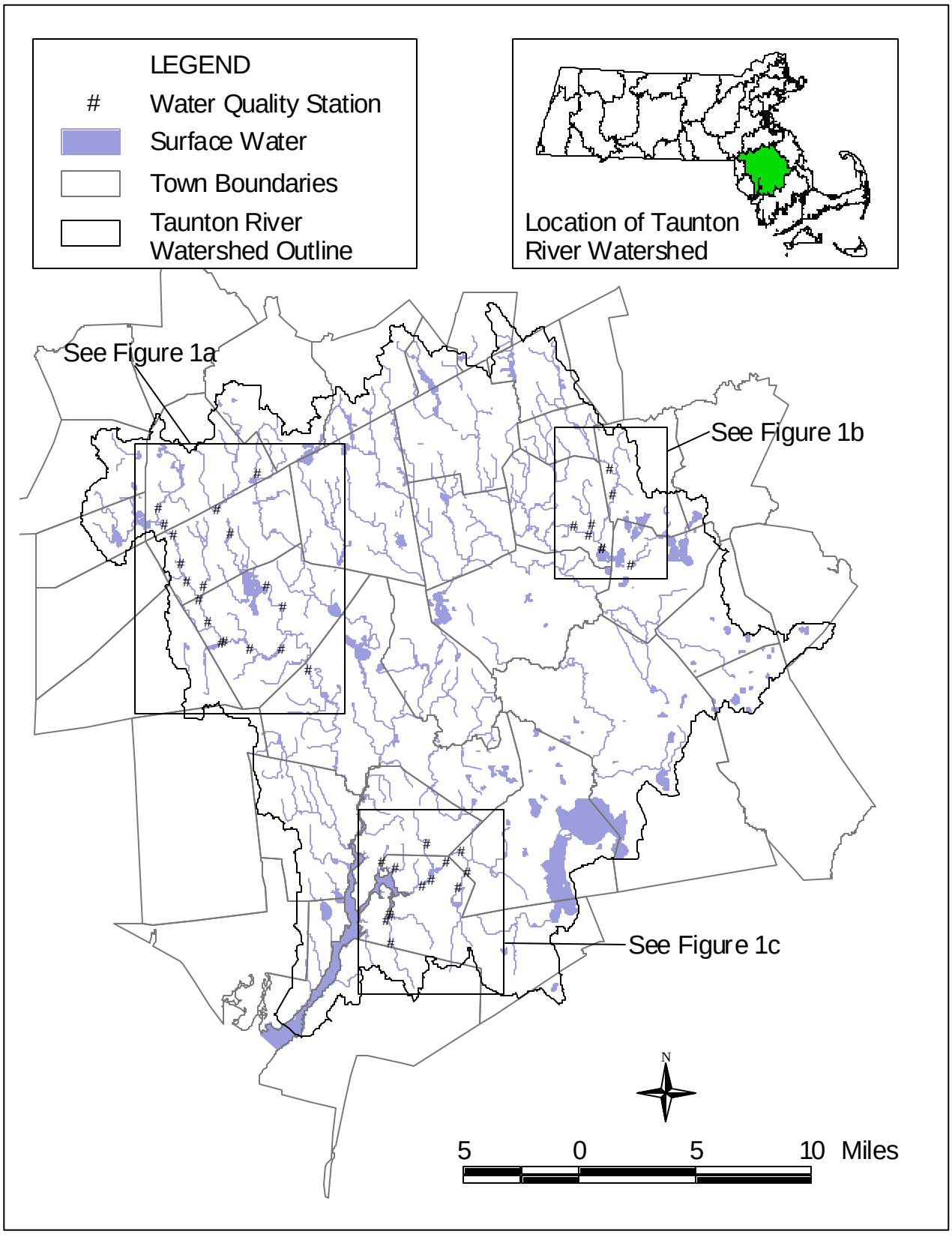


Figure 1. Taunton River Watershed 2001 Water Quality Stations.

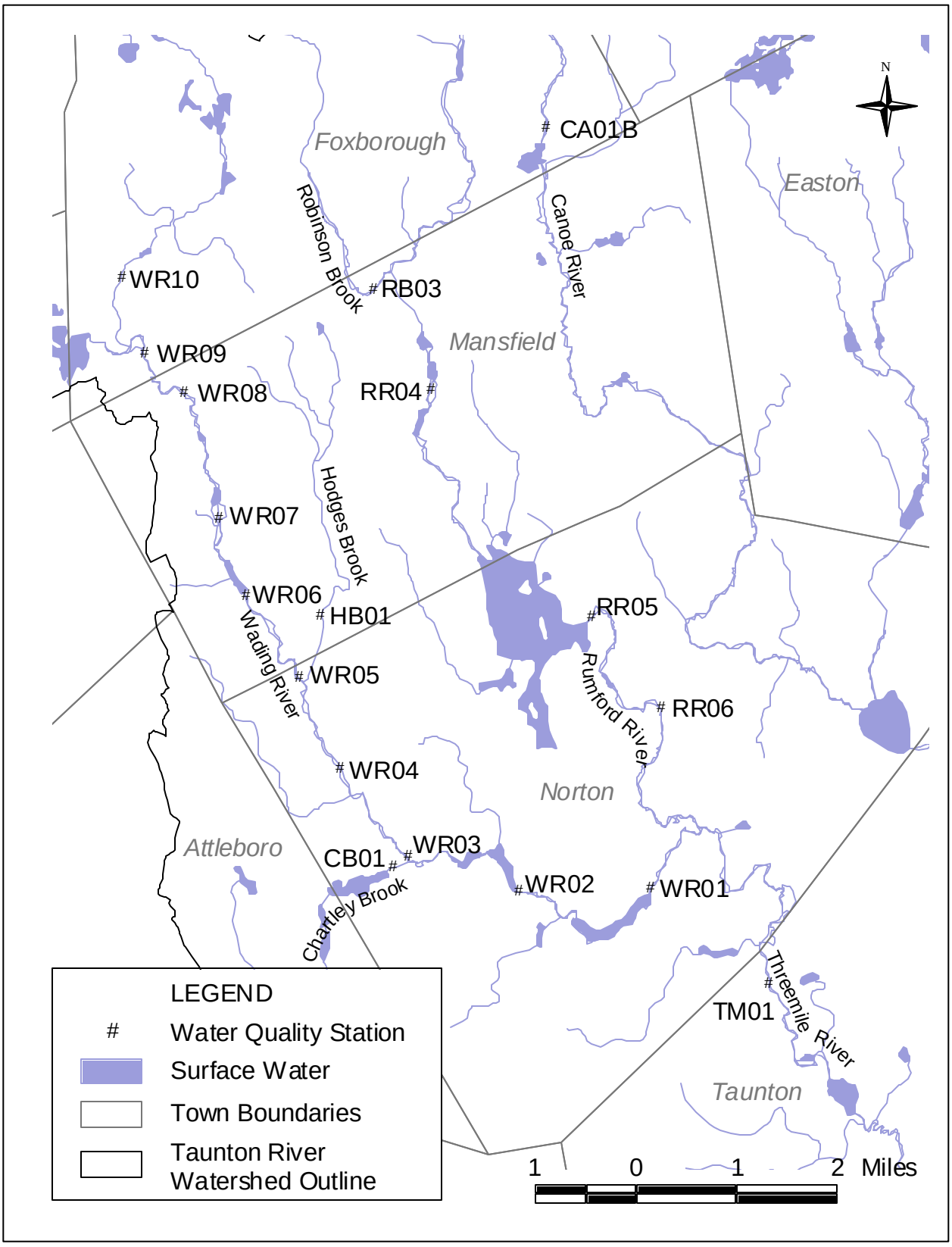


Figure 1a. Wading River, Rumford River, Canoe River and Three Mile River Subwatersheds 2001 Water Quality Stations.

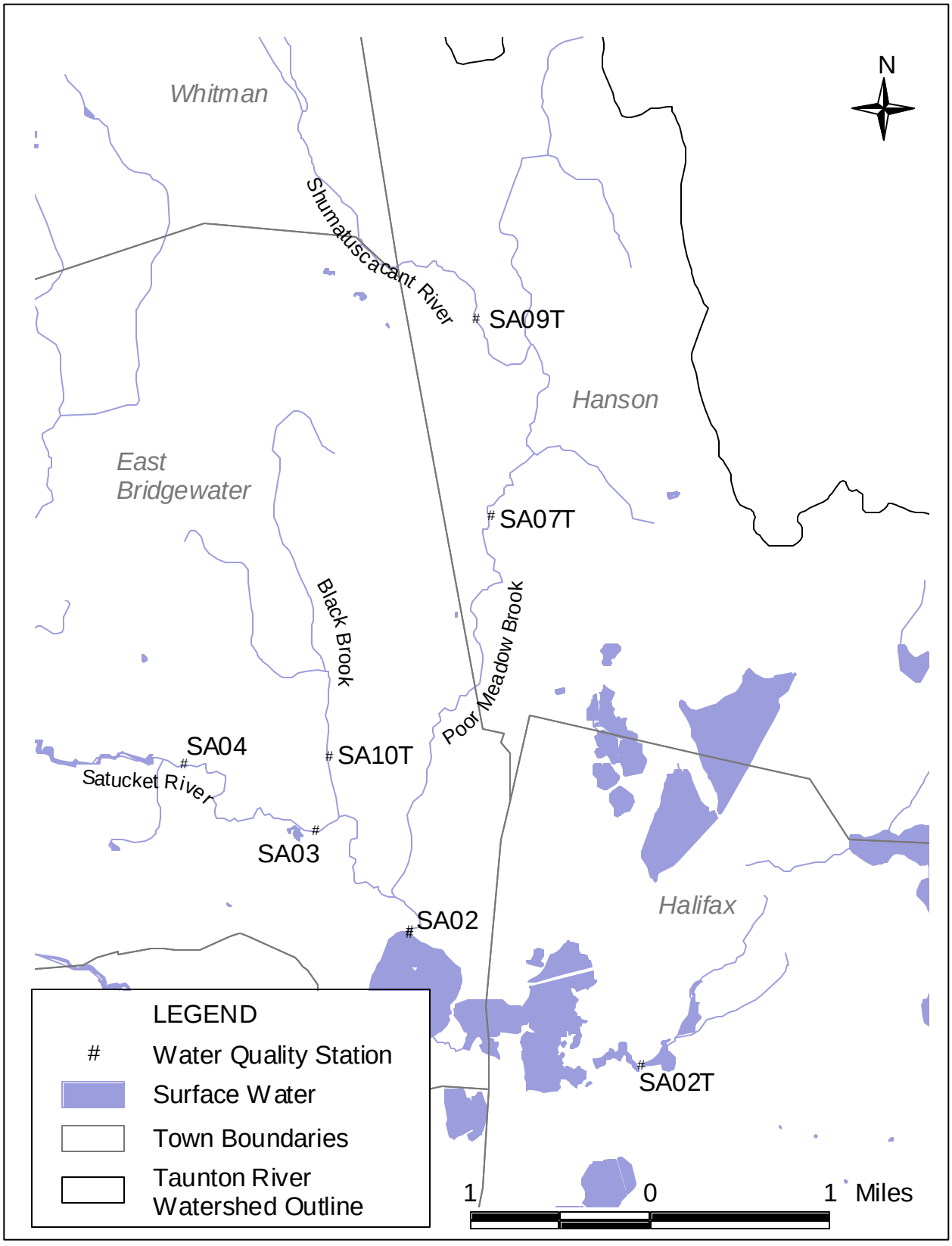


Figure 1b. Satucket River Subwatershed 2001 Water Quality Stations.

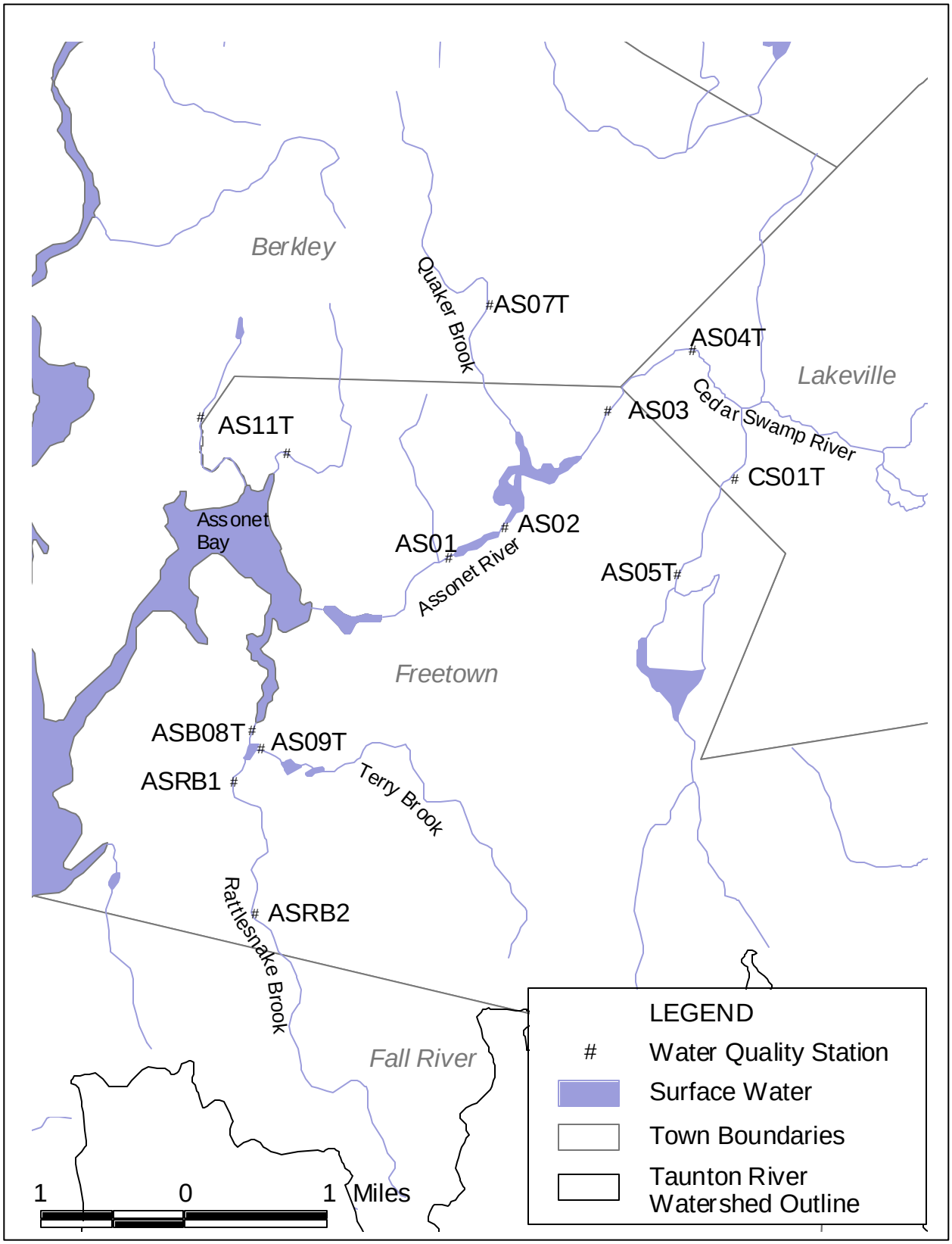


Figure 1c. Assonet River Subwatershed 2001 Water Quality Stations.

Table 1: Taunton River Basin Sampling Location Descriptions and Sampling Schedule - 2001														
Wading River, Rumford River, Canoe River and Three Mile River Subwatersheds Sampling Location Descriptions														
Station number	**Water Body**	**Location**	**June 20**	**July 23**	**July 24**	**July 25**	**July 26**	**Aug 6**	**Aug7**	**Aug 8**	**Aug 9**	**Sept 17**	**Sept 18**	**Sept 19**
WR10	Wading River	Spruce St., Foxborough	B											
WR09	Wading River	Cedar St., Rte 106, Foxborough	B											
WR08	Wading River	West St., Mansfield	B			C, N SS, H	H		C, N, SS, H		B	C, N, SS, H	H	
WR07	Wading River	Balcolm St., Mansfield	B											
WR06	Wading River	Outlet Sweets Pond-Otis St., Mansfield,	B											
WR05	Wading River	Richardson Ave., Norton	B											
HB01	Hodges Brook	Oak St., Mansfield									B	B		
WR04	Wading River	Walker St. Above Camp Read, Norton	B						B, FWA					
WR03	Wading River	Rte. 123, Norton at Wading River C. C.	B			B, C, N, SS, H	H		B, C, N, SS, H			B, C, N, SS, H	H	
CB01	Unnamed tributary to Wading River	Outlet Chartley Pond at Worcester St., Norton									B	B		
WR02	Wading River	Barrows St., Norton	B											
WR01	Wading River	At Rte. 140, Norton	B			B					B	B		
TM01	Threemile River	At Harvey St., Taunton				B, C, N, SS, H	H		B, C, N, SS, H			B, C, N, SS, H	H	
RB03	Rumford River-Robinson Brook	Central St. Bridge, Mansfield				B			B, C, N, SS, FWA, H			B, C, N, SS, H		
RR04	Rumford River	Spring St., Mansfield				B, C, N, SS, H	H		B, C, N, SS, FWA, H			B, C, N, SS, H	H	
RRO5	Rumford River	Outlet of Norton Reservoir, Reservoir St., Norton				B, C, N, SS, H	H		C, N, SS, H		B	B, C, N, SS, FWA, H	H	
RR06	Rumford River	Rte 123, Norton				B					B			
CA01B	Canoe River	East St., Foxborough							B, C, N, SS, FWA, H			B, C, N, SS, H		

Table 1 continued: Taunton River Basin Sampling Location Descriptions and Sampling Schedule - 2001

Satucket River Subwatershed Sampling Location Descriptions														
Station number	**Water Body**	**Location**	**June 20**	**July 23**	**July 24**	**July 25**	**July 26**	**Aug 6**	**Aug7**	**Aug 8**	**Aug 9**	**Sept 17**	**Sept 18**	**Sept 19**
SA04	Satucket River	Bridge St., East Bridgewater		C, N, SS, H	B, H					C, N, SS, H			C, N, SS, H	B, H
SA03	Satucket River	Washington St., East Bridgewater		C, N, SS, H	B, H					C, N, SS, H			C, N, SS, H	B
SA10T	Satucket River-Black Brook	Crescent St., East Bridgewater			B									
SA09T	Satucket River-Shumatuscacant River	West Washington St., Hanson			B									
SA07T	Satucket River-Poor Meadow Brook	Main St. Hanson			B									
SA02	Satucket River	Outlet Robbins Pond, Pond St., East Bridgewater		C, N, SS, H	B, H					C, N, SS, H			C, N, SS, H	B, H
SA02T	Unnamed tributary to Winnetuxet River	Outlet Stump Pond, Elm St., Halifax			B									
Assonet River Subwatershed Station Location Descriptions														
Station number	**Water Body**	**Location**	**June 20**	**July 23**	**July 24**	**July 25**	**July 26**	**Aug 6**	**Aug7**	**Aug 8**	**Aug 9**	**Sept 17**	**Sept 18**	**Sept 19**
AS05T	Unnamed tributary to Cedar Swamp River	Howland Rd., Freetown, outlet cranberry bogs		B						B, C, N, SS, H			B, C, N, SS, H	
CS01T	Unnamed tributary to Cedar Swamp River	Mill St., Lakeville		No flow						B				
AS04T	Assonet River-Cedar Swamp River	Malbone St., Lakeville		B, C, N, SS, H	H					B, C, N, SS, H			B, C, N, SS, H	H
AS03	Assonet River	Route 79, Freetown		B, C, N, SS, H	H					B, C, N, SS, H			B, C, N, SS, H	H
AS07T	Quaker Brook	Bryant St., Berkley		No flow						B				
AS02	Assonet River	Outlet Forge Pond, Forge Rd., Freetown		B						B				
AS01	Assonet River	Locust St., Freetown		B, C, N, SS, H	H					B, C, N, SS, H			B, C, N, SS, H	H
AS11T	Unnamed tributary to Assonet Bay	Friend St., Berkley											No flow	
AS10T	Unnamed tributary to Assonet Bay	N. Main St., Freetown											B	
ASRB2	Rattlesnake Brook	Footbridge in Freetown/Fall River Forest, Freetown						H						

Table 1 continued: Taunton River Basin Sampling Location Descriptions and Sampling Schedule - 2001

Assonet River Subwatershed Station Location Descriptions Continued														
Station number	**Water Body**	**Location**	**June 20**	**July 23**	**July 24**	**July 25**	**July 26**	**Aug 6**	**Aug7**	**Aug 8**	**Aug 9**	**Sept 17**	**Sept 18**	**Sept 19**
ASRB1	Rattlesnake Brook	So Main St., Freetown											B	
AS09T	Terry Brook	So Main St., Freetown											B, FWA	
ASB08T	Rattlesnake Brook	Narrows Rd., Freetown		B										

* Parameters:

C = total alkalinity, total hardness, chlorides
N = nitrates, ammonia, total phosphorus (low-level)
TSS = total suspended solids
B = bacteria (fecal coliform and E. coli)
FWA=fluorescent whitening agents
H=DO, pH, temperature, specific conductance

Table 2. WES/DWM Analytical Methods & MDLs for 2001 Water Quality Analytes

	EPA Method*	SM Methods**	Other Methods	MDLs	RDLs
In-Situ Water Quality Analytes					
Hydrolab® Multiprobe Series 3			DWM SOP (CN 4.0)	Not Applicable	Not Applicable
Water Quality Analytes					
Total Phosphorus		SM 4500-P-E		0.005, 0.01 and 0.010 mg/l	0.010 mg/l
Alkalinity		SM 2320 B		2 and 2.0 mg/l	2 mg/l
Hardness	EPA 200.7	SM 2340 B		0.66 mg/l	0.66 mg/l
Chloride		SM 4500 Cl B		1.0, 1, 2 and 2.0 mg/l	1.0 mg/l
TSS		SM 2540 D		1.0 mg/l	1.0 mg/l
NH3-N	EPA 350.1			0.02, 0.020 and 0.10 mg/l	0.02, 0.020 mg/l
NO3-NO2-N	EPA 353.1			0.02, 0.020 and 0.10 mg/l	0.02, 0.020 mg/l
Fecal Coliform		SM 9222D		Not defined; usu. 5 and 10 cfu/100ml	No Information
E. coli		SM 9213D		Not defined; usu. 5 and 10 cfu/100ml	No Information
Enterococcus		SM 9230C		Not defined; usu. 5 and 10 cfu/100ml	No Information

***** = "Methods for Chemical Analysis of Water and Wastes", Environmental Protection Agency, Environmental Monitoring Systems Laboratory – Cincinnati (EMSL-CI), EPA-600/4-79-020, Revised March 1983 and 1979 where applicable. ****** = Standard Methods, Examination of Water and Wastewater, 20th edition.

Survey Conditions

Table 3 and Table 4 contain information on the survey conditions during each sampling event. The stream discharge data (Table 4) is used to estimate hydrological conditions during water quality sampling and to determine if the bacterial sampling conditions should be described as wet or dry weather events. Wet weather is defined as precipitation within a five-day antecedent period that leads to more than a slight increase in stream discharge (flow). During "dry weather", trace amounts of precipitation may fall, but no measurable change in stream flow occurs. Because the sources of bacterial contamination differ in wet and dry conditions, it is important to determine if the water quality data were representative of wet or dry weather. The discharge values were also examined in relation to the 7-day, 10-year (7Q10) low flow statistic.

The USGS stream gage at the Taunton River, Bridgewater (01108000) was used for streamflow (discharge) statistics (Socolow *et al*. 2002). It is located just outside the area included in the sampling area. Figures 2a-2c present stream discharge and precipitation data combined for the days prior to the sampling dates. The determination of 7Q10 was from the USGS *Gazetteer of Hydrologic Characteristics of Streams in Massachusetts-Taunton and Ten Mile River Basins and Coastal River Basins of Mount Hope Bay, Narragansett Bay, and Rhode Island Sound* (Wandle and Keezer, 1984).

The antecedent weather conditions for five days prior to sampling was determined by reviewing the National Oceanographic and Atmospheric Administration's data from their website (tgsv5.nws.noaa.gov/cgi-bin/box). The data from Taunton, Massachusetts were used for both stream flow and weather conditions since it represented the closest town to the sampling locations.

July 23, 2001 - The survey on July 23 was conducted during dry weather. The field crew described the sky as clear with only a slight (1-5 mph) breeze blowing. Only 0.01 inches of precipitation fell during the five days prior to sampling (Table 3). The discharge fell from 164 cfs on July 18 to 117 cfs on the sample date (Table 4). This was a dry weather survey.

July 24, 2001 -The survey on July 24 was also a dry weather survey. No precipitation fell over the 5 days prior to sampling. Conditions on the sampling day were described in the field sheets as being clear, with a slight breeze blowing (1-5 mph) and the air temperature in the 80's F.

July 25, 2001 -The survey on July 25 was also a dry weather survey. No precipitation fell over the 5 days prior to sampling. According to the field sheets, the sampling conditions remained the same as the previous days i.e.: clear, air temperature in the 80's F. The wind conditions varied over the day, but most places recorded either calm or a slight breeze blowing (1-5 mph).

July 26, 2001 - Rain fell on the sampling date for a total of 0.92 inches. There had been no previous precipitation during the five day antecedent period. The field conditions for this pre-dawn survey were described as calm but cloudy. Only the 2:15 field sheet mentions a light rain falling. The precipitation that fell during the day led to a slight increase in discharge from 109 cfs on July 25 to 113 cfs on July 26. The discharge on this day was significantly below the monthly mean of 213 cfs. Over the Period of Record (POR) the mean discharge was also higher at 188 cfs than the flows recorded during July. This is considered to be a dry weather survey because the precipitation fell after the sampling was completed.

Aug. 7, 2001 - At the beginning part of the 5 day antecedent period significant precipitation did occur. Over August 3 and 4 three quarters of an inch of rain fell. This precipitation led to an increase in discharge two days before the sampling date from 87 cfs four days prior to sampling to 110 cfs 2 days prior. However, by the sampling date the flow had declined to 92 cfs and since there had only been 0.01 inches of rain two days prior to sampling, this also represents dry weather sampling.

Aug. 8, 2001 -Field notes describe the day as clear with the wind calm and the air temperature between 80 and 90 F. At the beginning part of the 5 day antecedent period, 0.53 inches of rain fell (Aug. 3) and on Aug. 4, 0.22 inches fell. A tenth of an inch fell on Aug. 3, but following this each day was dry. The Aug. 3 precipitation event lead to an increase in discharge from 87 cfs to 103 on Aug 4. Discharge increased again on Aug. 5 to 110 cfs and then declined to 92 cfs on the sampling day. The monthly mean was almost twice as high at 177 cfs (Table 4). This is considered to be a dry weather survey.

Aug. 9, 2001 -On August 9, the field notes indicate that it too was a clear day in the northern part of the Taunton River basin, but farther south near E. Bridgewater had partly, cloudy skies. All areas recorded a slight breeze (1-5 mph). The air temperature was again in the 80-90's F. Two tenths of an inch of rain fell on the first antecedent day (Aug. 4). A tenth of an inch fell the following day. The stream discharge increased with these two small rain events to a high of 110 cfs, but then declined quickly to 92 cfs on the sampling date that is only slightly higher than the minimum for that month (87 cfs). This is considered to be a dry weather survey.

Sept. 17, 2001 - Air temperatures dropped from the August sampling to 50-60 F. The wind conditions were calm (0-1 mph) under clear skies. There was a slight precipitation event on Sept. 14, 0.11 inches, but it did not affect the discharge that varied little over this 5 day period from 71 cfs on Sept. 12 to 66 cfs on Sept. 17. The 66 cfs recorded was almost twice as low as the monthly mean of 128 cfs. The period of record mean (1930-2001) was 175 cfs (Table 4). This is considered a dry weather survey.

Sept. 18, 2001 - Field notes for Sept. 18 reported clear skies, air temperature in the 70-80 F range in the mid afternoon with calm wind conditions. The 5 day antecedent period was dry except for one precipitation event four days previous to sampling when it rained a tenth of an inch (Table 3). It also rained one hundredth of an inch on the sampling date. Neither of these two small events affected the flow that remained quite stable over the time period. The discharge as measured on the Taunton River near Bridgewater, MA was 70 cfs on Sept. 13 and declined to 66 cfs on the sampling date-Sept. 18. The monthly mean was almost twice as high at 128 cfs while the POR mean exceeded that with 175 cfs. This is considered to be a dry weather survey.

Sept. 19, 2001 - According to field notes for Sept. 19, the weather was clear with a slight breeze blowing (1-5 mph). The air temperature was lower than the previous day (50-60 F). Over the five day antecedent period, the discharge dropped from 70 to 65 cfs (Table 3). Five days prior to sampling, a tenth of an inch fell, other than that there was only a trace on Sept. 18. Discharge on the sampling date remained far below the monthly mean for Sept. (65 cfs for Sept. 19 compared to a mean of 128 cfs for the monthly means). This is considered to be a dry weather survey.

Table 3: Taunton River Basin Precipitation Data Summary (reported in inches of rain)						
Survey Dates	5 Days Prior	4 Days Prior	3 Days Prior	2 Days Prior	1 Day Prior	Sample Date
National Weather Service at Taunton, MA						
July 23	0.01	0.00	0.00	0.00	0.00	0.00
July 24	0.00	0.00	0.00	0.00	0.00	0.00
July 25	0.00	0.00	0.00	0.00	0.00	0.00
July 26	0.00	0.00	0.00	0.00	0.00	0.92
Aug 7	0.00	0.53	0.22	0.01	0.00	0.00
Aug 8	0.53	0.22	0.01	0.00	0.00	0.00
Aug 9	0.22	0.01	0.00	0.00	0.00	0.00
Sept 17	0.00	0.00	0.11	0.00	0.00	0.02
Sept 18	0.00	0.11	0.00	0.00	0.00	0.01
Sept 19	0.11	0.00	0.00	0.00	0.01	0.00

Table 4: Taunton River-2001 USGS Flow Data Summary *(Socolow et al., 2002)* Discharge in Cubic Feet per Second (cfs) Gage # 01108000 Taunton River near Bridgewater, MA								
Survey Dates	5 Days Prior	4 Days Prior	3 Days Prior	2 Days Prior	1 Day Prior	Sample Date	Monthly Mean	POR* Mean
July 23	164	155	143	134	124	117	213	188
July 24	155	143	134	124	117	115	213	188
July 25	143	134	124	117	115	109	213	188
July 26	134	124	117	115	109	113	213	188
Aug 7	92	87	103	110	99	95	177	154
Aug 8	87	103	110	99	95	92	177	154
Aug 9	103	110	99	95	92	92	177	154
Sept 17	71	70	70	70	67	66	128	175
Sept 18	70	70	70	67	66	66	128	175
Sept 19	70	70	67	66	66	65	128	175
7Q10 = 24.6 cfs *(Wandle and Keezer, 1984)* * POR = monthly mean for period of record (1930 - 2001)								

Figure 2a.
Taunton River Basin - Precipitation and Discharge Data
July 2001

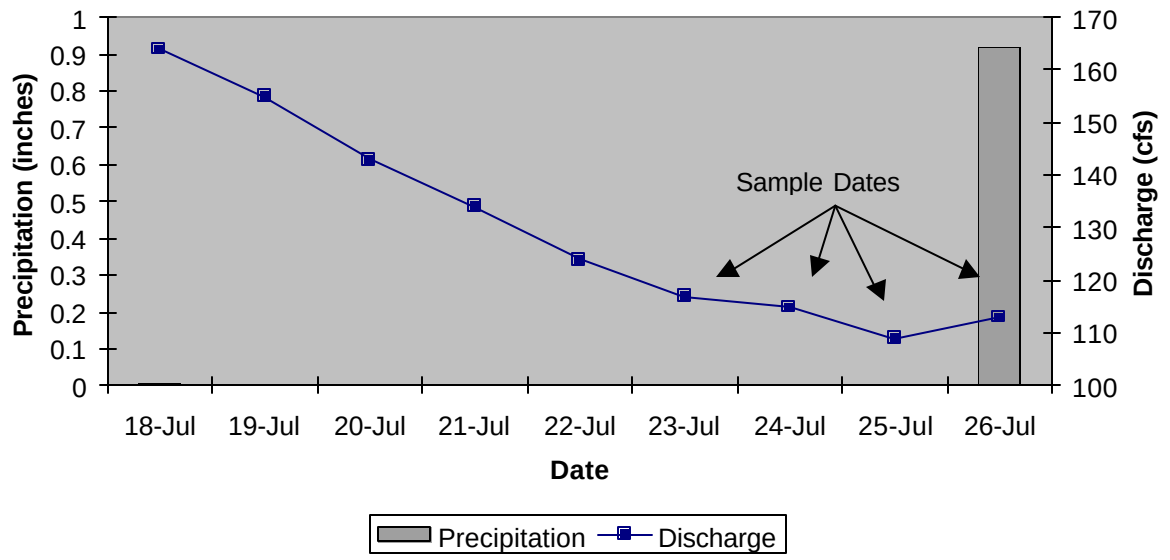


Figure 2b.
Taunton River Basin - Precipitation and Discharge Data
August 2001

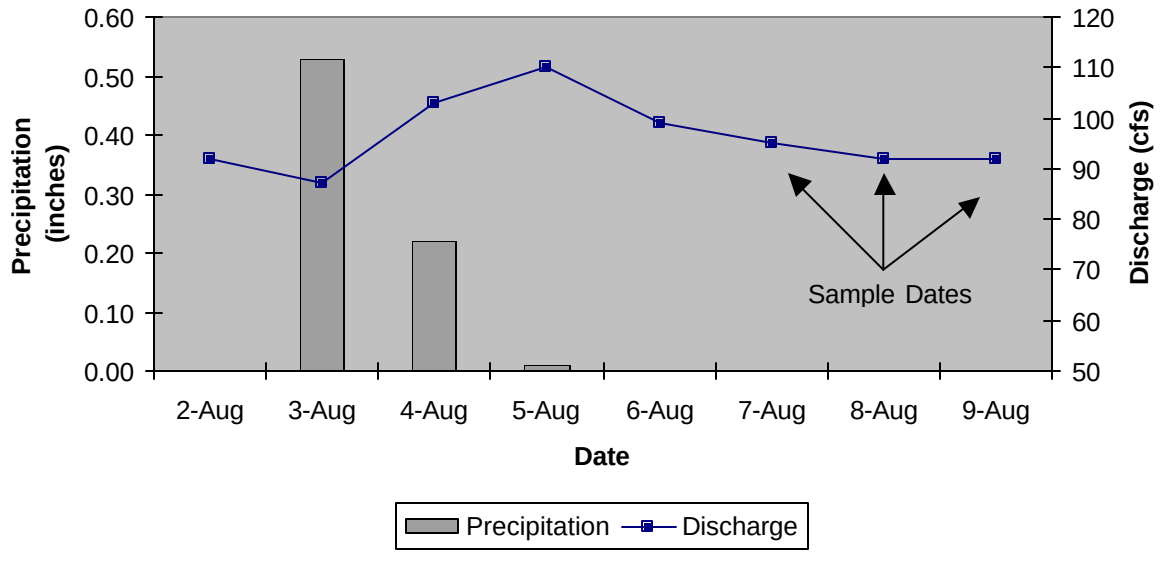
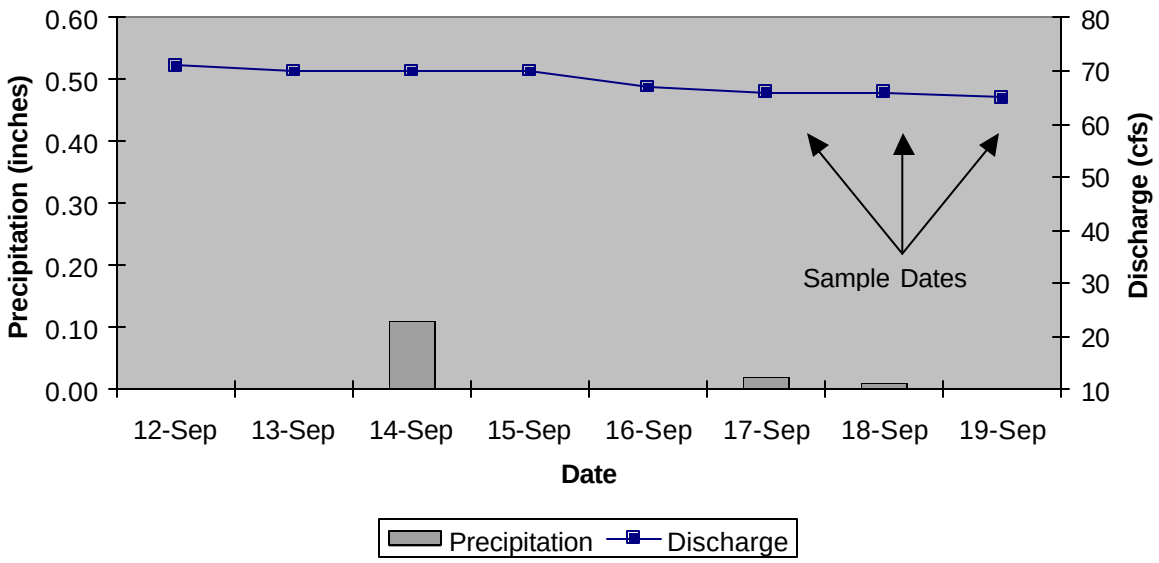


Figure 2c.
Taunton River Basin - Precipitation and Discharge Data
September 2001



Water Quality Data

All MA DEP DWM water quality data are managed and maintained in the *Water Quality Data Access Database.* Tables 5 – 9 below are data exports for the Taunton River Watershed. Data validation procedures are described in Appendix 1. Data qualifiers are listed at the bottom of each table and in Appendix 2.

Table 5: Taunton River Watershed Water Quality Data (2001) - Hydrolab® Multiprobe
Temperature, pH, Conductivity, Total Dissolved Solids (TDS), Dissolved Oxygen (DO), and Dissolved Oxygen Percent Saturation.

Robbins Pond (Palis: 62162)
Unique_ID: W0866 Station: RP01
Description: approximately 20 feet from outlet, East Bridgewater.

Date	OWMID	Time	Depth	Temp	pH	Conductivity at 25°C	TDS	DO	DO Saturation
		(24hr)	(m)	(°C)	(SU)	(uS/cm)	(mg/l)	(mg/l)	(%)
09/18/01	62-0119	14:54	0.1i	21.8u	6.9c	106	67.6	9.8	109

Unnamed Tributary to Cedar Swamp River
Unique_ID: W0824 Station: AS05T, Mile Point: 1.6
Description: outlet cranberry bog at Howland Road, Freetown.

Date	OWMID	Time	Depth	Temp	pH	Conductivity at 25°C	TDS	DO	DO Saturation
		(24hr)	(m)	(°C)	(SU)	(uS/cm)	(mg/l)	(mg/l)	(%)
08/08/01	62-0203	13:07	0.2	29.7u	4.7	47.5	30.4	7.8u	100u
09/18/01	62-0270	13:00	0.2	18.9u	5.9u	45.6	29.2	9.8u	103u

ASSONET RIVER (Saris: 6235100)
Unique_ID: W0817 Station: AS03, Mile Point: 5.9
Description: Route 79 (Richmond Road), Freetown.

Date	OWMID	Time	Depth	Temp	pH	Conductivity at 25°C	TDS	DO	DO Saturation
		(24hr)	(m)	(°C)	(SU)	(uS/cm)	(mg/l)	(mg/l)	(%)
07/23/01	62-0106	13:38	##i	22.0	5.7	87.3	55.9	5.8u	65u
07/24/01	62-0114	03:01	0.3	21.3	5.5	87.2	55.8	4.9u	54u
08/08/01	62-0210	02:06	##i	23.0	4.8	77.9	49.8	3.0u	34u
08/08/01	62-0201	12:17	0.4	23.1	4.9	79.5	50.9	3.4u	39u
09/18/01	62-0268	12:13	0.1i	14.1	6.0	87.7	56.1	7.8u	74u
09/19/01	62-0248	01:37	0.7	15.2u	6.0u	89.1	57.0	##u	##u

ASSONET RIVER (Saris: 6235100)
Unique_ID: W0818 Station: AS01, Mile Point: 4.1
Description: Locust Street, Freetown.

Date	OWMID	Time	Depth	Temp	pH	Conductivity at 25°C	TDS	DO	DO Saturation
		(24hr)	(m)	(°C)	(SU)	(uS/cm)	(mg/l)	(mg/l)	(%)
07/23/01	62-0104	13:00	##i	22.2	6.0u	91.5	58.5	7.3u	82u
07/24/01	62-0112	02:28	0.5	22.7	5.8	90.8	58.1	7.6u	87u
08/08/01	62-0208	01:49	##i	24.1	5.3	85.7	54.8	8.3u	97u
08/08/01	62-0199	11:44	0.2	25.0u	5.3	88.1	56.4	8.2u	97u
09/18/01	62-0266	11:40	0.1i	19.0	6.4	94.6	60.5	9.1u	96u
09/19/01	62-0247	01:14	0.4	18.9	6.3	95.2	60.9	8.6	90

RATTLESNAKE BROOK (Saris: 6235125)
Unique_ID: W0864 Station: ASRB2, Mile Point: 1.6
Description: footbridge in Freetown-Fall River Forest, Freetown.

Date	OWMID	Time	Depth	Temp	pH	Conductivity at 25°C	TDS	DO	DO Saturation
		(24hr)	(m)	(°C)	(SU)	(uS/cm)	(mg/l)	(mg/l)	(%)
08/06/01	62-0280	14:28	##i	20.1	4.4u	45.1	28.8	8.4	90

CEDAR SWAMP RIVER (Saris: 6235225)
Unique_ID: W0816 Station: AS04T, Mile Point: 0.6
Description: Malbone Street, Lakeville.

Date	OWMID	Time	Depth	Temp	pH	Conductivity at 25°C	TDS	DO	DO Saturation
		(24hr)	(m)	(°C)	(SU)	(uS/cm)	(mg/l)	(mg/l)	(%)
07/23/01	62-0107	14:04	##i	22.3u	5.6	88.8	56.8	4.8u	54u
07/24/01	62-0115	03:24	0.7	22.1	5.5	88.3	56.5	5.4u	61u
08/08/01	62-0211	02:23	0.1i	22.9	4.6	77.5	49.6	1.3	15
08/08/01	62-0202	12:41	0.5	23.4u	4.7	77.7	49.7	1.7	19
09/18/01	62-0269	12:38	0.3	14.7	5.9	90.9	58.2	5.6	54
09/19/01	62-0249	01:50	0.5	15.7u	6.0u	90.0	57.6	6.0u	59u

THREEMILE RIVER (Saris: 6235350)
Unique_ID: W0821 Station: TM01, Mile Point: 9.5
Description: Harvey Street, Taunton.

Date	OWMID	Time	Depth	Temp	pH	Conductivity at 25°C	TDS	DO	DO Saturation
		(24hr)	(m)	(°C)	(SU)	(uS/cm)	(mg/l)	(mg/l)	(%)
07/25/01	62-0145	12:45	0.8	24.9	7.0cu	358	229	6.8	81
07/26/01	62-0152	03:31	0.3	25.4	7.0c	379u	242u	6.3	76
08/07/01	62-0183	02:49	##i	23.4	7.0cu	369	236	6.9u	79u
08/07/01	62-0175	14:09	0.3	24.6	7.0c	313u	201u	7.1	83
09/17/01	62-0241	13:46	0.4	15.3	7.0c	450	288	8.5u	83u
09/18/01	62-0222	01:40	0.6	16.1	7.1c	460	295	8.4u	83u

WADING RIVER (Saris: 6235450)
Unique_ID: W0819 Station: WR08, Mile Point: 11.2
Description: West Street, Mansfield.

Date	OWMID	Time	Depth	Temp	pH	Conductivity at 25°C	TDS	DO	DO Saturation
		(24hr)	(m)	(°C)	(SU)	(uS/cm)	(mg/l)	(mg/l)	(%)
07/25/01	62-0142	13:43	0.7	25.9	6.7u	391	250	5.4	65
07/26/01	62-0149	04:58	0.2	25.5	6.6	394u	252u	4.1u	50u
08/07/01	62-0282	03:54	##i	23.9	6.6	423	271	4.8u	55u
08/07/01	62-0172	15:17	0.2	26.2	6.7u	408	261	6.2u	75u
09/17/01	62-0238	14:51	0.3	15.9u	6.7	434	278	8.0	79
09/18/01	62-0281	02:23	0.3	15.5	6.7	451	289	6.8u	67u

WADING RIVER (Saris: 6235450)
Unique_ID: W0823 Station: WR03, Mile Point: 5
Description: Route 123, Norton.

Date	OWMID	Time	Depth	Temp	pH	Conductivity at 25°C	TDS	DO	DO Saturation
		(24hr)	(m)	(°C)	(SU)	(uS/cm)	(mg/l)	(mg/l)	(%)
07/25/01	62-0143	13:12	0.9	25.9	6.8u	365	233	6.3	77
07/26/01	62-0150	04:11	0.2	25.4	6.8	364u	233u	5.3u	64u
08/07/01	62-0182	03:21	##i	23.2	6.5	273	175	5.3	60
08/07/01	62-0173	14:43	0.2	25.0	6.6	269	172	6.4	76
09/17/01	62-0239	14:19	0.3	16.1	6.8u	311	199	8.7u	86u
09/18/01	62-0221	02:00	0.3	15.6	6.9u	317	203	8.1	80

RUMFORD RIVER (Saris: 6235600)
Unique_ID: W0820 Station: RR04, Mile Point: 8.2
Description: Spring Street, Mansfield.

Date	OWMID	Time	Depth	Temp	pH	Conductivity at 25°C	TDS	DO	DO Saturation
		(24hr)	(m)	(°C)	(SU)	(uS/cm)	(mg/l)	(mg/l)	(%)
07/25/01	62-0146	11:42	0.6	26.7u	6.7u	457	292	7.8	96
07/26/01	62-0153	05:34	0.2	25.7	6.8	457	293	7.6u	92u
08/07/01	62-0181	01:36	##i	25.4	6.6u	478	306	7.4u	88u
08/07/01	62-0176	11:11	0.1i	25.6u	6.6u	479	307	7.5	90
09/17/01	62-0242	11:20	0.3	18.0u	6.5	459	294	7.0	72
09/18/01	62-0223	00:57	0.3	18.1	6.5	462	295	6.8u	70u

RUMFORD RIVER (Saris: 6235600)
Unique_ID: W0822 Station: RR05, Mile Point: 4.5
Description: Reservoir Street, Norton.

Date	OWMID	Time	Depth	Temp	pH	Conductivity at 25°C	TDS	DO	DO Saturation
		(24hr)	(m)	(°C)	(SU)	(uS/cm)	(mg/l)	(mg/l)	(%)
07/25/01	62-0147	12:16	0.7	28.3	7.0cu	363	232	7.2u	91u
07/26/01	62-0154	02:39	0.3	28.3	7.0c	362	232	6.0u	77u
08/07/01	62-0185	02:18	##i	27.4	6.9cu	381	244	5.9	72
08/07/01	62-0178	13:31	0.2	28.9	7.2cu	385	246	7.5u	96u
09/17/01	62-0244	12:59	0.3	20.7u	6.9u	390	250	7.6u	83u
09/18/01	62-0224	01:20	0.2	19.8	6.8u	390	249	6.4u	69u

ROBINSON BROOK (Saris: 6235625)
Unique_ID: W0829 Station: RB03, Mile Point: 0.5
Description: Central Street, Mansfield.

Date	OWMID	Time	Depth	Temp	pH	Conductivity at 25°C	TDS	DO	DO Saturation
		(24hr)	(m)	(°C)	(SU)	(uS/cm)	(mg/l)	(mg/l)	(%)
08/07/01	62-0177	11:53	0.2	23.2u	6.8u	857cu	549u	8.4u	96u
09/17/01	62-0243	11:46	0.3	14.0u	6.7u	806cu	516cu	9.9u	94u

CANOE RIVER (Saris: 6235850)
Unique_ID: W0830 Station: CA01B, Mile Point: 11.3
Description: East Street, Foxborough.

Date	OWMID	Time	Depth	Temp	pH	Conductivity at 25°C	TDS	DO	DO Saturation
		(24hr)	(m)	(°C)	(SU)	(uS/cm)	(mg/l)	(mg/l)	(%)
08/07/01	62-0179	12:30	0.1i	21.4	6.6u	120	76.5	8.3u	92u
09/17/01	62-0245	12:16	0.4	12.2u	6.7u	111	71.0	10.4u	95u

SATUCKET RIVER (Saris: 6236950)
Unique_ID: W0813 Station: SA02, Mile Point: 5.6
Description: outlet Robbins Pond, Pond Street, East Bridgewater.

Date	OWMID	Time	Depth	Temp	pH	Conductivity at 25°C	TDS	DO	DO Saturation
		(24hr)	(m)	(°C)	(SU)	(uS/cm)	(mg/l)	(mg/l)	(%)
07/23/01	62-0111	15:55	##i	30.0	7.1cu	98.5	63.0	8.7	112
07/24/01	62-0118	04:22	0.3	25.2u	6.3	98.6	63.1	7.0	83
08/08/01	No Flow	**	--	--	--	--	--	--	--
08/08/01	62-0207	15:12	0.2	33.0	6.8u	102	65.5	8.6	117
09/18/01	62-0274	14:46	##i	22.3u	6.9	106	67.6	9.6u	109u
09/19/01	62-0252	02:50	0.3	19.9	6.5	107	68.8	8.2u	88u

SATUCKET RIVER (Saris: 6236950)
Unique_ID: W0815 Station: SA03, Mile Point: 4
Description: Washington Street, East Bridgewater.

Date	OWMID	Time	Depth	Temp	pH	Conductivity at 25°C	TDS	DO	DO Saturation
		(24hr)	(m)	(°C)	(SU)	(uS/cm)	(mg/l)	(mg/l)	(%)
07/23/01	62-0110	15:36	##i	25.0	6.5	176	112	5.0	60
07/24/01	62-0117	04:45	0.3	25.9	6.3	172	110	4.2u	50u
08/08/01	62-0215	03:27	##i	27.7	6.4u	168	108	3.9u	48u
08/08/01	62-0206	14:50	0.1i	28.8	6.4	169	108	3.2	40
09/18/01	62-0273	14:22	##i	17.6u	6.4	171	109	5.7u	58u

SATUCKET RIVER (Saris: 6236950)
Unique_ID: W0814 Station: SA04, Mile Point: 2.6
Description: Bridge Street, East Bridgewater.

Date	OWMID	Time	Depth	Temp	pH	Conductivity at 25°C	TDS	DO	DO Saturation
		(24hr)	(m)	(°C)	(SU)	(uS/cm)	(mg/l)	(mg/l)	(%)
07/23/01	62-0109	15:12	##i	28.5	6.4	177	113	4.4u	56u
07/24/01	62-0116	05:09	0.5	24.4	6.2	176	113	3.9	46
08/08/01	62-0214	03:07	##i	26.2	6.4u	182	117	4.2u	51u
08/08/01	62-0205	14:23	0.3	26.9u	6.4u	187u	120u	3.7	46
09/18/01	62-0272	13:58	0.1i	18.4u	6.4	210	135	7.3u	77u
09/19/01	62-0250	02:31	0.4	16.6	6.5	203	130	6.9u	69u

" ## " = Censored data (i.e., data that have been discarded for some reason).
" -- " = No data (i.e., data not taken/not required)
" i " = Inaccurate readings from Hydrolab® multiprobe likely.
" u " = Unstable readings, due to lack of sufficient equilibration time prior to final readings, non-representative location, highly-variable water quality conditions, etc.
" c " = greater than calibration standard used for pre-calibration, or outside the acceptable range about the calibration standard. See Section Appendix 1 for acceptance criteria.

Table 6: Taunton River Watershed Water Quality Data (2001) – Physico-Chemical Data
Chloride, Alkalinity, Hardness, Ammonia Nitrogen, Nitrate-Nitrite Nitrogen, Total Phosphorus, and Total Suspended Solids

Unnamed Tributary to Cedar Swamp River
Unique_ID: W0824 Station: AS05T, Mile Point: 1.6
Description: outlet cranberry bog at Howland Road, Freetown.

Date	OWMID	QAQC	Time	Chloride	Alkalinity	Hardness	NH3-N	NO3-NO2-N	TP	TSS
			(24hr)	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
08/08/01	62-0203	--	13:08	10	<2	6.4	<0.02	<0.06	0.16	2.9
09/18/01	62-0270	--	12:55	10	4	8	<0.02	<0.06	0.15	4.6

ASSONET RIVER (Saris: 6235100)
Unique_ID: W0817 Station: AS03, Mile Point: 5.9
Description: Route 79 (Richmond Road), Freetown.

Date	OWMID	QAQC	Time	Chloride	Alkalinity	Hardness	NH3-N	NO3-NO2-N	TP	TSS
			(24hr)	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
07/23/01	62-0106	--	13:30	##b	3	13	<0.02	0.15	0.064	<1.0
08/08/01	62-0201	--	12:13	17	2	12	<0.02	<0.06	0.082	<1.0
09/18/01	62-0268	--	12:05	18	4	13	<0.02	0.27	0.051	<1.0

ASSONET RIVER (Saris: 6235100)
Unique_ID: W0818 Station: AS01, Mile Point: 4.1
Description: Locust Street, Freetown.

Date	OWMID	QAQC	Time	Chloride	Alkalinity	Hardness	NH3-N	NO3-NO2-N	TP	TSS
			(24hr)	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
07/23/01	62-0105	62-0104	**	##b	2	14	<0.02	<0.06	0.067	4.8
07/23/01	62-0104	62-0105	13:00	##b	3	14	<0.02	<0.06	0.062	4.1
08/08/01	62-0200	62-0199	**	18	3	14	<0.02	<0.06	0.057	2.7d
08/08/01	62-0199	62-0200	11:40	17	<2	14	<0.02	<0.06	0.057	7.4d
09/18/01	62-0267	62-0266	**	18	4	14	<0.02	<0.06	0.051	3.8
09/18/01	62-0266	62-0267	11:25	20	4	14	<0.02	<0.06	0.051	3.8

CEDAR SWAMP RIVER (Saris: 6235225)
Unique_ID: W0816 Station: AS04T, Mile Point: 0.6
Description: Malbone Street, Lakeville.

Date	OWMID	QAQC	Time	Chloride	Alkalinity	Hardness	NH3-N	NO3-NO2-N	TP	TSS
			(24hr)	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
07/23/01	62-0107	--	14:15	##b	3	14	<0.02	0.14	0.065	0.98
08/08/01	62-0202	--	12:38	19	<2	11	<0.02	<0.06	0.093	<1.0
09/18/01	62-0269	--	12:30	19	4	13	0.06	0.29	0.060	1.5

THREEMILE RIVER (Saris: 6235350)
Unique_ID: W0821 Station: TM01, Mile Point: 9.5
Description: Harvey Street, Taunton.

Date	OWMID	QAQC	Time	Chloride	Alkalinity	Hardness	NH3-N	NO3-NO2-N	TP	TSS
			(24hr)	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
07/25/01	62-0145	--	12:55	77	23	49	<0.02	2.0	0.12	1.2
08/07/01	62-0175	--	14:10	67	23	45	<0.02	1.7	0.098	1.1
09/17/01	62-0241	--	13:40	80	36	75	<0.02	7.3	0.11	1.1

WADING RIVER (Saris: 6235450)
Unique_ID: W0819 Station: WR08, Mile Point: 11.2
Description: West Street, Mansfield.

Date	OWMID	QAQC	Time	Chloride	Alkalinity	Hardness	NH3-N	NO3-NO2-N	TP	TSS
			(24hr)	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
07/25/01	62-0142	--	13:50	97	23	56	<0.02	0.21	0.022	<1.0
08/07/01	62-0172	--	15:20	110	24	49	<0.02	0.18	0.020	<1.0
09/17/01	62-0238	--	14:45	110	22	51	<0.02	0.18	0.037	4.5

WADING RIVER (Saris: 6235450)
Unique_ID: W0823 Station: WR03, Mile Point: 5
Description: Route 123, Norton.

Date	OWMID	QAQC	Time	Chloride	Alkalinity	Hardness	NH3-N	NO3-NO2-N	TP	TSS
			(24hr)	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
07/25/01	62-0144	62-0143	**	88	21	45	<0.02	0.25	0.016	<1.0
07/25/01	62-0143	62-0144	13:20	88	21	47	<0.02h	0.23	0.017	<1.0
08/07/01	62-0174	62-0173	**	56	15	41	<0.02	0.27	0.020	<1.0
08/07/01	62-0173	62-0174	14:50	57	17	41	<0.02	0.27	0.018	<1.0
09/17/01	62-0240	62-0239	**	73	21	44	<0.02	0.29	0.011	1.4d
09/17/01	62-0239	62-0240	14:10	74	22	44	<0.02	0.30	0.012	<1.0d

RUMFORD RIVER (Saris: 6235600)
Unique_ID: W0820 Station: RR04, Mile Point: 8.2
Description: Spring Street, Mansfield.

Date	OWMID	QAQC	Time	Chloride	Alkalinity	Hardness	NH3-N	NO3-NO2-N	TP	TSS
			(24hr)	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
07/25/01	62-0146	--	11:45	120	25	49	<0.02	0.38	0.026	2.0
08/07/01	62-0176	--	11:15	120	18	52	<0.02	0.33	0.022	1.3
09/17/01	62-0242	--	11:10	110	17	51	<0.02	0.18	0.032	2.9

RUMFORD RIVER (Saris: 6235600)
Unique_ID: W0822 Station: RR05, Mile Point: 4.5
Description: Reservoir Street, Norton.

Date	OWMID	QAQC	Time	Chloride	Alkalinity	Hardness	NH3-N	NO3-NO2-N	TP	TSS
			(24hr)	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
07/25/01	62-0147	--	12:25	88	18	38	<0.02	<0.06	0.041	3.5
08/07/01	62-0178	--	13:30	100	21	38	<0.02	<0.06	0.032	3.6
09/17/01	62-0244	--	12:55	100	20	39	<0.02	0.06	0.036	2.4

ROBINSON BROOK (Saris: 6235625)
Unique_ID: W0829 Station: RB03, Mile Point: 0.5
Description: Central Street, Mansfield.

Date	OWMID	QAQC	Time	Chloride	Alkalinity	Hardness	NH3-N	NO3-NO2-N	TP	TSS
			(24hr)	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
08/07/01	62-0177	--	11:50	230	21	71	<0.02	0.90	0.021	1.4
09/17/01	62-0243	--	11:40	210	18	67	<0.02	1.2	0.011	<1.0

CANOE RIVER (Saris: 6235850)
Unique_ID: W0830 Station: CA01B, Mile Point: 11.3
Description: East Street, Foxborough.

Date	OWMID	QAQC	Time	Chloride	Alkalinity	Hardness	NH3-N	NO3-NO2-N	TP	TSS
			(24hr)	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
08/07/01	62-0179	--	12:40	29	8	19	<0.02	0.48	0.033	<1.0
09/17/01	62-0245	--	12:13	20	10	23	<0.02	0.91	0.011	<1.0

SATUCKET RIVER (Saris: 6236950)
Unique_ID: W0813 Station: SA02, Mile Point: 5.6
Description: outlet Robbins Pond, Pond Street, East Bridgewater.

Date	OWMID	QAQC	Time	Chloride	Alkalinity	Hardness	NH3-N	NO3-NO2-N	TP	TSS
			(24hr)	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
07/23/01	62-0111	--	15:53	##b	5	14	<0.02	<0.06	0.14	2.2
08/08/01	62-0207	--	15:12	22	5	14	<0.02	<0.06	0.17	1.6
09/18/01	62-0274	--	14:50	24	4	14	<0.02	<0.06	0.16	2.2

SATUCKET RIVER (Saris: 6236950)
Unique_ID: W0815 Station: SA03, Mile Point: 4
Description: Washington Street, East Bridgewater.

Date	OWMID	QAQC	Time	Chloride	Alkalinity	Hardness	NH3-N	NO3-NO2-N	TP	TSS
			(24hr)	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
07/23/01	62-0110	--	15:35	##b	11	23	<0.02	0.16	0.12	1.2
08/08/01	62-0206	--	14:48	37	14	24	<0.02	0.16	0.13	1.4
09/18/01	62-0273	--	14:15	24	12	23	<0.02	0.22	0.13	1.2

SATUCKET RIVER (Saris: 6236950)
Unique_ID: W0814 Station: SA04, Mile Point: 2.6
Description: Bridge Street, East Bridgewater.

Date	OWMID	QAQC	Time	Chloride	Alkalinity	Hardness	NH3-N	NO3-NO2-N	TP	TSS
			(24hr)	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
07/23/01	62-0109	--	15:05	##b	12	24	<0.02	0.28	0.14	1.1
08/08/01	62-0205	--	14:18	39	14	25	<0.02	0.32	0.12	1.6
09/18/01	62-0272	--	13:50	43	13	30	<0.02	0.81	0.10	2.0

" ## " = Censored data (i.e., data that has been discarded for some reason).
" ** " = Missing data (i.e., data that should have been reported).
" -- " = No data (i.e., data not taken/not required)
" b " = blank Contamination in lab reagent blanks and/or field blank samples (indicating possible bias high and false positives).
" d " = precision of field duplicates (as RPD) did not meet project data quality objectives identified for program or in QAPP. Batched samples may also be affected.

Table 7: Taunton River Watershed Water Quality Data (2001) - Bacteria and Fluorescent Whitening Agents

Unnamed Tributary to Cedar Swamp River
Unique_ID: W0824 Station: AS05T, Mile Point: 1.6
Description: outlet cranberry bog at Howland Road, Freetown.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml
07/23/01	62-0096	--	10:50	15	5	10
08/08/01	62-0191	--	10:50	25	5	60
09/18/01	62-0258	--	10:05	<5	<5	24b

Unnamed Tributary to Cedar Swamp River
Unique_ID: W0861 Station: CS01T, Mile Point: 0.5
Description: Mill Street, Lakeville.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml
07/23/01	No Flow	--	10:40	--	--	--
08/08/01	62-0192	--	10:40	30	10	70

Unnamed Tributary to Assonet Bay
Unique_ID: W0825 Station: AS11T, Mile Point: 0.9
Description: Friend Street, Berkley.

Date	OWMID	QAQC	Time
			(24hr)
09/18/01	No Flow	--	**

Unnamed Tributary to Assonet Bay
Unique_ID: W0827 Station: AS10T, Mile Point: 0.2
Description: North Main Street, Freetown.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml
09/18/01	62-0263	--	08:50	5	<5	14b

Unnamed Tributary to Wading River
Unique_ID: W0856 Station: CB01, Mile Point: 0.2
Description: Outlet Chartley Pond, South Worcester Street, Norton.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml
08/09/01	62-0158	--	10:10	90	<5	<5
09/17/01	62-0225	--	10:45	22	17b	370

Unnamed Tributary to West Stump Pond
Unique_ID: W0865 Station: SA02T, Mile Point: -8
Description: Elm Street, Halifax.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml
07/24/01	62-0122	62-0120	**	45	20	<5
07/24/01	62-0120	62-0122	10:18	30	15	5

ASSONET RIVER (Saris: 6235100)
Unique_ID: W0817 Station: AS03, Mile Point: 5.9
Description: Route 79 (Richmond Road), Freetown.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml
07/23/01	62-0091	--	10:15	55	55	30
08/08/01	62-0186	--	09:50	130	10	110
09/18/01	62-0253	--	09:27	38	5	86b

ASSONET RIVER (Saris: 6235100)
Unique_ID: W0860 Station: AS02, Mile Point: 4.5
Description: Forge Road (outlet of Forge Pond), Freetown.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml
07/23/01	62-0092	--	09:35	15	5	<5
08/08/01	62-0187	--	09:35	45	<5	40

ASSONET RIVER (Saris: 6235100)
Unique_ID: W0818 Station: AS01, Mile Point: 4.1
Description: Locust Street, Freetown.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml
07/23/01	62-0093	--	09:20	15	15	20
08/08/01	62-0188	--	09:20	90	25	1100
09/18/01	62-0255	--	09:12	7	5	110b

RATTLESNAKE BROOK (Saris: 6235125)
Unique_ID: W0852 Station: ASRB1, Mile Point: 0.4
Description: South Main Street, Freetown.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus	OB-1	OB-2	FWA-4	FWA-1	FWA-2
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml	ug/l	ug/l	ug/l	ug/l	ug/l
09/18/01	62-0261	--	08:30	43	<5	490b	<0.22m	<0.13	<0.13	<0.019	<0.20

RATTLESNAKE BROOK (Saris: 6235125)
Unique_ID: W0826 Station: ASB08T, Mile Point: 0.001
Description: Narrows Road, Freetown.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml
07/23/01	62-0099	--	11:15	45	15	<5

TERRY BROOK (Saris: 6235150)
Unique_ID: W0828 Station: AS09T, Mile Point: 0.02
Description: South Main Street, Freetown.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus	OB-1	OB-2	FWA-4	FWA-1	FWA-2
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml	ug/l	ug/l	ug/l	ug/l	ug/l
09/18/01	62-0262	--	08:18	14	<5	250b	<0.22m	<0.13	<0.13	<0.019	<0.20

QUAKER BROOK (Saris: 6235200)
Unique_ID: W0862 Station: AS07T, Mile Point: 1.1
Description: Bryant Street, Berkley.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml
07/23/01	No Flow	--	**	--	--	--
08/08/01	62-0193	--	11:20	160	7	530

CEDAR SWAMP RIVER (Saris: 6235225)
Unique_ID: W0816 Station: AS04T, Mile Point: 0.6
Description: Malbone Street, Lakeville.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml
07/23/01	62-0095	62-0094	**	37	15	15
07/23/01	62-0094	62-0095	10:25	25	20	15
08/08/01	62-0190	62-0189	**	100e	130de	50
08/08/01	62-0189	62-0190	10:25	120	50d	25
09/18/01	62-0257	62-0256	**	48	14	43b
09/18/01	62-0256	62-0257	09:48	29	5	19b

THREEMILE RIVER (Saris: 6235350)
Unique_ID: W0821 Station: TM01, Mile Point: 9.5
Description: Harvey Street, Taunton.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml
07/25/01	62-0137	--	10:50	220	110	98
08/07/01	62-0166	--	11:45	200	110	350
09/17/01	62-0233	--	10:00	130	24b	76

WADING RIVER (Saris: 6235450)
Unique_ID: W0875 Station: WR10, Mile Point: 13.2
Description: Spruce Street, Foxborough (identified as Cocasset River on 1987 USGS quad).

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml
06/20/01	62-0089	--	11:20	##h	##h	##h

WADING RIVER (Saris: 6235450)
Unique_ID: W0874 Station: WR09, Mile Point: 12
Description: Cedar Street (Route 106), Foxborough.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml
06/20/01	62-0088	--	11:05	##h	##h	##h

WADING RIVER (Saris: 6235450)
Unique_ID: W0819 Station: WR08, Mile Point: 11.2
Description: West Street, Mansfield.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml
06/20/01	62-0087	--	10:50	##h	##h	##h
08/09/01	62-0161	--	10:55	590	300	450

WADING RIVER (Saris: 6235450)
Unique_ID: W0873 Station: WR07, Mile Point: 9.7
Description: Balcom Street, Mansfield.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml
06/20/01	62-0086	--	10:35	##h	##h	##h

WADING RIVER (Saris: 6235450)
Unique_ID: W0872 Station: WR06, Mile Point: 8.8
Description: Otis Street, Mansfield.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml
06/20/01	62-0085	62-0084	**	##dh	##dh	##dh
06/20/01	62-0084	62-0085	10:15	##dh	##dh	##dh

WADING RIVER (Saris: 6235450)
Unique_ID: W0871 Station: WR05, Mile Point: 7.5
Description: Richardson Avenue, Norton.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml
06/20/01	62-0083	--	09:50	##h	##h	##h

WADING RIVER (Saris: 6235450)
Unique_ID: W0863 Station: WR04, Mile Point: 6.3
Description: Walker Street, Norton.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus	OB-1	OB-2	FWA-4	FWA-1	FWA-2
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml	ug/l	ug/l	ug/l	ug/l	ug/l
06/20/01	62-0082	--	09:35	##h	##h	##h	--	--	--	--	--
08/07/01	62-0162	--	11:00	460	190	690	<0.22	<0.13	<0.13	<0.019	<0.20

WADING RIVER (Saris: 6235450)
Unique_ID: W0823 Station: WR03, Mile Point: 5
Description: Route 123, Norton.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus	OB-1	OB-2	FWA-4	FWA-1	FWA-2
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml	ug/l	ug/l	ug/l	ug/l	ug/l
06/20/01	62-0081	--	09:20	##h	##h	##h	--	--	--	--	--
07/25/01	62-0135	62-0134	**	65	45	110d	--	--	--	--	--
07/25/01	62-0134	62-0135	11:15	50	20	50d	--	--	--	--	--
08/07/01	62-0164	62-0163	**	980	75	4000	<0.22	<0.13	<0.13	<0.019	<0.20
08/07/01	62-0163	62-0164	11:15	860	85	5000	<0.22	<0.13	<0.13	<0.019	<0.20
09/17/01	62-0231	62-0230	**	86	14bd	110	<0.22	<0.13	<0.13	<0.019	<0.20
09/17/01	62-0230	62-0231	10:30	67	43bd	100	<0.22	<0.13	<0.13	<0.019	<0.20

WADING RIVER (Saris: 6235450)
Unique_ID: W0870 Station: WR02, Mile Point: 3.3
Description: Barrows Street, Norton.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml
06/20/01	62-0080	--	09:00	##h	##h	##h

WADING RIVER (Saris: 6235450)
Unique_ID: W0858 Station: WR01, Mile Point: 1
Description: Route 140, Norton.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml
06/20/01	62-0079	--	08:45	##h	##h	##h
07/25/01	62-0136	--	10:40	55	25	130
08/09/01	62-0219	62-0165	**	54d	17d	280
08/09/01	62-0165	62-0219	09:20	95d	50d	190
09/17/01	62-0232	--	09:40	110	38b	33

HODGES BROOK (Saris: 6235525)
Unique_ID: W0831 Station: HB01, Mile Point: 0.7
Description: Oak Street, Mansfield.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus	OB-1	OB-2	FWA-4	FWA-1	FWA-2
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml	ug/l	ug/l	ug/l	ug/l	ug/l
08/09/01	62-0159	--	10:30	740	290	1000	--	--	--	--	--
09/17/01	62-0226	--	11:00	130	38b	230	<0.22	<0.13	<0.13	<0.019	<0.20

RUMFORD RIVER (Saris: 6235600)
Unique_ID: W0820 Station: RR04, Mile Point: 8.2
Description: Spring Street, Mansfield.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus	OB-1	OB-2	FWA-4	FWA-1	FWA-2
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml	ug/l	ug/l	ug/l	ug/l	ug/l
07/25/01	62-0139	--	09:15	140	70	30	--	--	--	--	--
08/07/01	62-0168	--	09:30	25	15	35	<0.22	<0.13	<0.13	<0.019	<0.20
09/17/01	62-0276	--	08:00	190	100	710	--	--	--	--	--

RUMFORD RIVER (Saris: 6235600)
Unique_ID: W0822 Station: RR05, Mile Point: 4.5
Description: Reservoir Street, Norton.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus	OB-1	OB-2	FWA-4	FWA-1	FWA-2
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml	ug/l	ug/l	ug/l	ug/l	ug/l
07/25/01	62-0140	--	10:00	35	10	60	--	--	--	--	--
08/09/01	62-0169	--	11:05	300	60	150	--	--	--	--	--
09/17/01	62-0235	--	09:15	86	10b	350	<0.22	<0.13	<0.13	<0.019	<0.20

RUMFORD RIVER (Saris: 6235600)
Unique_ID: W0859 Station: RR06, Mile Point: 2.5
Description: Route 123, Norton.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml
07/25/01	62-0141	--	10:15	75	40	500
08/09/01	62-0171	--	09:50	110	35	100

ROBINSON BROOK (Saris: 6235625)
Unique_ID: W0829 Station: RB03, Mile Point: 0.5
Description: Central Street, Mansfield.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus	OB-1	OB-2	FWA-4	FWA-1	FWA-2
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml	ug/l	ug/l	ug/l	ug/l	ug/l
07/25/01	62-0138	--	09:40	300	150	260	--	--	--	--	--
08/07/01	62-0167	--	09:50	240	25	560	<0.22	<0.13	<0.13	<0.019	<0.20
09/17/01	62-0234	--	08:30	150	24b	300	--	--	--	--	--

CANOE RIVER (Saris: 6235850)
Unique_ID: W0830 Station: CA01B, Mile Point: 11.3
Description: East Street, Foxborough.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus	OB-1	OB-2	FWA-4	FWA-1	FWA-2
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml	ug/l	ug/l	ug/l	ug/l	ug/l
08/07/01	62-0170	--	10:20	230	120	380	<0.22	<0.13	<0.13	<0.019	<0.20
09/17/01	62-0236	--	08:50	19	5b	4800	--	--	--	--	--

SATUCKET RIVER (Saris: 6236950)
Unique_ID: W0813 Station: SA02, Mile Point: 5.6
Description: outlet Robbins Pond, Pond Street, East Bridgewater.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml
07/24/01	62-0121	--	10:00	5	<5	<5
09/19/01	62-0278	62-0260	**	<5	<5	<5
09/19/01	62-0260	62-0278	09:43	<2	<2	5

SATUCKET RIVER (Saris: 6236950)
Unique_ID: W0815 Station: SA03, Mile Point: 4
Description: Washington Street, East Bridgewater.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml
07/24/01	62-0123	--	09:47	50	40	65
09/19/01	62-0259	--	09:28	130	24	81

SATUCKET RIVER (Saris: 6236950)
Unique_ID: W0814 Station: SA04, Mile Point: 2.6
Description: Bridge Street, East Bridgewater.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml
07/24/01	62-0124	--	09:13	95	65	60
09/19/01	62-0254	--	09:10	29	<5	43

BLACK BROOK (Saris: 6236975)
Unique_ID: W0867 Station: SA10T, Mile Point: 0.3
Description: Crescent Street, East Bridgewater.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml
07/24/01	62-0128	--	09:37	4000	1000	1000

POOR MEADOW BROOK (Saris: 6237000)
Unique_ID: W0869 Station: SA07T, Mile Point: 3.2
Description: Main Street, Hanson.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml
07/24/01	62-0125	--	10:38	65	40	95

SHUMATUSCACANT RIVER (Saris: 6237025)
Unique_ID: W0868 Station: SA09T, Mile Point: 0.6
Description: West Washington Street, Hanson.

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Enterococcus
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml
07/24/01	62-0127	--	11:01	32e	37e	90

" ## " = Censored data (i.e., data that has been discarded for some reason).
" ** " = Missing data (i.e., data that should have been reported).
" -- " = No data (i.e., data not taken/not required).
" b " = Blank contamination in lab reagent blanks and/or field blank samples (indicating possible bias high and false positives).
" d " = Precision of field duplicates (as RPD) did not meet project data quality objectives identified for program or in QAPP. Batched samples may also be affected.
" e " = Not theoretically possible. Specifically, used for bacteria data where colonies per unit volume for e-coli bacteria > fecal coliform bacteria and for other incongruous or conflicting results.
" h " = Holding time violation (usually indicating possible bias low).
" m " = method SOP not followed (only partially implemented or not implemented at all) due to complications with sample matrix (eg. sediment in sample, floc formation), lab error (eg. cross-contamination between samples), additional steps taken by the lab to deal with matrix complications, lost/unanalyzed samples, missing data or deviations from field sampling SOPs.

QUALITY CONTROL DATA

Taunton River Watershed quality control data for trip blanks and field duplicate samples can be found in Tables 8 and 9, respectively. Data qualifiers are presented at the bottom of each table and in Appendix 2. Additional information pertaining to the data validation process is provided in Appendix 1.

Table 8: Taunton River Watershed Quality Control Data-Blanks (2001)

Date	OWMID	QAQC	Time	Fecal Coliform	E. Coli	Entero-coccus	Chloride	Alkalinity	Hardness	NH3-N	NO3-NO2-N	TP	TSS	OB-1	OB-2	FWA-4	FWA-1	FWA-2
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	ug/l	ug/l	ug/l	ug/l	ug/l
06/20/01	62-0090	Blank	11:25	##h	##h	##h	--	--	--	--	--	--	--	--	--	--	--	--
07/23/01	62-0108	Blank	**	--	--	--	##b	<2	<0.66	<0.02	<0.06	<0.005	<1.0	--	--	--	--	--
07/23/01	62-0103	Blank	11:30	<5	<5	<5	--	--	--	--	--	--	--	--	--	--	--	--
07/24/01	62-0129	Blank	11:00	<5	<5	<5	--	--	--	--	--	--	--	--	--	--	--	--
07/25/01	62-0148	Blank	**	--	--	--	<1	<2	<0.66	<0.02	<0.06	<0.005	<1.0	--	--	--	--	--
08/07/01	62-0160	Blank	**	<5	<5	<5	--	--	--	--	--	--	--	<0.22	<0.13	<0.13	<0.019	<0.20
08/07/01	62-0180	Blank	**	--	--	--	<1	<2	<0.66	<0.02	<0.06	<0.005	<1.0	--	--	--	--	--
08/08/01	62-0204	Blank	**	--	--	--	<1	<2	<0.66	<0.02	<0.06	<0.005	<1.0	--	--	--	--	--
08/08/01	62-0198	Blank	11:25	<5	<5	<5	--	--	--	--	--	--	--	--	--	--	--	--
08/09/01	62-0220	Blank	**	<5	<5	<5	--	--	--	--	--	--	--	--	--	--	--	--
09/17/01	62-0227	Blank	**	<5	<5b	<5	--	--	--	--	--	--	--	<0.22	<0.13	<0.13	<0.019	<0.20
09/17/01	62-0246	Blank	**	--	--	--	<1	<2	<0.66	<0.02	<0.06	<0.005	<1.0	--	--	--	--	--
09/18/01	No Flow	Blank	**	<5	<5	5b	--	--	--	--	--	--	--	<0.22m	<0.13	<0.13	<0.019	<0.20
09/18/01	62-0271	Blank	**	--	--	--	<1	<2	<0.66	<0.02	<0.06	<0.005	<1.0	--	--	--	--	--
09/19/01	62-0279	Blank	**	<5	<5	<5	--	--	--	--	--	--	--	--	--	--	--	--

" ## " = Censored data (i.e., data that has been discarded for some reason).
" ** " = Missing data (i.e., data that should have been reported).
" -- " = No data (i.e., data not taken/not required).
" b " = Blank contamination in lab reagent blanks and/or field blank samples (indicating possible bias high and false positives).
" h " = Holding time violation (usually indicating possible bias low).

Table 9: Taunton River Quality Control Data-Duplicates (2001)

UNNAMED TRIBUTARY

Unique_ID: W0865 Station: SA02T, Mile Point: -8

Description: unnamed tributary to Winnetuxet River, outlet of Stump Pond, at Elm Street, Halifax

Date	OWMID	QAQC	Time	Log10 (Fecal Coliform)	Log10 (E. Coli)	Log10 (Entero-coccus sp.)	Chloride	Alkalinity	Hardness	NH3-N	NO3-NO2-N	TP	TSS	OB-1	OB-2	FWA-4	FWA-1	FWA-2
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	ug/l	ug/l	ug/l	ug/l	ug/l
07/24/01	62-0122	62-0120	**	1.653	1.301	0.699	--	--	--	--	--	--	--	--	--	--	--	--
07/24/01	62-0120	62-0122	10:18	1.477	1.176	0.699	--	--	--	--	--	--	--	--	--	--	--	--
Relative Percent Difference				*11.3%*	*10.1%*	*0.0%*	--	--	--	--	--	--	--	--	--	--	--	--

ASSONET RIVER (Saris: 6235100)

Unique_ID: W0818 Station: AS01, Mile Point: 4.1

Description: Locust Street, Freetown

Date	OWMID	QAQC	Time	Log10 (Fecal Coliform)	Log10 (E. Coli)	Log10 (Entero-coccus sp.)	Chloride	Alkalinity	Hardness	NH3-N	NO3-NO2-N	TP	TSS	OB-1	OB-2	FWA-4	FWA-1	FWA-2
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	ug/l	ug/l	ug/l	ug/l	ug/l
07/23/01	62-0105	62-0104	**	--	--	--	##b	2	14	<0.02	<0.06	0.067	4.8	--	--	--	--	--
07/23/01	62-0104	62-0105	13:00	--	--	--	##b	3	14	<0.02	<0.06	0.062	4.1	--	--	--	--	--
Relative Percent Difference				--	--	--		*40.0%*	*0.0%*	*0.0%*	*0.0%*	*7.8%*	*15.7%*	--	--	--	--	--
08/08/01	62-0200	62-0199	**	--	--	--	18	3	14	<0.02	<0.06	0.057	2.7d	--	--	--	--	--
08/08/01	62-0199	62-0200	11:40	--	--	--	17	<2	14	<0.02	<0.06	0.057	7.4d	--	--	--	--	--
Relative Percent Difference				--	--	--	*5.7%*	*40.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*93.1%*	--	--	--	--	--
09/18/01	62-0267	62-0266	**	--	--	--	18	4	14	<0.02	<0.06	0.051	3.8	--	--	--	--	--
09/18/01	62-0266	62-0267	11:25	--	--	--	20	4	14	<0.02	<0.06	0.051	3.8	--	--	--	--	--
Relative Percent Difference				--	--	--	*10.5%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	--	--	--	--	--

CEDAR SWAMP RIVER (Saris: 6235225)

Unique_ID: W0816 Station: AS04T, Mile Point: 0.6

Description: Malbone Street, Lakeville

Date	OWMID	QAQC	Time	Log10 (Fecal Coliform)	Log10 (E. Coli)	Log10 (Entero-coccus sp.)	Chloride	Alkalinity	Hardness	NH3-N	NO3-NO2-N	TP	TSS	OB-1	OB-2	FWA-4	FWA-1	FWA-2
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	ug/l	ug/l	ug/l	ug/l	ug/l
07/23/01	62-0095	62-0094	**	1.568	1.176	1.176	--	--	--	--	--	--	--	--	--	--	--	--
07/23/01	62-0094	62-0095	10:25	1.398	1.301	1.176	--	--	--	--	--	--	--	--	--	--	--	--
Relative Percent Difference				*11.5%*	*10.1%*	*0.0%*	--	--	--	--	--	--	--	--	--	--	--	--
08/08/01	62-0190	62-0189	**	2.000	2.114	1.699	--	--	--	--	--	--	--	--	--	--	--	--
08/08/01	62-0189	62-0190	10:25	2.079	1.699	1.398	--	--	--	--	--	--	--	--	--	--	--	--
Relative Percent Difference				*3.9%*	*21.8%*	*19.4%*	--	--	--	--	--	--	--	--	--	--	--	--
09/18/01	62-0257	62-0256	**	1.681	1.146	1.633	--	--	--	--	--	--	--	<0.22m	<0.13	<0.13	<0.019	<0.20
09/18/01	62-0256	62-0257	09:48	1.462	0.699	1.279	--	--	--	--	--	--	--	<0.22m	<0.13	<0.13	<0.019	<0.20
Relative Percent Difference				*13.9%*	*48.5%*	*24.4%*	--	--	--	--	--	--	--	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*

WADING RIVER (Saris: 6235450)
Unique_ID: W0872 Station: WR06, Mile Point: 8.8
Description: Otis Street, Mansfield

Date	OWMID	QAQC	Time	Log10 (Fecal Coliform)	Log10 (E. Coli)	Log10 (Entero-coccus sp.)	Chloride	Alkalinity	Hardness	NH3-N	NO3-NO2-N	TP	TSS	OB-1	OB-2	FWA-4	FWA-1	FWA-2
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	ug/l	ug/l	ug/l	ug/l	ug/l
06/20/01	62-0085	62-0084	**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
06/20/01	62-0084	62-0085	10:15	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Relative Percent Difference				--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

WADING RIVER (Saris: 6235450)
Unique_ID: W0823 Station: WR03, Mile Point: 5
Description: Route 123, Norton

Date	OWMID	QAQC	Time	Log10 (Fecal Coliform)	Log10 (E. Coli)	Log10 (Entero-coccus sp.)	Chloride	Alkalinity	Hardness	NH3-N	NO3-NO2-N	TP	TSS	OB-1	OB-2	FWA-4	FWA-1	FWA-2
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	ug/l	ug/l	ug/l	ug/l	ug/l
07/25/01	62-0135	62-0134	**	1.813	1.653	2.041	--	--	--	--	--	--	--	--	--	--	--	--
07/25/01	62-0134	62-0135	11:15	1.699	1.301	1.699	--	--	--	--	--	--	--	--	--	--	--	--
Relative Percent Difference				*6.5%*	*23.8%*	*18.3%*	--	--	--	--	--	--	--	--	--	--	--	--
07/25/01	62-0144	62-0143	**	--	--	--	88	21	45	<0.02	0.25	0.016	<1.0	--	--	--	--	--
07/25/01	62-0143	62-0144	13:20	--	--	--	88	21	47	<0.02h	0.23	0.017	<1.0	--	--	--	--	--
Relative Percent Difference				--	--	--	*0.0%*	*0.0%*	*4.3%*	*0.0%*	*8.3%*	*6.1%*	*0.0%*	--	--	--	--	--
08/07/01	62-0164	62-0163	**	2.991	1.875	3.602	--	--	--	--	--	--	--	<0.22	<0.13	<0.13	<0.019	<0.20
08/07/01	62-0163	62-0164	11:15	2.934	1.929	3.699	--	--	--	--	--	--	--	<0.22	<0.13	<0.13	<0.019	<0.20
Relative Percent Difference				*1.9%*	*2.9%*	*2.7%*	--	--	--	--	--	--	--	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*
08/07/01	62-0174	62-0173	**	--	--	--	56	15	41	<0.02	0.27	0.020	<1.0	--	--	--	--	--
08/07/01	62-0173	62-0174	14:50	--	--	--	57	17	41	<0.02	0.27	0.018	<1.0	--	--	--	--	--
Relative Percent Difference				--	--	--	*1.8%*	*12.5%*	*0.0%*	*0.0%*	*0.0%*	*10.5%*	*0.0%*	--	--	--	--	--
09/17/01	62-0231	62-0230	**	1.934	1.146	2.041	--	--	--	--	--	--	--	<0.22	<0.13	<0.13	<0.019	<0.20
09/17/01	62-0230	62-0231	10:30	1.826	1.633	2.000	--	--	--	--	--	--	--	<0.22	<0.13	<0.13	<0.019	<0.20
Relative Percent Difference				*5.8%*	*35.1%*	*2.0%*	--	--	--	--	--	--	--	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*
09/17/01	62-0240	62-0239	**	--	--	--	73	21	44	<0.02	0.29	0.011	1.4d	--	--	--	--	--
09/17/01	62-0239	62-0240	14:10	--	--	--	74	22	44	<0.02	0.30	0.012	<1.0d	--	--	--	--	--
Relative Percent Difference				--	--	--	*1.4%*	*4.7%*	*0.0%*	*0.0%*	*3.4%*	*8.7%*	*33.3%*	--	--	--	--	--

WADING RIVER (Saris: 6235450)
Unique_ID: W0858 Station: WR01, Mile Point: 1
Description: Route 140, Norton

Date	OWMID	QAQC	Time	Log10 (Fecal Coliform)	Log10 (E. Coli)	Log10 (Entero-coccus sp.)	Chloride	Alkalinity	Hardness	NH3-N	NO3-NO2-N	TP	TSS	OB-1	OB-2	FWA-4	FWA-1	FWA-2
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	ug/l	ug/l	ug/l	ug/l	ug/l
08/09/01	62-0219	62-0165	**	1.732	1.230	2.447	--	--	--	--	--	--	--	--	--	--	--	--
08/09/01	62-0165	62-0219	09:20	*13.2%*	*32.0%*	*7.1%*	--	--	--	--	--	--	--	--	--	--	--	--
Relative Percent Difference				*13.2%*	*32.0%*	*7.1%*	--	--	--	--	--	--	--	--	--	--	--	--

SATUCKET RIVER (Saris: 6236950)
Unique_ID: W0813 Station: SA02, Mile Point: 5.6
Description: outlet Robbins Pond, Pond Street, East Bridgewater

Date	OWMID	QAQC	Time	Log10 (Fecal Coliform)	Log10 (E. Coli)	Log10 (Entero-coccus sp.)	Chloride	Alkalinity	Hardness	NH3-N	NO3-NO2-N	TP	TSS	OB-1	OB-2	FWA-4	FWA-1	FWA-2
			(24hr)	CFU/100ml	CFU/100ml	CFU/100ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	ug/l	ug/l	ug/l	ug/l	ug/l
09/19/01	62-0278	62-0260	**	0.699	0.699	0.699	--	--	--	--	--	--	--	--	--	--	--	--
09/19/01	62-0260	62-0278	09:43	0.301	0.301	0.699	--	--	--	--	--	--	--	--	--	--	--	--
Relative Percent Difference				*79.6%*	*79.6%*	*0.0%*	--	--	--	--	--	--	--	--	--	--	--	--

" ## " = Censored data (i.e., data that has been discarded for some reason).
" ** " = Missing data (i.e., data that should have been reported).
" -- " = No data (i.e., data not taken/not required).
" b " = Blank contamination in lab reagent blanks and/or field blank samples (indicating possible bias high and false positives).
" d " = Precision of field duplicates (as RPD) did not meet project data quality objectives identified for program or in QAPP. Batched samples may also be affected.
" m " = Method SOP not followed (only partially implemented or not implemented at all) due to complications with sample matrix (eg. sediment in sample, floc formation), lab error (eg. cross-contamination between samples), additional steps taken by the lab to deal with matrix complications, lost/unanalyzed samples, missing data or deviations from field sampling SOPs.

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APPENDIX 1

QUALITY ASSURANCE/QUALITY CONTROL DATA VALIDATION FOR THE Taunton Watershed 2001 Water Quality Survey

Selected Excerpts from:
Data Validation Report for Year 2001 Project Data (CN 149.0)

December, 2004

Department of Environmental Protection
Division of Watershed Management

4.0 2001 *IN-SITU* MULTIPROBE DATA

4.1 QA/QC Objectives and Criteria for 2001 *In-Situ* Multi-probe Data

Trained DWM staff members (and their designees) conducted *in-situ* measurements using Hydrolab® Series 3 and Series 4 multi-probe instruments that simultaneously measure dissolved oxygen, temperature, pH, conductivity, and depth, and provide calculated estimates for total dissolved solids and % oxygen saturation.

To ensure the quality of the data, the following QA/QC steps were taken:

- Pre-Survey Calibration and Check: Standard pre-survey calibration of the Hydrolab® unit was conducted in accordance with the DWM SOP for Hydrolab® use. After the instrument was calibrated and before the instrument was released to field staff, an instrument check using both a low ionic standard and filtered de-ionized water was performed. The purpose of this check is to make sure that the instrument is providing stable readings as the waters in Massachusetts are typically of low ionic strength. If the instrument failed acceptance criteria, it was not released to field staff until the source of error was identified and corrected.

- Post-Survey Check: A standard post survey check of the Hydrolab® unit was performed in accordance with the DWM SOP for Hydrolab® use. Upon return of the Hydrolab® unit to DWM's lab after a survey run, a visual inspection was performed to identify any physical damage that may have occurred in the field. The calibration of the unit was then checked against both a low ionic standard and filtered de-ionized water. The results of the post survey calibration check were compared to the pre-calibration results. If visual damage was observed and/or post calibration acceptance criteria were not achieved, the source of error was investigated and data collected in the field may have been subject to qualification or censoring.

- Field Audits: As time and resources allowed, field review of Hydrolab® use by field staff was performed by DWM QA Analyst to verify field implementation of Hydrolab® use SOP (e.g., placement in representative locations).

- Data Reduction: The Hydrolab® Coordinator, QC Analyst and Database Manager reviewed the Hydrolab® data for instability, instrument malfunction, operator error and aberrant trends. If any of these conditions were detected, the data was investigated and may have been recommended for censoring. The Database Manager electronically tagged all data recommended for censoring in the database. Measured data were also evaluated for the following:

  • Consistency with the Hydrolab® SOP (specifically, the requirement for three (minimum)-five (preferred) sequential readings one-minute-apart at appropriate depths, proper field use, etc.).

  • Accuracy and precision of readings, as assessed through review of pre-survey calibration/check and post-survey check data, field notes for any information on faulty operation and/or unusual field conditions, and accuracy checks against WES laboratory data (e.g. turbidity).

• Representativeness of data (review of fieldsheets and notes for any information that might indicate non-representativeness; eg. not taken at the deep hole).

• Check for "outliers" or unreasonable data, based on best professional judgement. Outliers are identified and flagged for scrutiny.

•In lieu of verifying in the electronic record that the Hydrolab® was depth-calibrated prior to use, both general and specific criteria are used to accept, qualify or censor of Hydrolab® Depth readings, as follows:

General Depth Criteria: Apply to each OWMID# for lakes and rivers

- Clearly erroneous readings due to faulty depth sensor: Censor (i)
- Negative and zero depth readings: Censor (i); (likely in error)
- 0.1 m depth readings: Qualify (i); (potentially in error)
- 0.2 and greater depth readings: Accept without qualification; (likely accurate)

Specific Depth Criteria: Apply to entirety of depth data for survey date

- If zero and/or negative depth readings occur more than once per survey date, censor all negative/zero depth data, and qualify all other depth data for that survey (indicates that erroneous depth readings were not recognized in the field and that corrective action (field calibration of the depth sensor) was not taken, ie. that all positive readings may be in error.)

• Hydrolab® Record acceptance criteria: Within each set of records for individual OWMID #s, accept the final line of data for each depth where the change in depth from the previous accepted-record-depth is greater than 0.2 meters. See Appendix 2.

• The criterion used in 2001 to accept, qualify or censor Conductivity (and the dependent, calculated estimates for TDS and Salinity) readings was based on exceedance of the calibration standard concentration. For exceedances greater than two times the standard, the conductivity reading was typically censored. Readings above the calibration standard were qualified whenever the reading was less than two times the calibration standard. In cases where readings fell far below the calibration standard concentration (eg. measured value of 100 uS/cm using 6668 calibration standard), no censoring or qualification was imposed.

• For D.O. values less than 0.2 mg/l, 2001 data were accepted without qualification and reported as "<0.2". Similarly for % saturation, values less than 2% were accepted without qualification and reported as "<2%".

• For all parameters taken at the same location and whose range for 3-5 successive readings fluctuated beyond the range (+/-) of probe accuracy, the data was typically qualified or censored (depending on the degree of fluctuation) with "u" (unstable). Data exhibiting significant, continuous movement in one direction and that did not appear to reach equilibrium was also qualified or censored.

• For instances where temperature has been censored, data for Conductivity, pH and D.O. are typically qualified. (Hydrolab® readings for Conductivity, pH and dissolved oxygen are internally-corrected for temperature; conductivity is temperature-compensated to 25 deg. C, D.O. readings are adjusted about 5% per degree C to account for changes in oxygen solubility and membrane permeability, and pH is compensated for electrode effects due to variable sample temperatures.) In cases where temperature has only been qualified, no qualification of data for conductivity, pH and D.O. is imposed.

5.0 2001 DISCRETE WATER SAMPLE DATA

5.1 QA/QC Objectives and Criteria for 2001 Discrete Water Sample Data

The collection and analysis of discrete water samples in 2001 followed the DWM Standard Operating Procedure for grab sampling (CN# 1.1) and analyte-specific WES SOPs.

The grab sampling protocol outlines the use of new-for-2001 "**basket samplers**" in lieu of buckets (used by DWM in 2000) to collect samples from drop locations.

Also, the taking of field replicates for quality control purposes differed from that performed in 2000. In 2000, large-volume samples were split into two samples to measure precision or repeatability. In 2001, most replicate samples were taken as **separate, co-located (side-by-side), simultaneous field duplicates** to estimate overall precision (including variation due to sampling technique).

Using the following criteria, as well as other considerations and input from data reviewers, individual datum were either:

1. Accepted
2. Accepted with qualification, or
3. Censored

In cases where poor quality control (e.g., blank/cross contamination, lab accuracy) affected batched analyses or entire surveys, censoring/qualification decisions were applied to groups of samples (e.g., a specific crew's samples, a specific survey's samples or all samples from a specific batch analysis).

Criteria for acceptance of discrete water quality samples were as follows:

- For simplicity, samples that were "lost", "missing", "spilled" and "not analyzed" were 'censored' using the 'm' (method not followed) qualifier.

- Sampling/Analysis Holding Time: Each analyte has a standard holding time that has been established to ensure sample/analysis integrity. Refer to DWM Standard Operating Procedure CN# 1.1 for a complete listing. If the standard holding time was exceeded, this criterion is violated and the data may be censored, depending on the extent of exceedance. For minor exceedances (e.g., < than 20% of the holding time), the data is typically qualified ("h" for minor holding time violation).

- Quality Control Sample Frequency: At a minimum, one field blank and one replicate must be collected for every ten samples by any given sampling crew on any given date. If less than 10% blanks and replicates were collected, the data are typically qualified with "f". If blanks were omitted and duplicates taken, typically no data are qualified, as long as there are no documented historical problems for the survey-specific samplers or station locations with regard to field contamination. If blanks were taken but duplicates were not, the data may be qualified with "f". Typically, no censoring of data takes place for insufficient QC sample frequencies only.

- Field Blanks: Field blanks were prepared at the DWM Worcester Laboratory. Reagent grade water was transported into the field in a sample container where it was transferred into a different sample container directly or via a sampling device (equipment blank) using the same methods as for its corresponding field sample (e.g., blank samples were preserved in the same way). All blanks were submitted to the WES laboratory "blind". If the field blank results were greater than the MDL (indicating potential sampling error, airborne contaminants, dirty equipment, etc.), the data may be censored or qualified, depending on extent and other factors.

- Field Replicates: In 2001, field duplicate samples for rivers were taken as co-located, simultaneous duplicates. As a result, these duplicate results include any spatial, natural variability present between side-by-side samples (which should be minimal in most cases where site selection has accounted for uniform mixing).
Samples were submitted to WES laboratory "blind". In order for this data quality criterion to be met, the results must generally be:

- <20% Relative Percent Difference (RPD) for method detection limits >1mg/L, or
- <30% RPD for method detection limits <1mg/L.

or meet more specific criteria contained in a 2001 QAPP document. If the criteria are not met, the sample/duplicate data may be censored or qualified, depending on extent of exceedance and other factors. Arguably, very poor precision of field duplicate samples reflects poor reproducibility for entire surveys and/or analytical batch runs, and should result in censoring or qualification of the entire survey/batch data.

- Results of Field and/or Lab Audits and Miscellaneous Survey Information: If, based on the results of field evaluation of implementation of field sampling SOPs, samples are deemed to have been taken incorrectly or to not represent station conditions at the time of sampling, then individual or survey-based sample results may be qualified or censored. Likewise, the results of QC audits of lab(s) analytical accuracy (and precision) for specific parameters are evaluated. If results indicate poor accuracy or repeatability, batch run data may be qualified or censored. In addition, information from survey personnel regarding sample integrity and representativeness may lead to decisions to qualify or censor data.

- Laboratory assessment of analytical precision and accuracy**:** The WES Laboratory is solely responsible for the administration of its Quality Assurance Program and Standard Operating Procedures. WES staff release discrete water sample data when their established QA/QC criteria have been met. When the following criteria cannot be met, data are qualified using appropriate qualifiers:

- Low Calibration Standards – Checks the stability of the instrument's calibration curve; analyzes the *accuracy* of an instrument's calibration within a 5% range.
- Reference Standards – Generally, a second source standard (a standard different from the calibration stock standard) that analyzes the method *accuracy.*
- Laboratory Reagent Blank/Method Blank (LRB) – Reagent grade water (de-ionized) extracted with every sample set used to ensure that the system is free of target analytes (< MDL) and to assess potential blank contamination.
- Duplicate Sample – Measures the *precision* (as Relative Percent Difference or RPD) of the analytical process. The acceptable laboratory %RPD range is typically ≤ 25%. For bacteria, duplicate data are evaluated based the range of logged values.
- Spike Sample (Laboratory Fortified Blank - LFB, Laboratory Fortified Matrix - LFM)– Measures the *accuracy* (% Recovery) of an analytical method. The acceptable laboratory % recovery range is typically between 80 – 120% for LFB samples and 70 –130% for LFM discrete water samples.

5.2 Field and Lab Audit Results

Field Audits – In 2001, nine field audits (total) were performed by DWM's QC Analyst. Six of these were for water sample collection and multi-probe use. Specifically, these six audits were useful in:

- Reminding survey staff of the potential of using two separate multi-probe units when one crew is sampling fresh and salt waters (to ensure proper calibration ranges for conductivity measurements).
- Stressing the importance of survey timing to enable ebb tide sampling in tidal areas
- Noting inattention to required field safety precautions
- Noting inattention to proper care of multi-probe units
- Stressing the importance of filling out fieldsheets completely, and
- Stressing the need to depth-calibrate the multi-probe initially at the first station

Any field audit results affecting sample data are reflected in the tables below. (Copies of completed audit forms are available from DWM's QC Analyst.)

Lab Audits – To provide external evaluation of lab performance with regard to analyses for fecal coliform bacteria and nutrients (TP, TKN, PO4, NO3 and NH3) quality control samples were provided to WES.

The external audit of WES for fecal coliform bacteria analysis planned for 2001 was intended to employ semi-quantitative samples provided by Microcheck, Inc.. DWM placed the order two weeks prior but missed the cutoff for the PT Study. The audit was rescheduled for Spring, 2002. The results of the April, 2002 audit were satisfactory.

The nutrients QC samples (via Accustandard, Inc.) were diluted at DWM and sent double-blind to WES along with some equipment blank samples (see 5.3 below). Due to mis-communication between Accustandard and DWM, the dilution resulted in sample concentrations above the preferred range, making them less useful in assessing low-level accuracy. As a result, DWM instructed WES to run only the NO3-NO2-N and NH3-N QC samples. These results showed good precision between same concentration replicate samples (albeit at high concentrations) and ND for lab blank samples. Quality control audit samples for TP that were provided to WES in 2000 and 2002 showed satisfactory results.

5.4 Miscellaneous Information

The following are particularly noteworthy regarding 2001 DWM/CERO surveys and WES analyses. The validation decisions contained in the tables below reflect these considerations.

1) **MDL/RDL with regard to "ND" Results**: In 2001, WES began to use Reporting Detection Limits or RDLs in addition to MDLs in their data reports. These reports defined (in a standard footnote) results less than the RDL as not detected or "ND". Based on a clarifying email from Oscar Pancorbo dated 8/1/2003, "ND" actually referred to <MDL for most WES results prior to May, 2002. The exception to this is NO3-N, where "ND" results referred to <RDL.

2) **Turbidity Results**: Poor comparison between paired sample data for field vs. laboratory turbidity resulted in the censoring of all Year 2001 field turbidity results measured using the Hydrolab® multi-probe. Follow-up QC testing is planned to resolve accuracy/precision issues related to turbidity.

5.5 2001 Censored/Qualified Discrete Water Sample Data

Year 2001 data for discrete water samples that have been censored (##) or qualified (result shown) are listed below ***for the Taunton Watershed***, except for missing data. For qualifier definitions, see Appendix 2.

Projname	Analyte	DATE	OWMID	LabSNum	rResVal	DWMQual	Units
Taunton (2001)	Fecal Coliforms	6/20/2001	62-0079	2001190-01	##	**h**	CFU/100mL
Taunton (2001)	Fecal Coliforms	6/20/2001	62-0080	2001190-02	##	**h**	CFU/100mL
Taunton (2001)	Fecal Coliforms	6/20/2001	62-0081	2001190-03	##	**h**	CFU/100mL
Taunton (2001)	Fecal Coliforms	6/20/2001	62-0082	2001190-04	##	**h**	CFU/100mL
Taunton (2001)	Fecal Coliforms	6/20/2001	62-0083	2001190-05	##	**h**	CFU/100mL
Taunton (2001)	Fecal Coliforms	6/20/2001	62-0084	2001190-06	##	**dh**	CFU/100mL
Taunton (2001)	Fecal Coliforms	6/20/2001	62-0085	2001190-07	##	**dh**	CFU/100mL
Taunton (2001)	Fecal Coliforms	6/20/2001	62-0086	2001190-08	##	**h**	CFU/100mL
Taunton (2001)	Fecal Coliforms	6/20/2001	62-0087	2001190-09	##	**h**	CFU/100mL
Taunton (2001)	Fecal Coliforms	6/20/2001	62-0088	2001190-10	##	**h**	CFU/100mL
Taunton (2001)	Fecal Coliforms	6/20/2001	62-0089	2001190-11	##	**h**	CFU/100mL
Taunton (2001)	Fecal Coliforms	6/20/2001	62-0090	2001190-12	##	**h**	CFU/100mL
Taunton (2001)	Fecal Coliforms	7/24/2001	62-0127	2001294-07	32	**e**	CFU/100mL
Taunton (2001)	Fecal Coliforms	8/8/2001	62-0190	2001353-05	100	**e**	CFU/100mL
Taunton (2001)	Fecal Coliforms	8/9/2001	62-0165	2001356-06	95	**d**	CFU/100mL
Taunton (2001)	Fecal Coliforms	8/9/2001	62-0219	2001356-05	54	**d**	CFU/100mL
Taunton (2001)	E. coli - MTEC	6/20/2001	62-0079	2001190-01	##	**h**	CFU/100mL
Taunton (2001)	E. coli - MTEC	6/20/2001	62-0080	2001190-02	##	**h**	CFU/100mL

Projname	Analyte	DATE	OWMID	LabSNum	rResVal	DWMQual	Units
Taunton (2001)	E. coli - MTEC	6/20/2001	62-0081	2001190-03	##	**h**	CFU/100mL
Taunton (2001)	E. coli - MTEC	6/20/2001	62-0082	2001190-04	##	**h**	CFU/100mL
Taunton (2001)	E. coli - MTEC	6/20/2001	62-0083	2001190-05	##	**h**	CFU/100mL
Taunton (2001)	E. coli - MTEC	6/20/2001	62-0084	2001190-06	##	**dh**	CFU/100mL
Taunton (2001)	E. coli - MTEC	6/20/2001	62-0085	2001190-07	##	**dh**	CFU/100mL
Taunton (2001)	E. coli - MTEC	6/20/2001	62-0086	2001190-08	##	**h**	CFU/100mL
Taunton (2001)	E. coli - MTEC	6/20/2001	62-0087	2001190-09	##	**h**	CFU/100mL
Taunton (2001)	E. coli - MTEC	6/20/2001	62-0088	2001190-10	##	**h**	CFU/100mL
Taunton (2001)	E. coli - MTEC	6/20/2001	62-0089	2001190-11	##	**h**	CFU/100mL
Taunton (2001)	E. coli - MTEC	6/20/2001	62-0090	2001190-12	##	**h**	CFU/100mL
Taunton (2001)	E. coli - MTEC	7/24/2001	62-0127	2001294-07	37	**e**	CFU/100mL
Taunton (2001)	E. coli - MTEC	8/8/2001	62-0189	2001353-04	50	**d**	CFU/100mL
Taunton (2001)	E. coli - MTEC	8/8/2001	62-0190	2001353-05	130	**de**	CFU/100mL
Taunton (2001)	E. coli - MTEC	8/9/2001	62-0165	2001356-06	50	**d**	CFU/100mL
Taunton (2001)	E. coli - MTEC	8/9/2001	62-0219	2001356-05	17	**d**	CFU/100mL
Taunton (2001)	E. coli - MTEC	9/17/2001	62-0225	2001466-01	17	**b**	CFU/100mL
Taunton (2001)	E. coli - MTEC	9/17/2001	62-0226	2001466-02	38	**b**	CFU/100mL
Taunton (2001)	E. coli - MTEC	9/17/2001	62-0227	2001466-03	<5	**b**	CFU/100mL
Taunton (2001)	E. coli - MTEC	9/17/2001	62-0230	2001466-04	43	**bd**	CFU/100mL
Taunton (2001)	E. coli - MTEC	9/17/2001	62-0231	2001466-05	14	**bd**	CFU/100mL
Taunton (2001)	E. coli - MTEC	9/17/2001	62-0232	2001466-06	38	**b**	CFU/100mL
Taunton (2001)	E. coli - MTEC	9/17/2001	62-0233	2001466-07	24	**b**	CFU/100mL
Taunton (2001)	E. coli - MTEC	9/17/2001	62-0234	2001466-08	24	**b**	CFU/100mL
Taunton (2001)	E. coli - MTEC	9/17/2001	62-0235	2001466-09	10	**b**	CFU/100mL
Taunton (2001)	E. coli - MTEC	9/17/2001	62-0236	2001466-10	5	**b**	CFU/100mL
Taunton (2001)	Enterococci	6/20/2001	62-0079	2001190-01	##	**h**	CFU/100mL
Taunton (2001)	Enterococci	6/20/2001	62-0080	2001190-02	##	**h**	CFU/100mL
Taunton (2001)	Enterococci	6/20/2001	62-0081	2001190-03	##	**h**	CFU/100mL
Taunton (2001)	Enterococci	6/20/2001	62-0082	2001190-04	##	**h**	CFU/100mL
Taunton (2001)	Enterococci	6/20/2001	62-0083	2001190-05	##	**h**	CFU/100mL
Taunton (2001)	Enterococci	6/20/2001	62-0084	2001190-06	##	**dh**	CFU/100mL
Taunton (2001)	Enterococci	6/20/2001	62-0085	2001190-07	##	**dh**	CFU/100mL
Taunton (2001)	Enterococci	6/20/2001	62-0086	2001190-08	##	**h**	CFU/100mL
Taunton (2001)	Enterococci	6/20/2001	62-0087	2001190-09	##	**h**	CFU/100mL
Taunton (2001)	Enterococci	6/20/2001	62-0088	2001190-10	##	**h**	CFU/100mL
Taunton (2001)	Enterococci	6/20/2001	62-0089	2001190-11	##	**h**	CFU/100mL
Taunton (2001)	Enterococci	6/20/2001	62-0090	2001190-12	##	**h**	CFU/100mL
Taunton (2001)	Enterococci	7/25/2001	62-0134	2001301-01	50	**d**	CFU/100mL
Taunton (2001)	Enterococci	7/25/2001	62-0135	2001301-02	110	**d**	CFU/100mL
Taunton (2001)	Enterococci	9/18/2001	62-0253	2001469-01	86	**b**	CFU/100mL
Taunton (2001)	Enterococci	9/18/2001	62-0255	2001469-02	110	**b**	CFU/100mL
Taunton (2001)	Enterococci	9/18/2001	62-0256	2001469-03	19	**b**	CFU/100mL
Taunton (2001)	Enterococci	9/18/2001	62-0257	2001469-04	43	**b**	CFU/100mL
Taunton (2001)	Enterococci	9/18/2001	62-0258	2001469-05	24	**b**	CFU/100mL
Taunton (2001)	Enterococci	9/18/2001	62-0261	2001469-06	490	**b**	CFU/100mL
Taunton (2001)	Enterococci	9/18/2001	62-0262	2001469-07	250	**b**	CFU/100mL
Taunton (2001)	Enterococci	9/18/2001	62-0263	2001469-08	14	**b**	CFU/100mL
Taunton (2001)	Enterococci	9/18/2001	62-0265	2001469-09	5	**b**	CFU/100mL
Taunton (2001)	Chloride	7/23/2001	62-0104	2001295-01	##	**b**	mg/l
Taunton (2001)	Chloride	7/23/2001	62-0105	2001295-02	##	**b**	mg/l
Taunton (2001)	Chloride	7/23/2001	62-0106	2001295-03	##	**b**	mg/l
Taunton (2001)	Chloride	7/23/2001	62-0107	2001295-04	##	**b**	mg/l
Taunton (2001)	Chloride	7/23/2001	62-0108	2001295-05	##	**b**	mg/l

Projname	Analyte	DATE	OWMID	LabSNum	rResVal	DWMQual	Units
Taunton (2001)	Chloride	7/23/2001	62-0109	2001295-06	##	**b**	mg/l
Taunton (2001)	Chloride	7/23/2001	62-0110	2001295-07	##	**b**	mg/l
Taunton (2001)	Chloride	7/23/2001	62-0111	2001295-08	##	**b**	mg/l
Taunton (2001)	Ammonia-N	7/25/2001	62-0143	2001306-40	<0.02	**h**	mg/l
Taunton (2001)	Suspended solids	8/8/2001	62-0199	2001360-01	7.4	**d**	mg/l
Taunton (2001)	Suspended solids	8/8/2001	62-0200	2001360-02	2.7	**d**	mg/l
Taunton (2001)	Suspended solids	9/17/2001	62-0239	2001477-21	<1.0	**d**	mg/l
Taunton (2001)	Suspended solids	9/17/2001	62-0240	2001477-22	1.4	**d**	mg/l
Taunton (2001)	OB-1	9/18/2001	62-0256	2001468-01	<0.22	**m**	ug/l
Taunton (2001)	OB-1	9/18/2001	62-0257	2001468-02	<0.22	**m**	ug/l
Taunton (2001)	OB-1	9/18/2001	62-0261	2001468-03	<0.22	**m**	ug/l
Taunton (2001)	OB-1	9/18/2001	62-0262	2001468-04	<0.22	**m**	ug/l
Taunton (2001)	OB-1	9/18/2001	62-0265	2001468-05	<0.22	**m**	ug/l

APPENDIX 2

2001 DATA SYMBOLS AND QUALIFIERS FOR THE Taunton Watershed 2001 Water Quality Survey

Selected Excerpts from:
Data Validation Report for Year 2001 Project Data (CN 149.0)

December, 2004

Department of Environmental Protection
Division of Watershed Management

The following data qualifiers or symbols are used in the MADEP/DWM WQD database for qualified and censored water quality and Hydrolab® data. Decisions regarding censoring vs. qualification for specific, problematic data are made based on a thorough review of all pertinent information related to the data, including the magnitude or extent of the problem(s).

General Symbols (applicable to all types):

" ## " = Censored data (i.e., data that has been discarded for some reason).

" ** " = Missing data (i.e., data that should have been reported).

" -- " = No data (i.e., data not taken/not required)

" <mdl " = Less than method detection limit (MDL). Denotes a sample result that went undetected using a specific analytical method. The actual, numeric MDL is typically specified (e.g. <0.2).

Multiprobe-Specific Qualifiers:

" i " = inaccurate readings from Hydrolab® multiprobe likely; may be due to significant pre-survey calibration problems, post-survey calibration readings outside typical acceptance range for the low ionic check and for the deionized blank water check, lack of calibration of the depth sensor prior to use, or to checks against laboratory analyses.

Qualification Criteria for Depth (i):

General Depth Criteria: Apply to each OWMID#

- Clearly erroneous readings due to faulty depth sensor: Censor (i)
- Negative and zero depth readings: Censor (i); (likely in error)
- 0.1 m depth readings: Qualify (i); (potentially in error)
- 0.2 and greater depth readings: Accept without qualification; (likely accurate)

Specific Depth Criteria: Apply to entirety of depth data for survey date

- If zero and/or negative depth readings occur more than once per survey date, censor all negative/zero depth data, and qualify all other depth data for that survey (indicates that erroneous depth readings were not recognized in the field and that corrective action (field calibration of the depth sensor) was not taken, i.e. that all positive readings may be in error.)

" m " = method not followed; one or more protocols contained in the DWM Hydrolab® SOP not followed, i.e. operator error (e.g. less than 3 readings per station (rivers) or per depth (lakes), or instrument failure not allowing method to be implemented.

" s " = field sheet recorded data were used to accept data, not data electronically recorded in the Hydrolab® surveyor unit, due to operator error or equipment failure.

" u " = unstable readings, due to lack of sufficient equilibration time prior to final readings, non-representative location, highly-variable water quality conditions, etc. See Section 4.1 for acceptance criteria.

" c " = greater than calibration standard used for pre-calibration, or outside the acceptable range about the calibration standard. Typically used for conductivity (>718, 1,413, 2,760, 6,668 or 12,900 uS/cm) or turbidity (>10, 20 or 40 NTU). It can also be used for TDS and Salinity calculations based on qualified ("c") conductivity data, or that the calculation was not possible due to censored conductivity data (TDS and Salinity are calculated values and entirely based on conductivity reading). See Section 4.1 for acceptance criteria.

" ? " = Light interference on Turbidity sensor (Hydrolab error message). Data is typically censored.

Sample-specific Qualifiers:

" a " = accuracy as estimated at WES Lab via matrix spikes, PT sample recoveries, internal check standards and lab-fortified blanks did not meet project data quality objectives identified for program or in QAPP.

" b " = blank Contamination in lab reagent blanks and/or field blank samples (indicating possible bias high and false positives).

" d " = precision of field duplicates (as RPD) did not meet project data quality objectives identified for program or in QAPP. Batched samples may also be affected.

" e " = not theoretically possible. Specifically, used for bacteria data where colonies per unit volume for e-coli bacteria > fecal coliform bacteria, for lake Secchi and station depth data where a specific Secchi depth is greater than the reported station depth, and for other incongruous or conflicting results.

" f " = frequency of quality control duplicates did not meet data quality objectives identified for program or in QAPP.

" h " = holding time violation (usually indicating possible bias low)

" j " = 'estimated' value; used for lab-related issues where certain lab QC criteria are not met and re-testing is not possible (as identified by the WES lab only). Also used to report sample data where the sample concentration is less than the 'reporting' limit or RDL and greater than the method detection limit or MDL (mdl< x <rdl). Also used to note where values have been reported at levels less than the mdl.

" m " = method SOP not followed (only partially implemented or not implemented at all) due to complications with sample matrix (e.g. sediment in sample, floc formation), lab error (e.g. cross-contamination between samples), additional steps taken by the lab to deal with matrix complications, lost/unanalyzed samples, missing data or deviations from field sampling SOPs.

" p " = samples not preserved per SOP or analytical method requirements.

" r " = samples collected may not be representative of actual field conditions, based on documented or suspected field sampling error, or inexplicable or improbable ("outliers") values.

APPENDIX B
OWM/DWM WATER QUALITY MONITORING DATA TAUNTON RIVER WATERSHED 1996

The Taunton River Watershed water quality monitoring was conducted during the summer and fall of 1996 at seven Nemasket River stations. This monitoring involved the collection of instream grab samples at each station for: physico-chemical analyses (alkalinity, hardness, suspended solids), nutrients (total phosphorus) and bacteria (fecal coliform). Time, temperature, pH, total dissolved solids, specific conductance, turbidity, dissolved oxygen (DO), percent saturation and depth measurements were made *in situ* at each station using a Scout 2 Hydrolab®. Hydrolab® measurements also were taken during early morning hours at each station to document the lowest DO concentrations and saturations.

MATERIALS AND METHODS

Protocols for sampling and sample handling are described in the Basin Program Standard Operating Procedures (DEP, 1990). The Wall Experiment Station (WES), Massachusetts Department of Environmental Protection's (DEP) analytical laboratory, supplied all sample bottles, which were prepared according to the WES Laboratory Quality Assurance Plan and Standard Operating Procedures (DEP, 1995). Both quality control samples (field blanks, trip blanks, and split samples) and raw water quality samples were transported on ice to WES on each sampling date; they were analyzed subsequently according to the WES SOP (DEP, 1995). Quality control data are presented in Table B2, whereas raw water quality data are tabulated in tables B3 and B4.

RESULTS

In situ Hydrolab® data from the 1996 Taunton River Watershed Monitoring surveys are presented in Table B3. Water quality data are presented in Table B4.

Quality Assurance And Quality Control (QA/QC)

In general, monitoring surveys in the Taunton River Watershed in 1996 were performed with attention to maintaining quality assurance and control of field samples and field-generated data. For the majority of water quality surveys, quality control samples (field blanks and sample splits) were taken at a minimum of one each per crew per survey. Typically, field-monitoring activities followed accepted DWM standard operating procedures. Where strict procedures were not in place or necessary, it is assumed that DWM field staff exercised best professional judgment.

All Hydrolab® multi-probe data were validated using multi-staff review. Data symbols (e.g., ** for censored/missing data) were applied to Hydrolab® data as necessary. All turbidity measurements were qualified with an "i" due to the likely potential for systematic inaccuracies in field measurements. In general, all water quality sample data were validated by reviewing QC sample results, analytical holding time compliance, QC sample frequency and related ancillary data/documentation (at a minimum). Data validation for the 1996 surveys is available in a Memorandum - *1994, 95 & 96 QA/QC Assessment Report* (MA DEP 2000). Specific notes pertaining to the Taunton River Watershed were excerpted and appear in Table B2.

Table B1. Sampling Matrix for the 1996 DWM Taunton River Watershed Water Quality Surveys.

Station	June 1996	July 1996	August 1996	September 1996	October 1996
NK01	AMH,W,H,D	AMH,W,H,D	AMH,W,H,D	AMH,W,H,D	W,H,D
NKO1A	AMH,W,H,D	AMH,W,H,D	AMH,W,H	AMH,W,H,D	W,H
NK02	AMH,W,H	AMH,W,H	AMH,W,H	W,H	W,H
NK03	AMH,W,H,D	AMH,W,H,D	AMH,W,H,D	W,H,D	W,H,D
NK03A	AMH,W,H	AMH,W,H	AMH,W,H	W,H	W,H
NK04	AMH,W,H	AMH,W,H	AMH,W,H	W,H	W,H
NK05	AMH,W,H,D	AMH,W,H,D	AMH,W,H,D	W,H,D	W,H,D

AMH = early morning Hydrolab™ sampling (time, temperature, pH, total dissolved solids, specific conductance, turbidity, dissolved oxygen, % saturation), W = water quality samples (physico-chemical analyses, nutrients, bacteria), H = Hydrolab™ sampling (same parameters as AMH) and D = discharge.

Table B2. 1996 DWM data qualifications for the Taunton River Watershed data (excerpted from MA DEP 2000).

OWMID	Qualifier
62-0070-078	Total Phosphorous had been analyzed outside of the established holding time of 28 days. Samples were collected on 10/08/96 and analyzed on 11/07/96.

Table B3. 1996 Taunton River Watershed *in-situ* Hydrolab® data.

OWMID	Date	Time (24hr)	Measurement Depth (m)	Temp (°C)	pH (SU)	Conductivity (µS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)	Turbidity (NTU)
NEMASKET RIVER										
Station: NK01, Mile Point: 10.8, Unique ID: W0313										
Description: Vaughan Street bridge, Middleboro.										
62-0001	06/11/96	03:19	0.6	22.7	6.1	98	62.7	6.4	73	--
62-0008	06/11/96	09:58	0.5	22.6	6.0	99	63.1	6.2	72	--
62-0035	07/09/96	13:46	0.3	25.6	6.3	101	64.5	8.0	99	--
62-0017	07/09/96	03:19	0.2	25.1	6.0	103	65.7	4.3	52	--
62-0036	08/15/96	04:11	**i	23.5	5.6	93	59.5	**	**	15i
62-0043	08/15/96	09:49	**i	22.9	5.9	93	59.7	4.6	52	--
62-0052	09/10/96	03:34	0.2	22.4	5.6	85	54.1	3.7	42	--
62-0059	09/10/96	10:08	0.3	21.9	5.6	87	55.8	3.3	37	--
62-0070	10/08/96	10:19	0.2	14.1	5.9	90	57.4	8.3	80	--
NEMASKET RIVER										
Station: NK01A, Mile Point: 9.5, Unique ID: W0314										
Description: Bridge Street bridge (old bridge), Middleboro.										
62-0002	06/11/96	03:49	0.6	22.0	5.8	106	67.5	<1.0	11	--
62-0009	06/11/96	10:39	0.8	22.1	5.8	106	67.7	1.4	16	--
62-0018	07/09/96	03:41	0.2	24.0	5.9	121	77.7	1.5	18	--
62-0027	07/09/96	09:56	0.3	24.0	5.9	123	78.6	2.2	26	--
62-0037	08/15/96	04:36	0.3	19.5	5.4	110	70.5	1.4	15	22i
62-0045	08/15/96	10:13	**i	19.8	5.6	109	69.7	1.8	19	--
62-0053	09/10/96	03:58	0.5	20.1	5.6	94	60.1	<1.0	2	--
62-0060	09/10/96	10:34	0.4	20.1	5.6	97	62.1	<1.0	2	--
62-0071	10/08/96	10:49	0.4	12.2	5.4	89	57.2	3.8	35	--
NEMASKET RIVER										
Station: NK02, Mile Point: 7.7, Unique ID: W0315										
Description: Wareham Street bridge, Middleboro.										
62-0012	06/11/96	12:15	0.4	22.2	6.0	121	77.6	6.1	70	--
62-0019	07/09/96	04:03	0.7	23.6	6.0	163	104	3.5	41	--
62-0029	07/09/96	10:31	0.6	23.5	5.9	163	104	2.7	32	--
62-0038	08/15/96	05:02	0.7	20.3	5.6	134	86.0	3.1	35	8i
62-0046	08/15/96	10:32	**i	20.8	5.8	135	86.6	3.0	33	--
62-0061	09/10/96	11:06	0.5	20.1	5.7	111	71.1	<1.0	8	--
62-0072	10/08/96	11:16	0.4	12.0	5.5	97	62.1	4.1	37	--
NEMASKET RIVER										
Station: NK02A, Mile Point: 7.69, Unique ID: W0369										
Description: Wareham Street bridge, just below fish ladder, Middleboro.										
62-0003	06/11/96	04:13	0.9	21.7	5.8	116	74.0	<1.0	6	--

** = censored data, -- = no data, i = inaccurate readings from Hydrolab multiprobe likely

Table B3 Continued. 1996 Taunton River Watershed *in-situ* Hydrolab® data.

OWMID	Date	Time (24hr)	Measurement Depth (m)	Temp (°C)	pH (SU)	Conductivity (µS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)	Turbidity (NTU)
NEMASKET RIVER										
Station: NK03A, Mile Point: 7, Unique ID: W0316										
Description: East Main Street bridge, Middleboro.										
62-0004	06/11/96	04:45	0.3	21.5	6.1	**	**	6.7	75	--
62-0010	06/11/96	11:35	0.3	22.1	6.1	117	75.1	7.0	80	--
62-0020	07/09/96	04:23	0.2	23.1	6.4	149	96.0	6.6	78	--
62-0030	07/09/96	11:01	0.2	23.0	6.4	162	104	8.2	96	--
62-0039	08/15/96	05:27	**i	19.9	6.1	**	**	6.9	76	6i
62-0048	08/15/96	10:52	**i	20.7	6.2	137	87.6	8.5	93	--
62-0063	09/10/96	11:24	0.2	20.3	5.9	113	72.3	6.2	69	--
62-0074	10/08/96	12:25	0.2	12.0	5.8	100	64.2	9.0	83	--
NEMASKET RIVER										
Station: NK03, Mile Point: 5.4, Unique ID: W0317										
Description: Route 44 bridge, Middleboro. (Upstream of Middleboro WWTP discharge).										
62-0005	06/11/96	05:04	0.4	21.2	6.1	118	75.7	6.7	75	--
62-0013	06/11/96	13:18	0.4	22.7	6.2	119	76.4	7.4	85	--
62-0021	07/09/96	04:45	0.2	23.4	6.4	151	96.0	5.8	69	--
62-0031	07/09/96	11:30	0.3	23.1	6.4	159	102	7.3	86	--
62-0040	08/15/96	05:46	**i	19.3	6.1	136	87.2	6.8	74	4i
62-0047	08/15/96	11:10	0.1i	20.2	6.2	136	87.2	7.5	82	--
62-0062	09/10/96	11:42	0.4	20.2	5.9	111	71.1	6.3	69	--
62-0073	10/08/96	11:58	0.2	12.1	5.7	99	63.0	8.4	78	--
NEMASKET RIVER										
Station: NK04, Mile Point: 3.7, Unique ID: W0318										
Description: Plymouth Street bridge, Middleboro. (Downstream of Middleboro WWTP discharge).										
62-0006	06/11/96	05:28	0.5	21.0	6.2	141	90.3	4.9	54	--
62-0014	06/11/96	13:45	0.4	22.4	6.2	147	94.0	5.9	67	--
62-0022	07/09/96	05:09	0.2	22.9	6.5	233	149	4.0	46	--
62-0032	07/09/96	12:07	0.3	23.5	6.5	222	142	4.9	58	--
62-0041	08/15/96	06:10	**i	20.0	6.3	179	115	5.6	61	9i
62-0049	08/15/96	11:32	**i	20.3	6.4	171	109	6.0	65	--
62-0064	09/10/96	12:00	0.2	20.3	6.1	136	86.8	4.4	49	--
62-0075	10/08/96	12:55	0.2	11.8	5.9	119	76.3	7.6	70	--
NEMASKET RIVER										
Station: NK05, Mile Point: 2.5, Unique ID: W0319										
Description: Murdock Street bridge, Middleboro.										
62-0007	06/11/96	05:44	0.8	21.0	6.2	143	91.6	4.4	49	--
62-0015	06/11/96	14:04	0.5	22.5	6.2	139	88.9	5.9	67	--
62-0023	07/09/96	05:23	0.4	23.2	6.4	218	139	3.8	45	--
62-0033	07/09/96	12:30	0.5	23.5	6.5	222	142	4.7	56	--
62-0042	08/15/96	06:28	0.2	20.2	6.3	181	116	5.1	56	9i
62-0050	08/15/96	11:49	**i	20.9	6.5	177	113	5.8	64	--
62-0065	09/10/96	12:15	0.3	20.4	6.1	130	83.0	4.2	47	--
62-0077	10/08/96	13:28	0.2	11.8	5.9	117	75.2	7.7	71	--
FALL BROOK										
Station: FB01, Mile Point: 0.4, Unique ID: W0320										
Description: Wood Street bridge, Middleboro.										
62-0058	09/10/96	04:23	0.4	19.4	5.6	79	50.3	<1.0	3	--

** = censored data, -- = no data, i = inaccurate readings from Hydrolab multiprobe likely

Table B3 Continued. 1996 Taunton River Watershed *in-situ* Hydrolab® data.

OWMID	Date	Time (24hr)	Measurement Depth (m)	Temp (°C)	pH (SU)	Conductivity (µS/cm)	TDS (mg/L)	DO (mg/L)	Saturation (%)	Turbidity (NTU)
WADING RIVER										
Station: NB06WAD, Mile Point: 0.8, Unique ID: W0310										
Description: approximately 300 meters northeast (downstream) of Route 140, Norton.										
BC-0036	10/07/96	17:23	0.1i	11.8	6.8	246	157	9.9	91	4.4i
RUMFORD RIVER										
Station: NB16RUM, Mile Point: 1.8, Unique ID: W0311										
Description: approximately 25 meters southwest (downstream) of Pine Street, Norton.										
BC-0032	10/07/96	08:31	0.2	10.4	6.6	279	179	9.1	80	11i
FORGE RIVER										
Station: NB05FOR, Mile Point: 1, Unique_ID: W0312										
Description: approximately 75 meters south (downstream) of South Main Street (Route 104), Raynham.										
BC-0035	10/07/96	14:26	0.1i	11.8	6.3	288	184	9.2	84	10i

** = censored data, -- = no data, i = inaccurate readings from Hydrolab multiprobe likely

Table B4. 1996 Taunton River Watershed Water Quality and Bacteria Data.

OWMID	QA/QC	Date	Time (24hr)	Alkalinity	Hardness	Specific Conductivity (µS/cm)	Suspended Solids	Total Phosphorus	Fecal Coliform Bacteria (colonies/100mL)
NEMASKET RIVER									
Station: NK01		Description: Middleboro. Off the upstream side of the Vaughan Street bridge.							
62-0008		06/11/96	09:55	--	--	--	4.5	0.03	<20
62-0026		07/09/96	09:17	7.0	18	--	<2.5	0.02	60
62-0043	62-0044	08/15/96	09:45	--	13	--	<2.5	0.02	20
62-0044	62-0043	08/15/96	09:45	--	14	--	<2.5	0.02	60
62-0059		09/10/96	09:50	6.0	15	87	<2.5	0.03	60
62-0070		10/08/96	10:17	5.0	8.8	--	<2.5	**	40
NEMASKET RIVER									
Station: NK01A		Description: Middleboro. Off the upstream side of the Bridge Street bridge (old bridge).							
62-0009		06/11/96	10:39	--	--	--	<2.5	0.04	40
62-0027		07/09/96	09:55	13	22	--	<2.5	0.05	20
62-0045		08/15/96	10:10	--	14	--	<2.5	0.03	40
62-0060		09/10/96	10:30	10	20	94	7.0	0.07	100
62-0071		10/08/96	10:47	10	13	--	<2.5	**	20
NEMASKET RIVER									
Station: NK02		Description: Middleboro. Off the upstream side of Wareham Street bridge.							
62-0012		06/11/96	12:15	--	--	--	5.5	0.06	340
62-0028	62-0029	07/09/96	10:31	13	27	--	<2.5	0.04	180
62-0029	62-0028	07/09/96	10:31	13	28	--	<2.5	0.04	140
62-0046		08/15/96	10:30	--	18	--	<2.5	0.03	260
62-0061		09/10/96	10:50	11	20	110	9.0	0.07	120
62-0072		10/08/96	11:14	5.0	13	--	<2.5	**	<20
NEMASKET RIVER									
Station: NK03A		Description: Middleboro. Off the upstream side of East Main Street bridge.							
62-0010	62-0011	06/11/96	11:35	--	--	--	4.5	0.06	140
62-0011	62-0010	06/11/96	11:35	--	--	--	3.0	0.05	200
62-0030		07/09/96	11:01	13	28	--	<2.5	0.04	200
62-0048		08/15/96	10:50	--	20	--	<2.5	0.03	100
62-0063		09/10/96	11:20	11	21	109	7.5	0.06	140
62-0074		10/08/96	12:23	6.0	10	--	<2.5	**	40

** = missing/censored data -- = no data

Table B4 (cont). 1996 Taunton River Watershed Water Quality and Bacteria Data.

OWMID	QA/QC	Date	Time (24hr)	Alkalinity	Hardness	Specific Conductivity (µS/cm)	Suspended Solids	Total Phosphorus	Fecal Coliform Bacteria (colonies/100mL)
NEMASKET RIVER									
Station: NK03 Description: Middleboro. Off the upstream side of Route 44 bridge. This is upstream of the wastewater treatment plant.									
62-0013		06/11/96	13:18	--	--	--	<2.5	0.05	100
62-0031		07/09/96	11:30	14	33	--	<2.5	0.04	<20
62-0047		08/15/96	11:08	--	21	--	<2.5	0.03	120
62-0062		09/10/96	11:40	10	21	109	4.5	0.06	340
62-0073		10/08/96	11:58	5.0	6.3	--	<2.5	**	<20
NEMASKET RIVER									
Station: NK04 Description: Middleboro. Off the upstream side of Plymouth Street bridge. This is downstream of the was tewater treatment plant.									
62-0014		06/11/96	13:45	--	--	--	<2.5	0.11	320
62-0032		07/09/96	12:06	29	62	--	<2.5	0.10	20
62-0049		08/15/96	11:30	--	27	--	<2.5	0.06	120
62-0064		09/10/96	11:55	15	28	133	4.0	0.08	120
62-0075	62-0076	10/08/96	12:53	10	8.0	--	<2.5	**	<20
62-0076	62-0075	10/08/96	12:53	9.0	18	--	<2.5	**	20
NEMASKET RIVER									
Station: NK05 Description: Middleboro. Off the upstream side of Murdock Street bridge.									
62-0015		06/11/96	14:04	--	--	--	<2.5	0.10	280
62-0033		07/09/96	12:30	29	64	--	<2.5	0.10	<20
62-0050		08/15/96	11:47	--	30	--	<2.5	0.06	120
62-0065	62-0066	09/10/96	12:10	15	28	128	5.0	0.09	140
62-0066	62-0065	09/10/96	12:10	15	26	128	5.0	0.09	140
62-0077		10/08/96	13:27	10	18	--	<2.5	**	60

** = missing/censored data -- = no data

REFERENCES

MA DEP 1990. *Basins Program Standard Operating Procedures River and Stream Monitoring. Massachusetts Department of Environmental Protection, Division of Water Pollution Control, Technical Services Branch. Westborough, MA.*

MA DEP. 1995 January Draft. *Laboratory Quality Assurance Plan and Standard Operating Procedures.* Massachusetts Department of Environmental Protection, Division of Environmental Analysis. Wall Experiment Station, Lawrence, MA.

MA DEP. 2000. Memorandum to Rick McVoy, Laurie Kennedy, Tom Dallaire, Arthur Johson and Mollie Weinstein from Mark Guilmain dated February 2000. *1994, 95 & 96 QA/QC Assessment Report.* CN 36.0. Division of Watershed Management Department of Environmental Protection. Worcester, MA

APPENDIX C
DWM 1996 AND 2001 LAKE SURVEY DATA IN THE TAUNTON RIVER WATERSHED

1996

In the Taunton River Watershed, DWM conducted synoptic surveys at 88 lakes during the 1996 field season. Observations from at least one access point on each lake (multiple access points on larger lakes) were recorded on standardized field sheets. An attempt was made to observe the entire surface area of each lake to determine the extent of aerial macrophyte cover. At each sampling location general water quality conditions, identification and abundance of aquatic and wetland macrophyte plant species, and estimates of total percent aerial coverage were recorded. Macrophyte visual observations were augmented at each station by identifying plant specimens collected from the lake bottom. Specimens were retrieved using a "rake" (a short handled, double-sided garden rake on a 50 foot line) thrown to its maximum extension in multiple directions at each station. Macrophytes collected in the "rake" were identified (*in-situ* or in the laboratory) and recorded on the field sheets. Transparency was measured where possible using a standard 20-centimeter diameter Secchi disk. Where Secchi disk measurements were not feasible, transparency was estimated as being above or below 1.2 meter (the MDPH bathing beach guideline). Trophic status was estimated primarily using visual observations of macrophyte cover and phytoplankton populations. A more definitive assessment of trophic status would require more extensive collection of water quality and biological data.

Table C1. 1996 Taunton River Watershed lake observations and trophic status estimates.

Lake Name (local name), Location	Waterbody Identification Code (WBID)	Trophic Status Estimate	Survey Observations (Objectionable Conditions)
Ames Long Pond	MA62001	E	Slight stain; moderate turbidity (S.D. 0.9 m in south basin at culvert); brown mucky bottom with organic debris; 100% very dense cover of floating leaf and submergent plants in north basin, very dense cover of floating leaf and submergent plants in upper end of south basin; observed non-native aquatic and wetland species (Mh, Cc, Ls)
Assawompset Pond*	MA62003	M	Slight turbidity; organic debris and rocks, stones and gravel on bottom; some green periphyton on rocks; band of emergents along east, north and south shore, but overall lake coverage is sparse; non-native wetland species (Ls)
Beaumont Pond	MA62009	U	No water quality observations; 15-20 ft. perimeter of dense to very dense floating plants around the entire pond; non-native wetland species (Ls)
Big Bearhole Pond	MA62011	M	Slight tea stain; moderate turbidity; algae on rocks; bottom of fine brown silt and organic matter; southern perimeter almost entirely banded by very dense floating leaf plants, but less frequent along north shore; non-native aquatic species (Ms, Cc)
Briggs Pond	MA62021	U	No water quality observations; sparse surface plant cover throughout pond
Broad Cove	MA62022	U	No stain; slight to moderate green/brown turbidity; slight silt on rocky/gravelly bottom; brackish or salt pond; sparse surface aquatic plant cover throughout pond; non-native wetland species (Pa)
Brockton Reservoir (Salisbury Brook Reservoir)*	MA62023	U	Slight tea stain; moderate turbidity (>4 ft. SD est.); moderate algal bloom; dense floating leaf plant patches along west and north shore and around islands (<10% of total surface); non-native aquatic and wetland species (Ls, Cc)

*Indicates Class A (water supply) Waterbody; all others are class B. **WBID –** Waterbody identification code.
Trophic State: E= Eutrophic, **M=** Mesotrophic, **U=** Undetermined.
Non-native Plants: Cc= *Cabomba caroliniana*, **Ls=** *Lythrum salicaria*, **Mh=** *Myriophyllum heterophyllum*, **Pa=** *Phragmites australis*.
Note: M.sp. Possible *Myriophyllum heterophyllum* requires further confirmation when flowering heads are evident.

Table C1 Continued. 1996 Taunton River Watershed lake observations and trophic status estimates.

Lake Name (local name), Location	Waterbody Identification Code (WBID)	Trophic Status Estimate	Survey Observations (Objectionable Conditions)
Carpenter Pond (Lakeview Pond)	MA62032	E	Tea stain; slight turbidity; silty and organic matter on bottom; about 1/3 of south east arm covered with very dense floating leaf and emergent plants; almost 100% of main basin covered with very dense floating leaf and emergent plants; non-native wetland species (Ls)
Carver Pond	MA62033	E	Tea stain; slight turbidity; much debris on bottom; oily, powdery scum on surface at north end; about 75% of lake covered with very dense floating leaf and submergent plants; non-native aquatic species (Mh)
Chaffin Reservoir*	MA62035	E	Slight turbidity; oily sheen on surface in northeast cove; brown silty muck and partially decomposed debris on bottom; 100% covered with floating leaf and submergent plants, considerable encroaching vegetation
Chartley Pond	MA62038	E	Dark tea stain (0.4 m SD at outlet); undecomposed organic matter on bottom; overall 50% very dense cover of duckweed; non-native wetland species (Ls)
Cleveland Pond	MA62042	E	Tea stained water; slight brown silt over rocks and gravel, silty organic bottom further from shore; very dense floating and submerged vegetation around perimeter (about 10% of area affected); non-native aquatic and wetland species (Cc, Ls , Mh)
Cocasset Lake	MA62043	U	Tea stained water; moderate turbidity (1.1 m SD at outlet); undecomposed matter on bottom; sparse vegetation over entire lake; non-native wetland species (Ls)
Cooper Pond	MA62046	U	No water quality observations; several large patches of floating vegetation in center and around shore shoreline (about 10% of area affected)
Crocker Pond	MA62051	E	Tea stain; green (duckweed) scum on much of near shore surface; muck and debris on bottom; dense to very dense floating leaf plants (mostly duckweed) around perimeter; encroaching plants around entire pond, northern 2/3 of pond filled in; non-native wetland and aquatic species (Ls, Pa)
Cross St Pond	MA62053	U	Dark tea stained water (SD< 1.2 m, est.); brown mucky bottom with much debris; oily scum on surface on north side; sparse encroaching vegetation around most of pond
Cushing Pond	MA62056	U	Dark tea stain (~0.3 m SD at outlet); slight turbidity; some undecomposed matter on gravel and rock bottom; very dense submergent plant cover in cove near outlet, west shore and north east shore (about 10% of area affected); non-native aquatic and wetland species (Cc, Ls)
East Freetown Pond	MA62063	U	Slight tea stain; slight turbidity; undecomposed organic matter above sandy bottom; very dense floating leaf plants around most of perimeter, south and east shore coves very densely covered; non-native aquatic species (Mh)
Ellis-Brett Pond	MA62224	U	Pond is completely filled in with wetland plants, shrubs, and trees; non-native wetland species (Ls)

*Indicates Class A (water supply) Waterbody; all others are class B. **WBID –** Waterbody identification code.
Trophic State: E= Eutrophic, **M=** Mesotrophic, **U=** Undetermined.
Non-native Plants: Cc= *Cabomba caroliniana*, **Ls=** *Lythrum salicaria*, **Mh=** *Myriophyllum heterophyllum*, **Pa=** *Phragmites australis*.
Note: M.sp. Possible *Myriophyllum heterophyllum* requires further confirmation when flowering heads are evident.

Table C1 Continued. 1996 Taunton River Watershed lake observations and trophic status estimates.

Lake Name (local name), Location	Waterbody Identification Code (WBID)	Trophic Status Estimate	Survey Observations (Objectionable Conditions)
Elm Street Pond (#5)	MA62066	E	No open water; 100% covered with floating leaf plants
Forge Pond	MA62072	U	Dark tea stain; slight turbidity; bottom covered with organic matter; very dense patches of floating leaf and emergent plants in cove areas along southeastern and southwestern shores (about 20% of area affected)
Fuller Street Pond	MA62234	E	Little open water visible; waterbody is shallow with stumps; encroaching vegetation; transitioning to a marsh; non-native aquatic species (Mh)
Furnace Lake	MA62076	U	Tea stained water; powdery brown scum on surface (west shore); slight turbidity; partially decomposed organic matter on bottom; patches of very dense floating leaf plants moderately spaced throughout pond (about 25% of area affected)
Gavins Pond	MA62077	E	Tea stained water; slight turbidity; much organic matter on bottom; about 75% of pond with very dense cover of submergent plants; non-native aquatic and wetland species (Mh, Ls)
Gravel Pit Pond	MA62080	U	No water observed; pond has been converted to a cranberry bog
Great Quitticus Pond*	MA62083	U	Slight turbidity; bottom variable from gravel and rock to organic matter and vegetation; occasional patches of floating leaf and emergent plants around shoreline
Gushee Pond	MA62084	U	Tea stained water; bog encroachment on west shore, floating leaf plants around entire perimeter, north end more dense (about 25% of area affected); non-native aquatic species (Mh, Cc)
Hewitt Pond	MA62088	E	Dark tea stain (<1.2 m SD est.); upper end filled in with marsh plants, floating leaf plants very dense on east and west shores (about 25 % of area affected)
Hobart Pond	MA62090	E	Slight tea stain; brown/green turbidity (likely < 1.2 m SD, est.); brown/green silt and debris on sandy/gravelly bottom; abundant green periphyton; very dense floating leaf and submergent plants along northeast shore; non-native wetland and aquatic species (Ls, Mh)
Island Grove Pond	MA62094	E	Very turbid (1.0 m SD at outlet); blue-green bloom; moderate inorganic debris over sandy bottom; 100% open water, few emergent beds along north shore, sparse submerged elsewhere; non-native aquatic and wetland species (Cc, Ls)
Johns Pond	MA62096	U	Very clean; orange, brown, and white foam on windward shore; some debris on beach; sparse vegetation, a few floating leaf and emergent plant patches widely spaced around pond
Johnson Pond	MA62097	U	Dark tea stain; moderate turbidity (0.2 m SD at boat ramp);slight brown silt over sand and gravel bottom; small patches of floating leaf plants at north end and occasionally along west shore; non-native aquatic and wetland species (Cc, Ls)
Kings Pond	MA62101	U	Dark tea stain (likely < 1.2 m SD, est); slight turbidity; bottom mainly undecomposed oak leaves; sparse vegetation; non-native wetland species (Ls)

*Indicates Class A (water supply) Waterbody; all others are class B. **WBID –** Waterbody identification code.
Trophic State: E= Eutrophic, **M=** Mesotrophic, **U=** Undetermined.
Non-native Plants: Cc= *Cabomba caroliniana*, **Ls=** *Lythrum salicaria*, **Mh=** *Myriophyllum heterophyllum*, **Pa=** *Phragmites australis*.
Note: M.sp. Possible *Myriophyllum heterophyllum* requires further confirmation when flowering heads are evident.

Table C1 Continued. 1996 Taunton River Watershed lake observations and trophic status estimates.

Lake Name (local name), Location	Waterbody Identification Code (WBID)	Trophic Status Estimate	Survey Observations (Objectionable Conditions)
Leach Pond	MA62103	E	Slight tea stain; slight turbidity; brown silty bottom with organic debris; 100% covered with very dense floating leaf and submergent plants
Little Cedar Swamp Pond	MA62106	E	No open water; 100% marsh and floating leaf plants
Little Quitticus Pond*	MA62107	U	Slight turbidity; silty brown covering on rocks and bottom; water level slightly low; orange stain on rocks along east shore; floating leaf plants dense to very dense in patches along north, south and southwest shores; non-native wetland species (Pa)
Long Pond*	MA62108	U	Good water clarity; slight silt covering on beach sand and bottom; moderate to very dense floating leaf and emergent plants in several coves; non-native aquatic and wetland species observed and reported (Cc, Ls, Mh)
Longwater Pond	MA62109	U	Moderate tea stain; brown turbidity (1.2+ m SD at outlet); mucky bottom; very dense floating leaf and submergent plants at outlet and in occasional patches around lake (overall <10% of area affected); non-native wetland and aquatic species (Ls, Mh)
Lower Porter Pond	MA62111	U	Slight tea stain; slight turbidity; bottom brown silt and vegetation with patchy green algal mats; about 5% of the area covered with aquatic plants; non-native aquatic species (Cc, M.sp)
Meadow Brook Pond	MA62113	E	Dark tea stain (0.4 m SD at outlet); some organic matter on bottom; very dense floating leaf and emergent plants over about 75% of pond; non-native wetland species (Ls)
Middle Pond	MA62115	U	Moderate to high turbidity; organic material on bottom; about a third of the pond area covered by dense aquatic plants; non-native aquatic and wetland species (Cc, Ls, Ms)
Mirimichi Lake	MA62118	E	Tea stain; turbid in places; green (duckweed) and brown foamy scum in places; organic debris on bottom; 100% of pond covered by very dense floating and submerged plants; non-native aquatic and wetland species (Cc, Ls)
Monponsett Pond (East Basin)*	MA62218	U	Slight tea stain; slight turbidity; rocky/sandy bottom with little organic debris; occasional stands of emergents along non-developed shorelines; non-native aquatic species (Cc)
Monponsett Pond (West Basin)*	MA62119	U	Slight tea stain; turbid (<1.2 m SD, est.); fine brown silt on rocky gravelly bottom; occasional strands of emergents along non-developed shorelines; non-native aquatic species (Cc)
Mount Hope Mill Pond	MA62122	E	Slight tea stain; slight turbidity (> 1.2 m SD, est.); very dense cover of duckweed over 75% of upper end, about 25 % of lower end covered; non-native aquatic species (Cc)
Muddy Cove Brook Pond	MA62124	E	Very poor water quality; bluegreen bloom of paint-like, multicolored (green, gray green, light bluegreen) scum; sparse cover of plants; non-native wetland species (Ls)
Muddy Pond	MA62125	E	Tea stain; slight turbidity; organic matter on bottom; very dense floating and submerged plants cover about 60% of the pond; islands of wetland plants enlarging; non-native aquatic species (Cc)

*Indicates Class A (water supply) Waterbody; all others are class B. **WBID –** Waterbody identification code.
Trophic State: E= Eutrophic, **M=** Mesotrophic, **U=** Undetermined.
Non-native Plants: Cc= *Cabomba caroliniana*, **Ls=** *Lythrum salicaria*, **Mh=** *Myriophyllum heterophyllum*, **Pa=** *Phragmites australis*.
Note: M.sp. Possible *Myriophyllum heterophyllum* requires further confirmation when flowering heads are evident.

Table C1 Continued. 1996 Taunton River Watershed lake observations and trophic status estimates.

Lake Name (local name), Location	Waterbody Identification Code (WBID)	Trophic Status Estimate	Survey Observations (Objectionable Conditions)
Muddy Pond	MA62126	U	Water not observable; sparse plant cover, one patch of floating plants and emergent plants encroaching on northwest shore
Muddy Pond, Kingston	MA62233	E	Water clear; lots of filamentous green algae; bottom comprised of cobble/boulder; approximately half of pond covered with floating macrophytes.
Mullein Hill Chapel Pond	MA62127	U	Slight tea stain; little turbidity; much organic debris on bottom; water level low; 25% of area affected by very dense encroaching vegetation around most of pond; small islands forming
New Pond	MA62130	U	Slight tea stain; moderate brown turbidity (>1.2 m SD, est.); bottom vegetated; about a third of the pond affected by very dense submerged vegetation to surface, remaining very dense below surface; non-native aquatic and wetland species (Cc, Ls)
Nippenicket Lake	MA62131	U	Moderate tea stain; slight to moderate turbidity; emergent and floating leaf plants around most of pond perimeter; non-native aquatic and wetland species (Cc, Ls)
North Center Street Pond	MA62132	U	Tea stain; slight turbidity; heavy muck and organic debris bottom; very dense floating leaf and emergent plants around south, east, and northeast shores (about 25 % of area affected); possible non-native aquatic species (M.sp)
Norton Reservoir	MA62134	E	Dark tea stain; very turbid (0.4 m SD); bluegreen bloom in progress; north and south coves with dense to very dense floating and submerged plants, other areas moderately covered; non-native aquatic and wetland species (Cc, Ls, Mh)
Plymouth Street Pond	MA62141	E	No water visible; pond drained, only isolated pools remaining; completely filled except northernmost portion, which is covered with very dense floating leaf plants
Pocksha Pond*	MA62145	U	Slight turbidity; slight brown silt on rocks; sparse plant cover with occasional emergent beds around the south end of the pond and through the narrows; non-native wetland species (Ls)
Poquoy Pond	MA62147	E	Dark tea stain; about two thirds of the area covered by very dense plants, stumps visible
Prospect Hill Pond	MA62149	E	Sight turbidity; oily sheen on surface; organic matter on bottom; about 80% affected by very dense plant cover; encroaching plants all around; non-native wetland species (Ls)
Puds Pond	MA62151	U	No stain; slight green turbidity (2.1+ m SD); moderate plant cover, most of surface open
Reservoir	MA62158	E	Moderate tea stain; brown turbidity (>1.2 m SD, est.); bluegreen bloom; mucky bottom; 100% covered by floating leaf, emergent, submergent plants; non-native wetland species (Ls)
Reservoir*	MA62157	E	Little open water; 100% covered with very dense floating leaf and emergent plants
Richmond Pond	MA62159	E	Little open water; 100% floating leaf and submergent plants; non-native aquatic species (Cc)
Rico Lake (Precinct Street Pond/Furnace Pond)	MA62148	U	Low water level; marshy with many stumps; non-native aquatic and wetland species (Cc, Ls, Ms)

*Indicates Class A (water supply) Waterbody; all others are class B. **WBID –** Waterbody identification code.
Trophic State: E= Eutrophic, **M=** Mesotrophic, **U=** Undetermined.
Non-native Plants: Cc= *Cabomba caroliniana*, **Ls=** *Lythrum salicaria*, **Mh=** *Myriophyllum heterophyllum*, **Pa=** *Phragmites australis*.
Note: M.sp. Possible *Myriophyllum heterophyllum* requires further confirmation when flowering heads are evident.

Table C1 Continued. 1996 Taunton River Watershed lake observations and trophic status estimates.

Lake Name (local name), Location	Waterbody Identification Code (WBID)	Trophic Status Estimate	Survey Observations (Objectionable Conditions)
Robbins Pond	MA62162	U	Slight tea stain; slight turbidity; dark staining on stony gravelly bottom; occasional beds of emergent and floating leaf plants around pond; possible non-native aquatic species (M.sp)
Route One Pond (West)	MA62165	U	Dark tea stain; slight turbidity; dense floating leaf plants along south shore, patchy elsewhere (about 25% of the surface affected)
Sabbatia Lake	MA62166	U	Moderate tea stain; slight turbidity; brown silt on sand/gravel/rock bottom; about 25% of the surface affected by very dense floating leaf and submergent plants; non-native aquatic and wetland species (Cc, Ls, M.sp)
Savery Pond (Waterville Pond)	MA62167	U	Tea stain; turbid; oily sheen on windward shore; 100% open water with few patches floating leaf plants at southwest end; non-native aquatic species (Cc)
Segreganset River Ponds	MA62169	E	Dark tea stain (0.3 m SD at causeway); slight turbidity; both basins almost 100% covered with floating leaf and emergent plants; non-native wetland species (Pa)
Shovelshop Pond	MA62174	U	Little stain; slight turbidity; slight brown silt over gravel bottom; ~10ft band of floating leaf plants around entire shore; non-native wetland and aquatic species (Ls, Mh)
Somerset Reservoir*	MA62172	U	No stain; slight to moderate turbidity; light brown silt over rock and gravel bottom; water level low; sparse plant cover throughout; non-native wetland species (Ls, Pa)
Stetson Pond*	MA62182	U	Slight turbidity; orange stain on bottom, some organic matter and silt over sand and gravel; overall sparse plant cover, dense stands of emergents along southwest shore
Sunset Lake	MA62184	U	Dark tea stain; slight turbidity; undecomposed organic matter on bottom; dense submergent plants in cove areas and southeast end, most of pond open
Sweets Pond	MA62185	E	Slight tea stain; greenish turbidity (SD clearly visible on bottom (1.1+ m); muck and vegetation on bottom; 100% of pond covered with very dense floating leaf or submergent plants; non-native aquatic and wetland species (Mh, Ls)
The Reservoir*	MA62189	U	Slight turbidity; much undecomposed debris and silt on bottom; occasional stands of dense emergent plants around perimeter, frequent patches of submergent plants throughout
Thirty Acre Pond	MA62190	E	Slight tea stain; slight turbidity; green algal masses common; dark silt and organic matter over sand/gravel bottom; about 75% of pond covered with floating leaf and submergent plants; non-native aquatic and wetland species (Cc, M.sp, Pa)
Thurston Street Pond	MA62192	E	No water visible; 100% covered with floating leaf plants

*Indicates Class A (water supply) Waterbody; all others are class B. **WBID –** Waterbody identification code.
Trophic State: E= Eutrophic, **M=** Mesotrophic, **U=** Undetermined.
Non-native Plants: Cc= *Cabomba caroliniana*, **Ls=** *Lythrum salicaria*, **Mh=** *Myriophyllum heterophyllum*, **Pa=** *Phragmites australis*.
Note: M.sp. Possible *Myriophyllum heterophyllum* requires further confirmation when flowering heads are evident.

Table C1 Continued. 1996 Taunton River Watershed lake observations and trophic status estimates.

Lake Name (local name), Location	Waterbody Identification Code (WBID)	Trophic Status Estimate	Survey Observations (Objectionable Conditions)
Turnpike Lake	MA62198	E	Tea stain; moderate turbidity; brown silt and organic matter over gravel bottom; 100% floating leaf and submergent plants over the entire pond; non-native aquatic and wetland species (Cc, Mh, Ls)
Upper Leach Pond (Mountain Street Pond)	MA 62123	E	No stain; very slight turbidity; slight brown silt and undecomposed matter over gravel/stone bottom; upper end of pond filling in, small islands forming, about two thirds of pond (lower end) with moderate cover of floating leaf plants; non-native wetland species (Ls)
Upper Porter Pond	MA62200	E	Slight tea stain; slight turbidity (>1.2 m SD, est.); slight brown silt over sand and organic debris bottom; 100% covered with floating leaf and submergent plants; non-native aquatic and wetland species (Cc, Ls, M.sp)
Vandys Pond (McAvoy Pond)	MA62112	E	Dark tea stain; slight turbidity; oily sheen on surface at south end; organic debris on bottom; very dense submergent plants over 50% of pond; non-native aquatic species (Mh)
Waldo Lake	MA62201	U	Slight tea stain; slight turbidity (>1.2 m SD, est.); brown silt and debris over gravel bottom; few very dense patches of floating leaf plants, but sparse cover overall; non-native aquatic and wetland species (Cc, Ls, M.sp)
Wards Pond	MA62203	E	Moderate stain; moderate turbidity; little open water; almost 100% emergent and floating leaf plants; non-native wetland species (Ls)
Watson Pond	MA62205	U	No water observations made; about 20% of surface covered by very dense floating leaf or submergent plants; non-native aquatic and wetland species (Cc. Ls)
West Meadow Pond	MA62208	E	Moderate tea stain; slight turbidity; silty brown muck and organic debris on bottom; floating leaf plants very dense around perimeter (100-150 ft out) and remaining surface 100% covered with submergent plants; non-native wetland and aquatic species (Ls, Mh)
Whiteville Pond	MA62214	E	Little open water observable; 100% dense and very dense floating leaf and emergent plants
Whittenton Impoundment	MA62228	E	Moderate tea stain; sand/gravel/organic matter on bottom; 80-90% very dense floating leaf and submergent plants covering pond; non-native aquatic and wetland species (Cc, Ls, M.sp)
Winnecunnet Pond	MA62213	U	Oily scum, much debris, and little water visible on windward shore; very dense submergent plants on northeast, northwest and east shores (about 20% of pond affected); non-native aquatic and wetland species (Cc, Ls, M.sp)
Wolomolopoag Pond	MA62216	U	No water quality observations; sparse to moderate aquatic plant cover
Woods Pond	MA62220	E	No stain; bluegreen algal bloom (<1.2 m SD, est.); very dense floating leaf and encroaching emergents along west and south shore; occasional emergent plant beds along north shore; non-native aquatic species (Cc)

*Indicates Class A (water supply) Waterbody; all others are class B. **WBID –** Waterbody identification code.
Trophic State: E= Eutrophic, **M=** Mesotrophic, **U=** Undetermined.
Non-native Plants: Cc= *Cabomba caroliniana*, **Ls=** *Lythrum salicaria*, **Mh=** *Myriophyllum heterophyllum*, **Pa=** *Phragmites australis*.
Note: M.sp. Possible *Myriophyllum heterophyllum* requires further confirmation when flowering heads are evident.

2001

In the Taunton River Watershed, baseline lake surveys were conducted in July, August, and September 2001 to coincide with maximum growth of aquatic vegetation, highest recreational use, and highest lake productivity. Ames Long Pond (sampled by MDFW), West Meadow Pond (sampled by MDFW), Watson Pond, Lake Sabbatia, and Monponsett ponds were sampled three times each (generally at monthly intervals). A technical memorandum by Dr. Mark Mattson entitled *Baseline Lakes 2001 Technical Memo* provides details of sample collection methods, results, data, and weed maps for the lakes surveyed in the Farmington, Westfield, Concord, Taunton and South Coastal watersheds in 2001 (Mattson and Haque 2004). A subset of lakes from the Taunton and South Coastal watersheds were examined for impacts related to commercial cranberry operations. Additional samples were taken from the major inlets to these lakes, with notes on presence or absence of cranberry operations upstream from those tributaries. Data from these inlets and tributaries are presented in Table C3.

In situ measurements using the Hydrolab® (measures dissolved oxygen, water temperature, pH, conductivity, and depth and calculates total dissolved solids and % oxygen saturation) were recorded. At deep hole stations measurements were recorded at various depths creating profiles. In-lake samples were also collected and analyzed for alkalinity, total phosphorus, apparent color, and chlorophyll *a* (an integrated sample). Procedures used for water sampling and sample handling are described in the *Grab Collection Techniques for DWM Water Quality Sampling Standard Operating Procedure* and the *Hydrolab® Series 3 Multiprobe Standard Operating Procedure* (MA DEP 1999a and MA DEP 1999b). The Wall Experiment Station (WES), the Department's analytical laboratory, supplied all sample bottles and field preservatives, which were prepared according to the WES *Laboratory Quality Assurance Plan and Standard Operating Procedures* (MA DEP 1995). Samples were preserved in the field as necessary, transported on ice to WES, and analyzed according to the WES Standard Operating Procedure (SOP). Both quality control samples (field blanks, trip blanks, and split samples) and raw water quality samples were transported on ice to WES on each sampling date. They were subsequently analyzed according to the WES SOP. Information about data quality objectives (accuracy, precision, detection limits, holding times, representativeness and comparability) is available in the 2001 Data Validation Report (MA DEP 2004). Apparent color and chlorophyll *a* were measured according to standard procedures at the MA DEP DWM office in Worcester (MA DEP 1999c and MA DEP 1999d). An aquatic macrophyte survey was conducted at each lake. The aquatic plant cover (native and non-native) and species distribution was mapped and recorded. Details on procedures used can be found in the *TMDL Baseline Lakes Survey 2001* (MA DEP 2001). Data were excerpted from the *Baseline Lake Survey 2001 Technical Memo* and presented in tables C2 and C3.

Table C2. 2001 MassDEP DWM Taunton River Watershed Baseline Lakes *in-situ* Hydrolab® data.

Ames Long Pond (Palis: 62001) Unique ID: W0940 Station: A

Description: Deep hole, southern end of southern basin of pond, Easton

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Cond@ 25C (uS/cm)	TDS (mg/l)	SAL (ppt)	DO (mg/l)	SAT (%)
6/26/2001	LB-1500	10:57s	##ms	##ms	##ms	##ms	--	--	##ms	##ms
		11:01s	##ms	##ms	##ms	##ms	--	--	##ms	##ms
		11:05s	##ms	##ms	##ms	##ms	--	--	##ms	##ms
		11:09s	##ms	##ms	##ms	##ms	--	--	##ms	##ms
7/31/2001	LB-1542	13:14s	0.5s	25.2s	6.6s	142s	--	--	7.5s	90s
		13:17s	1.5s	23.6s	6.7s	142s	--	--	7.5s	88s
9/6/2001	LB-1584	11:24s	0.5s	22.2s	6.7s	138s	--	--	7.7s	88s
		11:29s	1.5s	21.6s	6.7s	138s	--	--	7.8s	88s

" u " = unstable readings, due to lack of sufficient equilibration time prior to final readings, non-representative location, highly-variable water quality conditions, etc .

" ## " = Censored data (i.e., data that has been discarded for some reason).

" -- " = No data (i.e., data not taken/not required).

" m " = method not followed; one or more protocols contained in the DWM Multi-probe SOP not followed, ie. operator error (e.g. less than 3 readings per station (rivers) or per depth (lakes), or instrument failure not allowing method to be implemented.

" s " = field sheet recorded data were used to accept data, not data electronically recorded in the Multi-probe surveyor unit, due to operator error or equipment failure.

Table C2 (cont). 2001 MassDEP DWM Taunton River Watershed Baseline Lakes *in-situ* Hydrolab® data.

Lake Sabbatia (Palis: 62166) Unique ID: W0948 Station: A

Description: Deep hole, approximately 900 feet southeast of boat ramp, Taunton

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Cond@ 25C (uS/cm)	TDS (mg/l)	SAL (ppt)	DO (mg/l)	SAT (%)
6/27/2001	LB-1236	10:29	0.5	27.4	6.4	145	92.6	--	6.9	85
		10:37	1.5	25.7	6.1	142u	90.6u	--	5.0u	59u
		10:47	2.4	23.8	6.0	145	92.6	--	3.8u	44u
		10:54	3.5	19.5	6.0	159	102	--	3.7u	39u
		11:04	4.5	15.8u	5.9	158	101	--	3.4u	33u
		11:13	5.4	13.7	5.8	149u	95.0u	--	2.4	22
		11:19	6.5	11.9	5.7	142	90.7	--	0.9	8
		11:26	7.5	10.8	5.7	137	87.7	--	0.5	4
		11:31	8.0	10.3u	5.8	138	88.2	--	<0.2u	<2u
7/26/2001	LB-1329	14:05	0.5	26.6	6.7u	146	93.5	--	7.3u	89u
		14:11	1.0	26.6	6.7	146	93.5	--	7.2	89
		14:16	2.0	26.6	6.7	146u	93.5u	--	7.2	88
		14:22	3.0	24.3u	6.3	145u	92.8u	--	4.7	55
		14:29	4.0	19.9	5.9	150	96.0	--	0.2u	2u
		14:34	4.9	16.7u	5.8	154	98.0	--	<0.2	<2
		14:40	6.0	13.2u	5.8	146u	94.0u	--	<0.2	<2
		14:46	7.0	11.7u	6.0u	151	97.0	--	<0.2	<2
8/28/2001	LB-1422	09:44	0.5	25.2	6.6i	157	101	--	7.6u	91u
		09:52	1.5	25.1	6.6	157	100	--	7.5	89
		10:02	2.5	24.9	6.5	158	101	--	7.1u	85u
		10:09	3.5	23.7	6.1	158	101	--	3.7	43
		10:15	4.5	19.2	6.1	162	104	--	<0.2	<2
		10:20	5.6	15.2u	6.2	163	104	--	<0.2	<2
		10:27	6.5	13.4	6.3	168	107	--	<0.2	<2
		10:33	7.5	11.5	6.6u	176	112	--	<0.2	<2

Monponsett Pond (PALIS: 62119) Unique ID: W0926 Station: A

Description: Deep hole, center of southern portion of west basin of pond, Halifax

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Cond@ 25C (uS/cm)	TDS (mg/l)	SAL (ppt)	DO (mg/l)	SAT (%)
6/20/2001	LB-1250	12:07	0.5	26.0	6.9c	161	103	--	8.3	100
		12:16	1.5	25.1	6.8u	161	103	--	7.5u	89u
		12:24	2.5	23.9	6.4u	165	105	--	3.4u	39u
		12:31	3.6	22.3	6.3	174	111	--	<0.2	<2
7/19/2001	LB-1343	10:08	0.5	23.5	6.5u	165	106	--	6.0	69
		10:15	1.5	23.5u	6.5	165	106	--	6.0u	69u
		10:20	2.5	23.5	6.5	165	106	--	6.1	70
		10:26	3.5	23.4	6.5	165	106	--	5.9	68
8/21/2001	LB-1436	13:00	0.5	26.4	9.4c	171	110	--	12.1u	147u
		13:05	1.5	25.6	8.3cu	164	105	--	9.5u	114u
		13:13	2.5	25.2	6.8u	166	106	--	7.5u	89u
		13:19	3.3	24.1	6.1u	171	110	--	0.8	9

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" ## " = Censored data (i.e., data that has been discarded for some reason).

" -- " = No data (i.e., data not taken/not required).

" m " = method not followed; one or more protocols contained in the DWM Multi-probe SOP not followed, ie. operator error (e.g. less than 3 readings per station (rivers) or per depth (lakes), or instrument failure not allowing method to be implemented.

" s " = field sheet recorded data were used to accept data, not data electronically recorded in the Multi-probe surveyor unit, due to operator error or equipment failure.

Table C2 (cont). 2001 MassDEP DWM Taunton River Watershed Baseline Lakes *in-situ* Hydrolab® data.

Monponsett Pond (PALIS: 62218) Unique ID: W0930 Station: B
Description: Deep hole, center of southern portion of east basin, Halifax

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Cond@ 25C (uS/cm)	TDS (mg/l)	SAL (ppt)	DO (mg/l)	SAT (%)
6/20/2001	LB-1254	16:03	0.5	27.7u	6.6u	139	88.7	--	8.3u	103u
		16:14	1.6	26.2u	6.7	139u	88.8u	--	8.0u	97u
		16:25	2.5	23.1u	6.2u	139	89.0	--	3.9u	45u
		16:32	3.3	20.1	6.1u	145	93.0	--	0.4	5
7/19/2001	LB-1351	12:13	0.6	24.0	6.6	143	91.5	--	8.0	92
		12:20	1.5	23.9	6.6	143	91.5	--	7.9	91
		12:26	2.6	23.9	6.6	143	91.2	--	7.7	89
		12:32	3.0	23.4u	6.1u	144	92.1	--	2.6u	29u
8/21/2001	LB-1440	15:11	0.5	27.1	6.9c	144	92.2	--	8.4	104
		15:20	1.5	26.2u	6.6	144	92.2	--	7.7u	94u
		15:25	2.5	25.0u	6.2u	145	92.7u	--	5.4u	65u
		15:32	2.9	24.3	6.0	147	94.1	--	2.6	30

Watson Pond (PALIS: 62205) Unique ID: W0947 Station: A
Description: Deep hole, center of pond, approximately 275 feet south from north central shore, Taunton

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Cond@ 25C (uS/cm)	TDS (mg/l)	SAL (ppt)	DO (mg/l)	SAT (%)
6/27/2001	LB-1241	13:49	0.5	28.5	7.2cu	116	73.9	--	9.5u	119u
		13:59	1.5	26.3	6.7	115	73.3	--	8.3u	100u
		14:05	2.4	24.3u	6.1	118	75.7	--	<0.2	<2
	LB-1242	14:13	0.5	28.3	7.6cu	115	73.9	--	9.7	121
		14:18	1.5	26.2u	6.7u	115	73.4	--	8.1u	97u
		14:25	2.5	23.9u	6.1	120	76.7	--	<0.2	<2
7/26/2001	LB-1334	11:09	0.5	27.4	6.9cu	119	76.0	--	8.2	102
		11:22	1.0	27.4	7.0c	119	76.0	--	8.1	100
		11:27	1.5	27.4	7.0cu	119	76.0	--	8.1	101
		11:32	2.0	26.2u	6.4u	119	76.2	--	5.4	66
		11:38	2.5	23.7u	6.3u	133	84.8	--	<0.2	<2
8/28/2001	LB-1427	12:50	0.5	25.9u	6.8	117	74.8	--	8.3u	100u
		12:54	1.5	25.0	6.5	117	74.8	--	6.4u	76u
		13:03	2.5	24.1	6.2	130	82.9	--	<0.2	<2

West Meadow Brook/West Meadow Pond (SARIS: 6237425) (PALIS: 62208) Unique ID: W0950 Station: A, Mile Point: 3.7
Description: Deep hole, middle of pond, West Bridgewater

Date	OWMID	Time (24hr)	Depth (m)	Temp (C)	pH (SU)	Cond@ 25C (uS/cm)	TDS (mg/l)	SAL (ppt)	DO (mg/l)	SAT (%)
6/28/2001	LB-1505	10:12s	0.5s	27.1s	6.8s	213s	--	--	6.9su	87su
		10:15s	1.0s	26.8s	6.6s	211s	--	--	5.7su	70su
9/7/2001	LB-1600	09:53s	0.5s	18.9su	6.4su	198s	--	--	4.0su	42su

" u " = unstable readings, due to lack of sufficient equilibration time prior to final readings, non-representative location, highly-variable water quality conditions, etc .
" ## " = Censored data (i.e., data that has been discarded for some reason).
" -- " = No data (i.e., data not taken/not required).
" m " = method not followed; one or more protocols contained in the DWM Multi-probe SOP not followed, ie. operator error (e.g. less than 3 readings per station (rivers) or per depth (lakes), or instrument failure not allowing method to be implemented.
" s " = field sheet recorded data were used to accept data, not data electronically recorded in the Multi-probe surveyor unit, due to operator error or equipment failure.

Table C3. 2001 MassDEP DWM Taunton River Watershed Baseline Lakes *physico-chemical* data.

Ames Long Pond (PALIS: 62001) Unique ID: W0940 Station: A
Description: Deep hole, southern end of southern basin of pond, Easton

Date	Secchi m	Secchi Time 24hr	Station Depth m	OWMID	QAQC	Time 24hr	Sample Depth m	Alkalinity mg/l	TP mg/l	Apparent Color PCU	Chl a mg/m3
6/26/2001	>2.5	11:15	2.5	LB-1496	LB-1495	**	0.5	7	0.034bd	27d	--
				LB-1495	LB-1496	**	0.5	7	0.015bd	<15d	--
				LB-1497	--	**	2.0	7	0.014bd	18	--
				LB-1499	LB-1498	**	0 - 2.0	--	--	--	1.2
				LB-1498	LB-1499	**	0 - 2.0	--	--	--	1.9
7/31/2001	>2.2	13:11	2.2	LB-1537	LB-1538	13:20	0.5	9	0.014	43	--
				LB-1538	LB-1537	13:21	0.5	8	0.014	43	--
				LB-1539	--	13:23	1.7	8	0.015	37	--
				LB-1540	LB-1541	13:25	0 - 1.7	--	--	--	5.3
				LB-1541	LB-1540	13:27	0 - 1.7	--	--	--	5.2
9/6/2001	>2.1	11:17	2.1	LB-1579	LB-1580	11:35	0.5	8	0.009	24	--
				LB-1580	LB-1579	11:35	0.5	9	0.009	24	--
				LB-1581	--	11:39	1.6	8	0.010	22	--
				LB-1582	LB-1583	11:30	0 - 1.6	--	--	--	4.3
				LB-1583	LB-1582	11:30	0 - 1.6	--	--	--	2.6

Snake River (SARIS: 6235750) Unique ID: W0949 Station: B, Mile Point: 0.4
Description: Field Street bridge, Taunton (tributary to Lake Sabbatia, Taunton)

Date	Secchi m	Secchi Time 24hr	Station Depth m	OWMID	QAQC	Time 24hr	Sample Depth m	Alkalinity mg/l	TP mg/l	Apparent Color PCU	Chl a mg/m3
6/27/2001	--	--	--	LB-1237	--	15:25	--	--	0.059	--	--
7/26/2001	--	--	--	LB-1330	--	15:45	--	--	0.048	--	--
8/28/2001	--	--	--	LB-1423	--	14:10	--	--	0.057	--	--

Lake Sabbatia (PALIS: 62166) Unique ID: W0948 Station: A
Description: Deep hole, approximately 900 feet southeast of boat ramp, Taunton

Date	Secchi m	Secchi Time 24hr	Station Depth m	OWMID	QAQC	Time 24hr	Sample Depth m	Alkalinity mg/l	TP mg/l	Apparent Color PCU	Chl a mg/m3
6/27/2001	2.0	10:25	8.6	LB-1231	LB-1232	**	0.5	12	0.037b	75	--
				LB-1232	LB-1231	**	0.5	10	0.033b	80	--
				LB-1233	--	**	8.0	10	0.051b	60	--
				LB-1235	LB-1234	**	0 - 6.0	--	--	--	<1.0
				LB-1234	LB-1235	**	0 - 6.0	--	--	--	<1.0
7/26/2001	2.1	14:50	8.2	LB-1324	LB-1325	14:14	0.5	12	0.028	100h	--
				LB-1325	LB-1324	14:14	0.5	12	0.031	110h	--
				LB-1326	--	14:40	7.5	12	0.061	200h	--
				LB-1328	LB-1327	15:10	0 - 6.0	--	--	--	<1.0
				LB-1327	LB-1328	15:10	0 - 6.0	--	--	--	1.1
8/28/2001	2.5	09:40	8.1	LB-1417	LB-1418	**	0.5	11	0.022b	50	--
				LB-1418	LB-1417	**	0.5	11	0.026b	60	--
				LB-1419	--	**	**	16	0.085b	140	--
				LB-1421	LB-1420	**	0 - **	--	--	--	2.6
				LB-1420	LB-1421	**	0 - **	--	--	--	2.3
10/4/2001	1.5	09:30	5.8	LB-1864	--	09:40	0.5	--	0.020b	--	--

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Table C3 (cont). 2001 MassDEP DWM Taunton River Watershed Baseline Lakes *physico-chemical* data.

Unnamed Tributary Unique ID: W0927 Station: E, Mile Point: 0.1
Description: unnamed cranberry bog inlet, northern edge of west basin of Monponsett Pond, approximately 325 feet upstream of confluence with pond, Hanson

Date	Secchi m	Secchi Time 24hr	Station Depth m	OWMID	QAQC	Time 24hr	Sample Depth m	Alkalinity mg/l	TP mg/l	Apparent Color PCU	Chl a mg/m3
6/20/2001	--	--	--	LB-1257	--	**	--	--	0.076	--	--
7/19/2001	--	--	--	LB-1344	--	11:45	--	--	0.11	--	--
8/21/2001	--	--	--	LB-1443	--	14:26	--	--	0.40	--	--

White Oak Brook (SARIS: 6236700) Unique ID: W0928 Station: F, Mile Point: 0.04
Description: approximately225 feet upstream of west basin of Monponsett Pond, Hanson

Date	Secchi m	Secchi Time 24hr	Station Depth m	OWMID	QAQC	Time 24hr	Sample Depth m	Alkalinity mg/l	TP mg/l	Apparent Color PCU	Chl a mg/m3
6/20/2001	--	--	--	LB-1258	--	**	--	--	0.20	--	--
7/19/2001	--	--	--	LB-1345	--	11:20	--	--	0.18	--	--
8/21/2001	--	--	--	LB-1444	--	13:56	--	--	0.085	--	--

Unnamed Tributary to West Basin Monponsett Pond Unique ID: W0929 Station: H, Mile Point: 0.04
Description: west side of earthberm at cranberry bog , Halifax.

Date	Secchi m	Secchi Time 24hr	Station Depth m	OWMID	QAQC	Time 24hr	Sample Depth m	Alkalinity mg/l	TP mg/l	Apparent Color PCU	Chl a mg/m3
6/20/2001	--	--	--	LB-1260	--	**	--	--	0.76	--	--
7/19/2001	--	--	--	LB-1347	--	11:03	--	--	0.21	--	--
8/21/2001	--	--	--	LB-1445	--	13:34	--	--	0.32	--	--

Monponsett Pond (PALIS: 62119) Unique ID: W0926 Station: A
Description: Deep hole, center of southern portion of west basin of pond, Halifax

Date	Secchi m	Secchi Time 24hr	Station Depth m	OWMID	QAQC	Time 24hr	Sample Depth m	Alkalinity mg/l	TP mg/l	Apparent Color PCU	Chl a mg/m3
6/20/2001	1.1	11:30	4.1	LB-1245	LB-1246	**	0.5	8	0.057b	65	--
				LB-1246	LB-1245	**	0.5	8	0.048b	65	--
				LB-1247	--	**	3.6	14	0.072b	120	--
				LB-1248	LB-1249	**	0 - 3.3	--	--	--	14.6
				LB-1249	LB-1248	**	0 - 3.3	--	--	--	16.8
7/19/2001	1.2	10:30	4.0	LB-1339	LB-1338	**	0.5	10	0.066	75h	--
				LB-1338	LB-1339	**	0.5	10	0.066	85h	--
				LB-1340	--	**	**	10	0.068	80h	--
				LB-1342	LB-1341	**	0 - **	--	--	--	22.0
				LB-1341	LB-1342	**	0 - **	--	--	--	22.6
8/21/2001	0.7	12:13	3.8	LB-1431	LB-1432	12:04	0.5	10	0.055b	100	--
				LB-1432	LB-1431	12:08	0.5	12	0.056b	95	--
				LB-1433	--	12:13	3.3	12	0.051b	110	--
				LB-1434	LB-1435	12:16	0 - 2.1	--	--	--	200d
				LB-1435	LB-1434	12:19	0 - 2.1	--	--	--	70d

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Table C3 (cont). 2001 MassDEP DWM Taunton River Watershed Baseline Lakes *physico-chemical* data.

Stetson Brook (SARIS: 6236725) Unique ID: W0931 Station: D, Mile Point: 0.02
Description: approximately 150 feet upstream of eastern basin of Monponsett Pond, Halifax

Date	Secchi m	Secchi Time 24hr	Station Depth m	OWMID	QAQC	Time 24hr	Sample Depth m	Alkalinity mg/l	TP mg/l	Apparent Color PCU	Chl a mg/m3
6/20/2001	--	--	--	LB-1255	--	**	--	--	0.079	--	--
7/19/2001	--	--	--	LB-1353	--	13:20	--	--	0.039	--	--
8/21/2001	--	--	--	LB-1442	--	16:29	--	--	0.14	--	--

Monponsett Pond (PALIS: 62218) Unique ID: W0930 Station: B
Description: Deep hole, center of southern portion of east basin, Halifax

Date	Secchi m	Secchi Time 24hr	Station Depth m	OWMID	QAQC	Time 24hr	Sample Depth m	Alkalinity mg/l	TP mg/l	Apparent Color PCU	Chl a mg/m3
6/20/2001	2.4	15:50	3.8	LB-1251	--	**	0.5	<2	0.024b	50	--
				LB-1252	--	**	3.3	10	0.041b	65	--
				LB-1253	--	**	0 - 3.3	--	--	--	3.9
7/19/2001	2.0	12:30	3.5	LB-1348	--	**	0.5	6	0.028b	65h	--
				LB-1349	--	**	**	7	0.033b	60h	--
				LB-1350	--	**	0 - **	--	--	--	6.8
8/21/2001	2.2	15:01	3.4	LB-1438	--	15:11	0.5	6	0.023b	49	--
				LB-1437	--	15:15	2.9	8	0.028b	80	--
				LB-1439	--	15:20	0 - 2.9	--	--	--	7.4

Watson Pond (PALIS: 62205) Unique ID: W0947 Station: A
Description: Deep hole, center of pond, approximately 275 feet south from north central shore, Taunton

Date	Secchi m	Secchi Time 24hr	Station Depth m	OWMID	QAQC	Time 24hr	Sample Depth m	Alkalinity mg/l	TP mg/l	Apparent Color PCU	Chl a mg/m3
6/27/2001	1.6	13:50	3.0	LB-1238	--	**	0.5	11	0.042b	50	--
				LB-1239	--	**	2.5	15	0.065b	85	--
				LB-1240	--	**	0 - 2.5	--	--	--	14.3
7/26/2001	1.6	11:38	10.0	LB-1331	--	11:00	0.5	14	0.048b	49h	--
				LB-1332	--	11:20	2.5	17	0.098b	100h	--
				LB-1333	--	11:50	0 - 2.5	--	--	--	27.1
8/28/2001	0.8	13:10	3.0	LB-1424	--	**	0.5	21	0.058	55	--
				LB-1425	--	**	**	16	0.067	75	--
				LB-1426	--	**	0 - **	--	--	--	45.0
10/4/2001	0.5	09:00	3.0	LB-1862	LB-1863	09:12	0.5	--	0.064	--	--
				LB-1863	LB-1862	09:14	0.5	--	0.069	--	--

West Meadow Brook/West Meadow Pond (SARIS: 6237425) (PALIS: 62208) Unique ID: W0950 Station: A, Mile Point: 3.7
Description: Deep hole, middle of pond, West Bridgewater

Date	Secchi m	Secchi Time 24hr	Station Depth m	OWMID	QAQC	Time 24hr	Sample Depth m	Alkalinity mg/l	TP mg/l	Apparent Color PCU	Chl a mg/m3
6/28/2001	>1.2	10:10	1.2	LB-1502	--	**	0.5	19	0.026	95	--
				LB-1504	--	**	0 - 0.7	--	--	--	4.0
9/7/2001	>1.0	09:41	1.0	LB-1598	--	10:05	0.5	17	0.019	65	
				LB-1599	--	10:05	0 - 0.5	--	--	--	2.9
10/4/2001	**	10:47	1.5	LB-1867	--	10:45	0.5	--	0.036	--	--

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APPENDIX D

Technical Memorandum TM-62-4

TAUNTON RIVER WATERSHED 2001 BIOLOGICAL ASSESSMENT

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Worcester, MA

2 February 2004

CONTENTS

Tables and Figures

INTRODUCTION

Biological monitoring is a useful means of detecting anthropogenic impacts to the aquatic community. Resident biota (e.g., benthic macroinvertebrates, fish, periphyton) in a water body are natural monitors of environmental quality and can reveal the effects of episodic and cumulative pollution and habitat alteration (Barbour et al. 1999, Barbour et al. 1995). Biological surveys and assessments are the primary approaches to biomonitoring.

As part of the Massachusetts Department of Environmental Protection/ Division of Watershed Management's (MA DEP/DWM) 2001 Taunton River watershed assessments, aquatic benthic macroinvertebrate biomonitoring was conducted to evaluate the biological health of various streams within the watershed. A total of twelve biomonitoring stations were sampled to investigate the effects of nonpoint and point source stressors—both historical and current—on the aquatic communities of the watershed. Some stations sampled during the 2001 biomonitoring survey were previously "unassessed" by DEP, while historical DEP biomonitoring stations—sampled in 1988 (Fiorentino 1996), and most recently in 1996 (Fiorentino 1996a)—were reevaluated to determine if water quality and habitat conditions have improved or worsened over time. To minimize the effects of temporal (seasonal and year to year) variability, sampling was conducted at approximately the same time of the month as the 1996 biosurveys. Sampling locations, along with station identification numbers and sampling dates, are noted in Table 1. Sampling locations are also shown in Figure 1.

To provide additional information necessary for making basin-wide aquatic life use-support determinations required by Section 305(b) of the Clean Water Act, all Taunton River watershed macroinvertebrate biomonitoring stations were compared to a regional reference station most representative of the "best attainable" conditions in the watershed. The regional reference station was established in the Canoe River, which was used as the reference condition during the 1996 biomonitoring survey as well. The Canoe River aquifer is presently designated an Area of Critical Environmental Concern (ACEC) (MA DEM 2003). The reference station was situated upstream from all known point sources of water pollution, and was also assumed (based on topographic map examinations and field reconnaissance) to be relatively unimpacted by nonpoint sources.

During "year 1" of its "5-year basin cycle", problem areas within the Taunton River watershed were better defined through such processes as coordination with appropriate groups (EOEA Taunton River Watershed Team, local watershed associations, MA DEP/DWM), assessing existing data, conducting site visits, and reviewing NPDES and water withdrawal permits. Following these activities, the 2001 biomonitoring plan was more closely focused and the study objectives better defined. Table 2 includes a summary of the perceived problems/issues identified prior to the 2001 Taunton River watershed biomonitoring survey.

The main objectives of biomonitoring in the Taunton River watershed were: (a) to determine the biological health of streams within the watershed by conducting assessments based on aquatic macroinvertebrate communities; and (b) to identify problem stream segments so that efforts can be focused on developing NPDES permits, Water Management Act (WMA) permits, stormwater management, and control of other nonpoint source (NPS) pollution. Specific tasks were:

1. Conduct benthic macroinvertebrate sampling and habitat assessments at locations throughout the Taunton River watershed.

2. Based upon the macroinvertebrate data, identify river segments within the watershed with potential point/nonpoint source pollution problems; and

3. Using the benthic macroinvertebrate data and supporting water chemistry and field/habitat data:

    - Assess the types of water quality and/or water quantity problems that are present, and

- if possible, make recommendations for remedial actions or additional monitoring and assessment.

- Provide macroinvertebrate and habitat data to MA DEP/DWM's Environmental Monitoring and Assessment Program for assessments of aquatic life use-support status required by Section 305(b) of the Federal Clean Water Act (CWA).

- Provide macroinvertebrate and habitat data for other informational needs of Massachusetts regulatory agencies.

Table 1. List of biomonitoring stations sampled during the 2001 Taunton River watershed survey, including station identification number, mile point, site description, and sampling date. Stations are listed hydrologically (from upstream-most drainage in the watershed to downstream-most).

Station ID	Mile Point	Taunton River Watershed Site description	Sampling Date
TR03[1]	0.8	Salisbury Plain River, 300 m downstream from Belmont Sreet, East Bridgewater, MA	2 August 2001
SR00	2.0	Satucket River, immediately upstream from Washington Street, Bridgewater, MA	2 August 2001
NR01	7.1	Nemasket River, 200 m upstream from Route 44, Middleborough, MA	1 August 2001
TR01[1, 2]	18.0	Canoe River, 200 m downstream from Willow Street, Foxborough, MA	31 July 2001
TR06[1, 2]	12.0	Rumford River, 200 m downstream from Cocasset Street, Foxborough, MA	31 July 2001
TR06B	7.9	Rumford River, 500 m downstream from Willow Street, Mansfield, MA	31 July 2001
RB03[2]	2.4	Robinson Brook, 200 m upstream from Route 140, Mansfield, MA	31 July 2001
TR05B[1, 2]	2.7	Wading River, 1 km downstream from Barrows Street, Norton, MA	1 August 2001
TH09[2]	8.5	Threemile River, 300 m downstream from Harvey Street, Taunton, MA	31 July 2001
CB00	1.4	Cedar Swamp River tributary, 300 m downstream from Howland Road, Freetown, MA	30 Jul 2001
AR00	3.9	Assonet River, 100 m downstream from Locust Street, Freetown, MA	2 August 2001
RA00	0.9	Rattlesnake Brook, at trail approx. 400 m upstream from Route 24, Freetown, MA	30 July 2001

[1] Macroinvertebrate biomonitoring conducted here by MA DEP/DWM in 1996 (Fiorentino 1996a)
[2] Macroinvertebrate biomonitoring conducted here by MA DEP/DWM in 1988 (Fiorentino 1996)

Table 2. List of known or suspected issues/problems identified prior to the 2001 Taunton River watershed biomonitoring survey.

Taunton River Watershed Stations	Issues/Problems
Canoe River (TR01)	-*watershed reference condition*[1, 2, 3]
Salisbury Plain River (TR03)	-NPS pollution[2, 3]; pathogens[4]; Brockton WWTP[2, 3, 5]
Satucket River (SR00)	-active cranberry bogs[3]; "unassessed" for aquatic life[4]; NPS pollution
Nemasket River (NR01)	-active cranberry bogs[1,3]; low DO[3]; NPS pollution-urban runoff[3]; "unassessed" for aquatic life[4]
Rumford River (TR06)	-water withdrawals upstream[1, 2, 3]; organic enrichment/low DO/pathogens[4]
Rumford River (TR06B)	-NPS pollution-urban runoff (Mansfield, golf course)[1]; organic enrichment/low DO/pathogens[4]
Robinson Brook (RB03)	-Foxboro Co. WWTP (inactive)[1]; NPS pollution-urban runoff (Foxborough; I-95)[1]
Wading River (TR05B)	-industrial discharges (Richardson, Inc.; Tweave, Inc.)[1, 2, 3, 5]; organic enrichment/low DO[4]
Threemile River (TH09)	-Mansfield WWTP[1, 3, 5]; impoundment effects (Norton Reservoir)[4]; Wheaton College WWTP[5]
Cedar Swamp River trib (CB00)	-active cranberry bog[3]; "unassessed" for aquatic life[4]; NPS pollution
Assonet River (AR00)	-"unassessed" for aquatic life[4]; NPS pollution
Rattlesnake Brook (RA00)	-reference potential; "unassessed" for aquatic life[4]

[1](Fiorentino 1996); [2](Fiorentino 1996a); [3](MA DEP 1998); [4](MA DEP 2003); [5](MA DEP 2003a)

TAUNTON RIVER WATERSHED
BIOMONITORING STATIONS

Figure 1. Location of MA DEP/DWM biomonitoring stations for the 2001 Taunton River watershed survey.

METHODS

Macroinvertebrate Sampling

The macroinvertebrate sampling procedures employed during the 2001 Taunton River watershed biomonitoring survey are described in the standard operating procedures *Water Quality Monitoring In Streams Using Aquatic Macroinvertebrates* (Nuzzo 2001), and are based on US EPA Rapid Bioassessment Protocols (RBPs) for wadeable streams and rivers (Barbour et al. 1999). The macroinvertebrate collection procedure utilized kick-sampling, a method of sampling benthic organisms by kicking or disturbing bottom sediments and catching the dislodged organisms in a net as the current carries them downstream (Figure 2). Sampling activities were conducted in accordance with the Quality Assurance Project Plan (QAPP) for benthic macroinvertebrate biomonitoring (Fiorentino 2001). Sampling was conducted at each station by MA DEP/DWM biologists throughout a 100 m reach, in riffle/run areas with fast currents and rocky (cobble, pebble, and gravel) substrates—generally the most productive habitats, supporting the most diverse communities in the stream system. Ten kicks in squares approximately 0.46 m x 0.46 m were composited for a total sample area of about 2 m^2. Samples were labeled and preserved in the field with denatured 95% ethanol, then brought to the MA DEP/DWM lab for further processing.

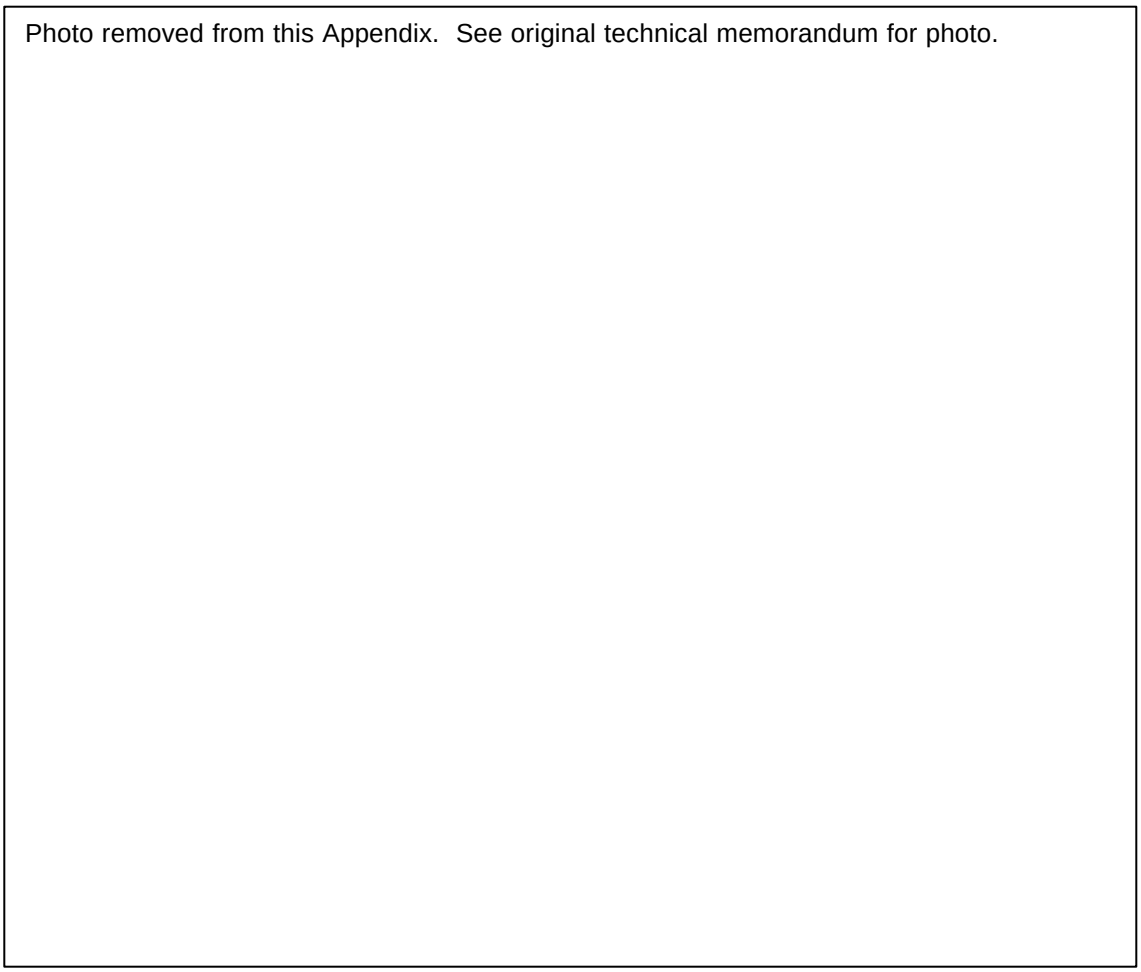


Figure 2. MA DEP/DWM biologist collecting macroinvertebrates using the “kick-sampling” technique.

Macroinvertebrate Sample Processing and Analysis

The macroinvertebrate sample processing and analysis procedures employed for the 2001 Taunton River watershed biomonitoring samples are described in the standard operating procedures (Nuzzo 2001) and were conducted in accordance with the Quality Assurance Project Plan (QAPP) for benthic macroinvertebrate biomonitoring (Fiorentino 2001). Macroinvertebrate sample processing entailed distributing whole samples in pans, selecting grids within the pans at random, and sorting specimens from the other materials in the sample until approximately 100 organisms (±10%) were extracted. For quality control purposes, a second 100-organism subsample was extracted from the reference station benthos sample. Specimens were identified to genus or species as allowed by available keys, specimen condition, and specimen maturity. Taxonomic data were analyzed using a modification of Rapid Bioassessment Protocol III (RBP III) metrics and scores (Plafkin et al. 1989). RBPIII offers a more rigorous bioassessment than RBPII, which was employed in the analysis of the 1996 family-level macroinvertebrate data for the Taunton River watershed. By increasing the level of taxonomic resolution, that is, by performing taxonomic identification to the lowest practical level, the ability to discriminate the level of impairment is enhanced. While this additional taxonomy requires considerably more time, discrimination of additional degrees of aquatic impairment is achieved. Based on the taxonomy, various community, population, and functional parameters, or "metrics", were calculated which allow measurement of important aspects of the biological integrity of the community. This integrated approach provides more assurance of a valid assessment because a variety of biological parameters are evaluated. Deficiency of any one metric should not invalidate the entire approach (Barbour et al. 1999). Metric values for each station were scored based on comparability to the reference station, and scores were totaled. The percent comparability of total metric scores for each study site to those for a selected "least-impacted" reference station yields an impairment score for each site. The analysis separates sites into four categories: non-impacted, slightly impacted, moderately impacted, and severely impacted. Each impact category corresponds to a specific aquatic life use-support determination used in the CWA Section 305(b) water quality reporting process—non-impacted and slightly impacted communities are assessed as "support" in the 305(b) report; moderately impacted and severely impacted communities are assessed as "impaired." A definition of the *Aquatic Life* use designation is provided in the *Massachusetts Surface Water Quality Standards* (SWQS) (MA DEP 1996). Impacts to the benthic community may be indicated by the absence of generally pollution-sensitive macroinvertebrate taxa such as Ephemeroptera, Plecoptera, and Trichoptera (EPT); dominance of a particular taxon, especially the pollution-tolerant Chironomidae and Oligochaeta taxa; low taxa richness; or shifts in community composition relative to the reference station (Barbour et al. 1999). Those biological metrics calculated and used in the analysis of 2001 Taunton River watershed macroinvertebrate data are listed and defined below [For a more detailed description of metrics used to evaluate benthos data, and the predicted response of these metrics to increasing perturbation, see Barbour et al. (1999)]:

1. Taxa Richness—a measure based on the number of taxa present. Generally greater with better water quality, habitat diversity, and habitat suitability. The lowest possible taxonomic level is assumed to be genus or species.

2. EPT Index—a count of the number of genera/species from the orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies). As a group these are considered three of the more sensitive aquatic insect orders. Therefore, the greater the contribution to total richness from these three orders, the healthier the community.

3. Biotic Index—Based on the Hilsenhoff Biotic Index (HBI), this is an index designed to produce a numerical value to indicate the level of organic pollution (Hilsenhoff 1982). Organisms have been assigned a value ranging from zero to ten based on their tolerance to organic pollution. Tolerance values currently used by MA DEP/DWM biologists were originally developed by Hilsenhoff and have since been supplemented by Bode et al. (1991) and Lenat (1993). A value of zero indicates the taxon is highly intolerant of pollution and is likely to be found only in pollution-free waters. A value of ten indicates the taxon is tolerant of pollution and may be found in highly polluted waters. The number of organisms and the individually assigned values are used in a mathematical formula that describes the degree of organic pollution at the study site. The formula for calculating HBI is:

$$HBI = \sum \frac{x_i t_i}{n}$$ where:

x_i = number of individuals within a taxon
t_i = tolerance value of a taxon
n = total number of organisms in the sample

4. Ratio of EPT and Chironomidae Abundance—The EPT and Chironomidae abundance ratio uses relative abundance of these indicator groups as a measure of community balance. Skewed populations having a disproportionate number of the generally tolerant Chironomidae ("midges") relative to the more sensitive insect groups may indicate environmental stress.

5. Percent Contribution Dominant Taxon—is the percent contribution of the numerically dominant taxon (genus or species) to the total number of organisms. A community dominated by few species indicates environmental stress. Conversely, more balance among species indicates a healthier community.

6. Ratio of Scraper and Filtering Collector Functional Feeding Groups—This ratio reflects the community food base. The proportion of the two feeding groups is important because predominance of a particular feeding type may indicate an unbalanced community responding to an overabundance of a particular food source (Barbour et al. 1999). Scrapers predominate when diatoms are the dominant food resource, and decrease in abundance when filamentous algae and mosses prevail. Filtering collectors thrive where filamentous algae and mosses are prevalent and where fine particulate organic matter (FPOM) levels are high.

7. Community Similarity—is a comparison of a study site community to a reference site community. Similarity is often based on indices that compare community composition. Most Community Similarity indices stress richness and/or richness and abundance. Generally speaking, communities with comparable habitat will become more dissimilar as stress increases. In the case of the Taunton River watershed bioassessment, an index of macroinvertebrate community composition was calculated based on similarity (i.e., affinity) to the reference community, expressed as percent composition of the following organism groups: Oligochaeta, Ephemeroptera, Plecoptera, Coleoptera, Trichoptera, Chironomidae, and Other. This reference site affinity approach is based on a modification of the Percent Model Affinity (Novak and Bode 1992). The (RSA) metric is calculated as:

$100 - (\Sigma\ \delta \times 0.5)$
where δ is the difference between the reference percentage and the sample percentage for each taxonomic grouping. RSA percentages convert to RBPIII scores as follows: <35% receives 0 points; 2 points in the range from 35 to 49%; 4 points for 50 to 64%; and 6 points for ≥65%.

Habitat Assessment

An evaluation of physical and biological habitat quality is critical to any assessment of ecological integrity (Karr et al. 1986; Barbour et al. 1999). Habitat assessment supports understanding of the relationship between physical habitat quality and biological conditions, identifies obvious constraints on the attainable potential of a site, assists in the selection of appropriate sampling stations, and provides basic information for interpreting biosurvey results (US EPA 1995). Before leaving the sample reach during the 2001 Taunton River watershed biosurveys, habitat qualities were scored using a modification of the evaluation procedure in Barbour et al. (1999). The matrix used to assess habitat quality is based on key physical characteristics of the water body and related streamside features. Most parameters evaluated are instream physical attributes often related to overall land-use and are potential sources of limitation to the aquatic biota (Barbour et al. 1999). The ten habitat parameters are as follows: instream cover, epifaunal substrate, embeddedness, sediment deposition, channel alteration, velocity/depth combinations, channel flow status, right and left (when facing downstream) bank vegetative protection, right and left bank stability, right and left bank riparian vegetative zone width. Habitat parameters are scored, totaled, and compared to a reference station (i.e., TR01 in the Canoe River) to provide a final habitat ranking.

Macroinvertebrate Sampling -- Qualitative

Macroinvertebrate biomonitoring was conducted at one station (SR00) based on modifications to the RBP I protocol, a screening or reconnaissance assessment that documents specific visual observations made in the field by a trained professional (Plafkin et al. 1989). The RBP I procedure was used at this station due to habitat and flow constraints that made the application of the RBP III methodology impractical. RBP I is used to discriminate obviously impacted and non-impacted areas from potentially affected areas. A biosurvey component focuses on qualitative sampling of benthic macroinvertebrates, supplemented by a preliminary field examination of other aquatic biota (periphyton, macrophytes, and fish). Qualitative benthic samples are collected from the most productive habitats using a kick net; benthic macroinvertebrate orders/families are listed on a field data sheet. A cursory evaluation of habitat is conducted in lieu of the RBPIII habitat assessment matrix. On the basis of the observations made on habitat, water quality, physical characteristics, and the qualitative biosurvey, the investigator determines by Best Professional Judgement (BPJ) whether impairment is detected.

QUALITY CONTROL

Field and laboratory Quality Control (QC) activities were conducted in accordance with the Quality Assurance Project Plan (QAPP) for benthic macroinvertebrate biomonitoring (Fiorentino 2001). Quality Control procedures are further detailed in the standard operating procedures (Nuzzo 2002).

Field Sampling Quality Control

Field Sampling QC entails: 1) Pre- and post-sampling rinses, inspection of, and picking of nets, sieves, and pans to prevent organisms collected from one station to be transferred to samples taken elsewhere; 2) On-site preservation of benthos sample in 95% ethanol to ensure proper preservation; and 3) To assess the consistency of the sampling effort, collection of a duplicate sample is performed at 10% of the stations sampled in the watershed. Two samples are collected “side by side” —a second kick sample (i.e., the duplicate) is taken adjacent to (where different assessment results are not expected due to the apparent absence of additional stressors) the original kick at each of the ten kicks conducted in a given 100 m sample reach. Duplicate samples are composited in a similar manner as the original sample; yet, they are preserved in a separate sample bottle marked “duplicate” and with all other information regarding station location remaining the same. Duplicate samples are used for the calculation of Precision of the benthos data.

Field Analytical Quality Control

Field Analytical QC entails multiple observers (at least both DWM benthic biologists, and a third person)—all trained in the habitat evaluation procedures—performing the Habitat Assessment at each biomonitoring station. A standardized Habitat Assessment Field Scoring Sheet is completed at all biomonitoring stations. Disagreement in habitat parameter scoring is discussed and resolved before the Habitat Assessment can be considered complete.

Fixed Laboratory Quality Control

Fixed Laboratory QC entails the following: 1) Taxonomy bench sheets are examined by a reviewer (the DWM benthic biologist not responsible for the taxonomic identifications) for errors in transcription from bench notebook, count totals, and spelling. All bench sheets are examined, and detected errors are brought to the taxonomist’s attention, discussed, and corrected. 2) Taxonomic duplication, in which “spot checks” are performed by a reviewer (the DWM benthic biologist not responsible for the taxonomic identifications) on taxonomy, is performed at the reviewer’s discretion. In general, all taxa that are rarely encountered in routine benthos samples, or taxa that the primary taxonomist may be less than optimally proficient at identifying, are checked. Spot checks are performed for all stations. Specimens may be sent to authorities for particular taxonomic groups. 3) Data reduction and analysis, including biological metric scoring (metric values are calculated through queries run in the DWM Benthic Macroinvertebrate Database), comparisons to reference station metrics, and impairment designations, are checked by a

reviewer (the DWM benthic biologist not responsible for performing the taxonomy and data analysis) for all benthos data at all stations. Detected errors are brought to the original taxonomist's attention and resolved. 4) Precision, a measure of mutual agreement among individual measurements or enumerated values of the same property of a sample and usually expressed as a standard deviation in absolute or relative terms, is compared using raw benthos data and metric values. If metric values and resulting scoring are significantly different (i.e., beyond an acceptable Relative Percent Difference) between the original and duplicate samples, the investigators will attempt to determine the cause of the discrepancy. Guidance regarding the calculation of Precision, including Relative Percent Difference (RPD) calculations and recommendations, can be found in US EPA (1995).

RESULTS AND DISCUSSION

The biological and habitat data collected at each sampling station during the 2001 biomonitoring survey are attached as an Appendix (Tables A1 – A3). Table A1 is the macroinvertebrates taxa list for each station and includes organism counts, the functional feeding group designation (FG) for each macroinvertebrate taxon, and the tolerance value (TV) of each taxon.

A summary table (Table A2) of the RBP III macroinvertebrate data analysis, including biological metric calculations, metric scores, and impairment designations, is included in the Appendix as well. Habitat assessment scores for each station are also included in the summary tables, while a more detailed summary of habitat parameters is shown in Table A3.

The 2001 biomonitoring data for this watershed generally indicate various degrees of nonpoint source-related problems in many of the streams examined. Urban runoff, habitat degradation, and other forms of NPS pollution compromise water quality and biological integrity throughout the watershed—most notably at TR06B and RB03. Serious water quality and biological impairment were also evident at TR03 and CB00, most likely the result of upstream wastewater treatment and cranberry farming activities, respectively. In addition, the effects of water quality degradation may be potentially exacerbated by the compromised assimilative capacities of flow-stressed streams currently impacted by water withdrawals. That said, some tributaries examined (i.e., Canoe River, Rattlesnake Brook) in the Taunton River watershed remain relatively non-impacted and are indicative of the "best attainable" conditions in the watershed. It is imperative that anthropogenic perturbations be kept to a minimum in these unimpaired waterbodies.

The Taunton River watershed received lower than average precipitation during the ten-month period leading up to the 2001 biomonitoring survey. Three (all were tributary gages) of the four USGS gaging stations in the watershed recorded annual (calendar year 2001) mean discharges that were below their respective averages for their entire period of record (USGS 2003). As a result, low flow effects to instream habitat (e.g., less than optimal channel flow status, exposed instream substrates, shallow or lack of pool areas) were observed at several of DWM's 2001 macroinvertebrate biomonitoring stations. Habitat parameters most susceptible to low baseflow generally scored better during the 1996 biomonitoring survey, when all active USGS gaging stations in the Taunton River watershed recorded above-average annual stream discharges (USGS 2003).

Taunton River Watershed

The Taunton River watershed is the second largest river basin contained wholly within Massachusetts boundaries, having a drainage area of 562 square miles. Located in southeastern Massachusetts, the watershed encompasses all or portions of 40 cities and towns. The Taunton River watershed has the flat to low hilly topography typical of eastern Massachusetts basins shaped by glaciation. The Taunton River has one of the flattest courses in the state, falling approximately 21 feet over its length; this level terrain creates extensive wetlands throughout the basin. The watershed contains over 94 square miles of wetlands, 12,883 acres of lakes, and some of the most productive cranberry bogs in the country. The Hockomock Swamp, located in the north-central portion of the watershed, is the largest vegetated freshwater wetland system in the state.

A major issue in the Taunton River watershed is the current and projected growth rate due to proposed transportation links. At this time over half the watershed is forested, recreational, and open land, while approximately 20 percent of the basin area is residential. Without careful planning and implementation of protection measures, there will be adverse impacts to the basin, including, reduction of water quantity, degradation of water quality, loss of habitat and recreational opportunities, and a fundamental change in the character of the basin.

Currently, population density is higher in the north, while water resources lie more densely toward the south. This relationship may change as proposed highways and train lines are extended to the southeast. The cities of Brockton and Taunton rely on surface water for drinking water needs, while the other basin communities rely almost exclusively on groundwater resources. MA DEP's Water Management Program, which regulates surface and ground water withdrawals in excess of an average of 100,000 gpd (gallons per day), has issued 30 permits and 139 registrations (for withdrawals in existence prior to 1986) in the Taunton River Basin. Additional applications are under review for new sources of public drinking water supplies and development of cranberry bogs.

Streamflow in the Taunton River fluctuates slowly due to the wetland areas, underlying stratified drift, and the flat gradient. Flow is measured continuously at four US Geological Survey (USGS) gaging stations: the Wading River near Norton; the Threemile River at North Dighton; the Segreganset River near Dighton, and the Taunton River at Bridgewater. On average, Taunton River streamflow is highest in March and lowest in August. The Taunton River and many of its tributaries (subwatersheds) have relatively low flows under natural conditions, due primarily to the stratified drift deposits that underlie much of the basin (approximately 62%).

The mainstem Taunton River is formed by the confluence of the Matfield and Town rivers in Bridgewater and follows a 38 mile course to Mount Hope Bay. The confluence of the Salisbury Plain River and Beaver Brook in East Bridgewater marks the beginning of the Matfield River. The Matfield River and its tributaries drain 77 square miles of the northeast portion of the Taunton River Basin. The outflow from Lake Nippenickett joins the Hockomock River to form the Town River. The Matfield River joins the Town River in the impounded waters at the head of the Taunton River. With the exception of this major dam, the Taunton River flows without physical obstruction to Mount Hope Bay. The terrain is relatively level, so the river is slow moving with only a few short sections of rapids. The freshwater portion maintains a fairly uniform cross-section with a width of about 80 feet. The Taunton flows southeasterly through Bridgewater and then turns southwest, forming the Bridgewater-Halifax and Bridgewater-Middleborough town boundaries. Along this section, the Taunton River receives flow from two tributaries, the Winnetuxet and Nemasket rivers.

The Winnetuxet River drains portions of Carver, Plympton, Halifax and Middleborough, while the Nemasket River flows through Lakeville and Middleborough. After being joined by these two tributaries, the Taunton River flows generally in a southwesterly direction, forming the boundaries between Raynham and Middleborough, and then Raynham and Taunton. The Cotley River is a small tributary which joins the freshwater portion of the Taunton River in Taunton. In East Taunton, the river becomes tidal, with tide waters from Mount Hope Bay reaching more than 18 miles upstream. In the city of Taunton, the river turns south, maintaining its relatively narrow channel-like appearance. The Mill River enters the estuary in Taunton. The Mill River is fed by the Canoe River and Mulberry Meadow Brook which flow into Winnecunnet Pond and then into Lake Sabbatia via the Snake River.

Downstream of the Threemile River confluence, the Taunton widens into a broad tidal estuary. The Threemile River is formed at the confluence of the Wading and Rumford rivers in the northwest section of the Taunton River Basin and has a drainage area of 84.5 square miles. The lower two miles of the Threemile River are tidal. Another small tributary, the Segreganset River, joins the Taunton River estuary in Dighton. The Assonet River is the last major tributary to empty into the Taunton Estuary. The freshwater portion of the Assonet flows through Lakeville and Freetown. The lower Assonet forms a broad estuarine finger of the Taunton River.

Canoe River

The Canoe River originates near Cow Hill in Sharon, meandering in a southeasterly direction through the towns of Sharon, Foxborough, Mansfield, and Norton before terminating in Winnecunnet Pond near the Norton-Taunton border. With the exception of parts of Mansfield center, the Canoe River drains relatively undeveloped areas of wetland, ponds, forest, and light residential land-use. Little Canoe River is its major tributary. The entire aquifer associated with the Canoe River has been designated an Area of Critical Environmental Concern. It has maintained ACEC status since 1993 (MA DEM 2003).

TR01—Canoe River, mile point 18.0, 200 m downstream from Willow Street, Foxborough, MA

Habitat

The TR01 sampling reach began approximately 200 m downstream from Willow Street in a forested parcel of conservation land owned by the Town of Foxborough. The stream was approximately 2 m wide and with a uniform depth of only about 0.25 m in both riffle and pool areas. Despite an abundance of cobble and pebble substrates, the reach offered less than optimal epifaunal habitat for macroinvertebrates due to its shallow nature. In fact, channel flow status was marginal at best, with less than 75% of the channel full of water and resulting in much exposed riffle substrate. Shallow pools and mostly exposed woody (e.g., snags and logs) material resulted in highly reduced fish habitat as well. Hardwoods (red maple, *Acer rubrum*; oak, *Quercus* sp.) shaded much (60%) of the sampling reach, while a dense shrub (sweet pepperbush, *Clethra alnifolia*; elderberry, *Sambucus canadensis*; greenbrier, *Smilax rotundifolia*) and herbaceous (ferns) layer occupied the margins of the stream channel. Instream vegetation consisted of a proliferation of mosses and some small areas of burreed (*Sparganium* sp.). Both stream banks were well vegetated and stable while the riparian zone extended undisturbed from both sides of the channel. Nonpoint source pollution inputs were absent in the sampling reach.

TR01 received a composite habitat score of 153/200—naturally occurring low baseflow conditions contributed most to point reductions for instream habitat parameters (Table A3). Habitat scored better during the 1996 biomonitoring survey here, when optimal channel flow status (i.e., water reached the base of both banks) resulted in excellent fish and macroinvertebrate habitat and led to a total habitat score of 181/200 (Fiorentino 1996). As was the case during the 1996 biosurveys, this was the designated regional reference station by virtue of its instream and riparian habitat potential, presumed good water quality, absence of nonpoint source pollution inputs, and minimal upstream/adjacent land-use impacts (e.g., absence of point source inputs, lack of channelization, minimal development and agricultural activity nearby, undisturbed and well vegetated riparian zone).

Benthos

The Canoe River biomonitoring station was characterized by a macroinvertebrate assemblage indicating a healthy aquatic community, with metric values indicative of good water quality and “least-impacted” conditions (Table A2). In particular, those attributes that measure components of community structure (i.e., Taxa Richness, EPT Index)—which have been shown to display the lowest inherent variability among commonly used metrics (Resh 1988)—scored well, further corroborating the designation as a reference station. A low Biotic Index, a high (10—highest value in the survey) EPT Index, and low (18%—lowest value in the survey) dominance of a single taxon indicated a dominance of pollution-sensitive taxa and good overall community balance among the TR01 benthos assemblage.

The abundance of the chironomid *Micropsectra* sp. among the resident biota here may be a reflection of the low baseflow conditions observed in this portion of the Canoe River during the 2001 biomonitoring survey, as this taxon has been known to predominate in streams subjected to periods of reduced flow (Fiorentino 2003; Fiorentino 2000; Fiorentino 1999; Bode, NY DEC, personal communication, 1998). Also common in the benthos sample was the leuctrid stonefly, *Allocapnia* sp.—a pollution sensitive taxon known to survive droughts (Bode, NY DEC, personal communication, 1998). The TR01 benthic community received a total metric score of 42 out of a possible score of 42 (Table A2).

Salisbury Plain River

The Salisbury Plain River originates at the confluence of Salisbury and Trout brooks near downtown Brockton. The river flows in a southerly direction through highly urbanized portions of Brockton before heading east to form the Matfield River at its confluence with Beaver Brook in East Bridgewater. The river receives discharge contributions from the Brockton Wastewater Treatment Plant (WWTP) (NPDES Permit No. MA0101010) just upstream from the West Bridgewater town line. The Brockton WWTP is an advanced treatment facility engaged in the collection and treatment of domestic wastewater. In addition, there are about 20 industrial users contributing wastewater to this facility.

TR03—Salisbury Plain River, mile point 0.8, 300 m downstream from Belmont Street, East Bridgewater, MA

Habitat

TR03 meandered through a residential portion of East Bridgewater near its boundary with West Bridgewater. The sampling reach began approximately 300 m downstream from Belmont Street and about 2 km downstream from the Brockton WWTP outfall. Estimated stream width was 4 m, while depth ranged from 0.50 m in the riffles to 0.75 m in the deepest pool areas. Swift current velocity and an abundance of large rocky substrates offered excellent epifaunal habitat for macroinvertebrates. Deep pools containing large boulders and submerged logs provided fish with ample stable cover as well. Channel flow status was optimal, with water reaching the base of both banks and leaving only minimal amounts of substrates exposed. Despite a mostly-closed (60% shaded) canopy, aquatic vegetation in the form of mosses and dense beds of macrophytes (water starwort, *Callitriche* sp.; waterwort, *Elodea* sp.; pondweed, *Potamogeton* sp.) covered virtually all of the 100 m sampling reach. Algal cover was also substantial (>50% cover), consisting mainly of filamentous green forms attached to boulders in both fast and slow current areas. Bank stability was good along the left (north) bank, due in part to a dense layer of shrubs (rose, *Rosa* sp.; sweet pepperbush, *Clethra alnifolia*), vines (*Vitis riparia*), and herbaceous (jewelweed, *Impatiens capensis*; smartweed, *Polygonum* sp., Japanese knotweed, *Polygonum cuspidatum*) growth. Much of the right (south) bank, however, contained areas of erosion. Bank failure was exacerbated by the dumping of trash and construction materials along portions of the reach—apparently an ongoing activity as this was observed during the 1996 biosurvey here as well (Fiorentino 1996). Riparian vegetation, while undisturbed along the left bank, was extremely reduced along the right bank with a thin layer of trees (red maple, *Acer rubrum*; oak, *Quercus* sp.; beech, *Fagus* sp.) providing only a narrow buffer between the river and adjacent road (Matfield Street).

TR03 received a total habitat assessment score of 168/200 (Table A3). Riparian disruption and erosion along the right bank led to the majority of the point reductions for habitat quality. In addition, instream sediment (sand) deposition and slight turbidity were observed during the benthos collections at TR03. Nevertheless, habitat parameters scored better here than at the regional reference station.

Benthos

Resident biota at TR03 received total metric scores of 16 and 14, representing only 38% and 33% comparability to the reference station and resulting in an assessment of "moderately impacted" for biological condition (Table A2). That habitat quality here was found to be highly comparable (actually better) to the reference condition suggests that water quality limits biological potential in this portion of the Salisbury Plain River. Metric values for the TR03 benthos were strongly suggestive of water quality degradation related to organic enrichment and low dissolved oxygen levels. Pollution sensitive EPT taxa, as well as algal scrapers (Tables A1)—generally less tolerant of organic pollutants than filter-feeders and gathering collectors, were virtually absent from the benthos sample taken here and suggest an oxygen-stressed community. Community imbalance also characterized the TR03 benthic community, the result of the hyperdominance of a single family. Indeed, the Chironomidae comprise well over half of the assemblage observed at TR03. The numerical dominance of the chironomid *Polypedilum flavum* is particularly significant, as this species is considered very tolerant of organic pollution. It has been commonly observed in streams with high amounts of suspended organic particulates and has been associated with sewage "recovery zones" (Bode and Novak 1998).

The 2001 bioassessment of TR03 was similar to results documented by DEP during the last biomonitoring survey conducted here in 1996, when high densities of filter-feeding hydropsychids and pollution tolerant chironomids resulted in poorly performing metrics (especially EPT Index and Scrapers/Filterers) and an assessment of "moderately impaired" (Fiorentino 1996). That the TR03 macroinvertebrate community remains structured in response to organic enrichment is not surprising given its location downstream from the Brockton WWTP. Nutrient loadings originating from the treatment facility's discharge probably not only shape benthic community structure and function in this portion of the river, but also probably account for the luxuriant filamentous algal growth and macrophyte cover observed here.

Satucket River

The Satucket River originates in Robbins Pond in Bridgewater and meanders in a generally westerly direction before joining the Matfield River in East Bridgewater. The subwatershed is relatively undeveloped, with some light residential land-use and small-scale agriculture mainly in the form of cranberry farms.

SR00—Satucket River, mile point 2.0, immediately upstream from Washington Street, East Bridgewater, MA

Habitat

Due to the lentic nature of the Satucket River, SR00 differed greatly from other biomonitoring stations in the Taunton River watershed survey in terms of epifaunal/riparian habitat, channel morphology, and hydrology. DWM conducted only a qualitative assessment of habitat and biological integrity at SR00, where soft substrates and imperceptible current velocity made comparisons to the more lotic Canoe River reference station inappropriate. Rather than conduct "kick" sampling throughout a 100 m reach, net "jabs" were made in the most productive habitat available to macroinvertebrates in this portion of the stream—namely submerged vegetation, snags, and root masses along the banks. In addition, a few kicks were made in what limited riffle area was available—those rocky substrates present appeared to be introduced. Virtually all sampling was confined to the area immediately upstream from the Washington Street crossing.

The low-gradient SR00 biomonitoring station was characterized by a mostly open-canopied channel bordered by a profusion of herbaceous and shrubby flood plain vegetation—typical of much of the Satucket River system. While the soft, muck-mud substrates that comprised most of the stream bottom provided only marginal epifaunal habitat, a variety of snags, submerged logs, overhanging shrubs, and deep pool areas provided fish with excellent habitat. Stream depth was approximately 0.2 m in the runs and over 0.50 m in the pool areas, with water easily reaching the base of both banks. Instream vegetation consisted of aquatic mosses while algae were not observed.

Both stream banks were well-vegetated and stabilized with shrubs (rose, *Rosa* sp.; dogwood, *Cornus stolinifera*; *Viburnum* sp.) and grasses. Riparian vegetation in the form of a hardwood (red maple, *Acer rubrum*; alder, *Alnus* sp.; ash, *Fraxinus americana*; elm, *Ulmus rubra*) forest extended undisturbed from the right (north) bank, while a nearby pasture disrupted the zone along the left (south) bank.

Benthos

The SR00 benthic community was comprised of a total of 26 taxa and included high densities of taxa (e.g., Gastropoda, Hemiptera, Amphipoda) commonly found in lentic stream systems. The assemblage displayed good trophic structure, with virtually every major feeding guild represented. EPT taxa, generally not abundant in low-gradient wetland dominated stream systems such as the Satucket River, were well represented and included several fairly pollution-sensitive genera (Table A1). Due to the qualitative nature of the biosurvey conducted at SR00, an assessment of biological condition based on RBP III criteria could not be made; however, the macroinvertebrate community encountered here does not appear to suggest the presence of gross organic pollution in this portion of the Satucket River. In fact, based on the variety of pollution intolerant taxa observed here, coupled with good overall riparian and instream habitat quality for a river of this nature, MA DEP/DWM's Assessment Group may want to consider a designation of "support" for

the aquatic life-use determination for this segment of the Satucket River unless DEP's 2001 water quality data (in preparation) suggest otherwise.

Nemasket River

The Nemasket River originates at the outlet of Assawompset Pond, which, in turn is fed by Long Pond. The ponds act as an emergency water supply for the New Bedford area. Flow is regulated at the dam located between Assawompset Pond and Great Quittacas Pond. The Nemasket flows northward from its source until it joins the Taunton River near the Bridgewater/Middleborough border. There is one flow regulation dam in Middleborough, below which the river flow becomes sluggish through the remainder of its course to the Taunton. In addition to urbanized portions of Middleborough, the Nemasket River subwatershed drains vast areas of forest, wetland, and cranberry bog.

NR01—Nemasket River, mile point 7.1, 200 m upstream from Rt. 44, Middleborough, MA

Habitat

The NR01 sampling reach began 200 m upstream from Rt. 44 in a grassy picnic area. This portion of the river has been greatly altered (i.e., highly channelized) as a result of historical mill activity. Sampling was conducted just downstream from the convergence of multiple channels near the lower extent of a series of low stone dams. Anthropogenic modifications to the river's morphology resulted in both stream banks being replaced by stone walls. The main stream channel, which was the site of the benthic survey, was essentially an open-canopied (<5 % shaded), straight and narrow (4 m width) sluiceway delivering swift water over an area of fairly uniform depth (0.30 m) and with virtually all cobble substrates before giving way to slower and deeper "flat water" areas near the Route 44 crossing. Natural bank and riparian vegetation has been replaced with a lawn and picnic area along the entire length of the reach's right (north) bank, while mostly grasses and a few scattered hardwoods (red maple, *Acer rubrum*; oak, *Quercus* sp.) comprised the only riparian vegetation along the left (south) bank. As one long riffle area, the sampling reach provided macroinvertebrates with excellent epifaunal habitat; however, the lack of stream sinuosity, homogenous flow regimes, and an absence of stable cover, resulted in poor fish habitat. Rooted macrophytes covered the majority (>90%) of the stream bottom, with water buttercup (*Ranunculus trichophyllus*) and water starwort (*Callitriche* sp.) the dominant submergent forms and reed canary grass (*Phalaris arundinacea*) the most common emergent type present. Filamentous green algae were observed attached to cobble substrates as well.

NR01 received a total habitat assessment score of 119/200, which was the poorest evaluation of instream and riparian habitat for a biomonitoring station in the 2001 survey (Table A3). Greatly modified channel morphology coupled with near-complete removal of a riparian buffer affected the scoring most.

Benthos

Metrics calculated for the original NR01 benthos sample performed generally similarly to those for the duplicate sample. Both samples received total metric scores that were 52%-57% comparable to reference station metrics. The resulting bioassessment was found to be "slightly impacted" regardless of which sample was compared to the reference community at TR01.

Filter-feeding taxa—most notably, Simuliidae (blackflies) and Hydropsychidae (net-spinning caddisflies)—dominated both the NR01 and NR01 duplicate samples, displacing scrapers and other more pollution sensitive EPT taxa (Tables A1 and A2). As a result, values for Scraper/Filterers and EPT Index metrics scored poorly (score=0 or 2). The preponderance of filter-feeders among the NR01 benthos assemblage is probably the result of an ample supply of suspended FPOM originating from large upstream impoundments (e.g., Assawompset and Long ponds). As is typical in lentic systems such as lakes and impoundments, autochthonous forms of organic matter become an important food resource for downstream lotic communities such as those encountered at NR01 (Wetzel 1975). When these lentic systems are subjected to increasingly productive conditions, the result can be an almost complete displacement of other trophic groups by filter feeding taxa downstream from the impoundment. Other

sources of organic enrichment, such as extensive upstream wetland/bog areas (including over 1133 acreas of cranberry bog), numerous golf courses, and urban runoff associated with downtown Middleborough, may also be responsible for the delivery of the FPOM load that shapes community structure and function in downstream macroinvertebrate populations in the Nemasket River.

In addition to the potential water quality effects associated with organic enrichment mentioned above, habitat degradation may influence biological integrity in this portion of the Nemasket River. The severe disruption of bank and riparian habitat parameters, coupled with the dramatic historical channel alteration that has occurred at NR01 to produce a low scoring (119/200) habitat assessment, can potentially impact resident biota through effects such as reduced riparian buffering from nearstream pollution and erosional activities, reduced stream shading, loss of streamside habitat and nutrient inputs, and scouring.

Rumford River

The Rumford River originates in Foxborough, draining the relatively undeveloped eastern portion of town as it flows in a southerly direction. Land use becomes increasingly urbanized as the river makes its way towards Mansfield center and then its confluence with Robinson Brook near Interstate 495. Immediately after crossing the interstate the river enters Norton Reservoir. From the reservoir outlet the Rumford River continues to meander in a generally southeasterly direction through wetland areas until it converges with the Wading River to form the Threemile River in Norton.

TR06—Rumford River, mile point 12.0, 200 m downstream from Cocasset St., Foxborough, MA

Habitat

The TR06 sampling reach began approximately 200 m downstream from Cocasset Street and the Vandys Pond outlet in a forested portion of Foxborough. Red maple (*Acer rubrum*), oak (*Quercus* sp.), and white pine (*Pinus strobus*) trees provided about a 75% shaded canopy above the small stream, which was only half a meter wide and with depths ranging from 0.2 – 0.4 m in both riffle and pool areas. Epifaunal substrates were rocky but small, mainly comprised of gravel and some small cobble. Nevertheless, swift current velocities provided macroinvertebrates with ample benthic habitat. The shallow nature of the stream was less conducive to the maintenance of fish populations, as was the lack of stable cover. In addition, deposits of sand—which may be originating from the upstream road crossing—compromised pool habitat for fish. Channel flow status was suboptimal—water filled slightly more than 75% of the channel—and instream turbidity was observed. The dense forest provided a wide riparian zone along the right (east) bank, and a profusion of wetland vegetation (ferns and grasses; skunk cabbage, *Symplocarpus foetidus*) and shrubs (dogwood, *Cornus cornuta*; witch hazel, *Hamamelis virginiana*; sweet pepperbush, *Clethra alnifolia*) helped to stabilize the bank. The steep nature of the left (west) bank resulted in small areas of erosion and less than optimal vegetative protection. The backyard of a private residence encroached slightly on the riparian zone along the left bank near the top of the reach.

TR06 received a total habitat assessment score of 146/200—the second lowest habitat score given to a biomonitoring station in the 2001 survey (Table A3). Interestingly, this station received a much higher habitat score (182/200) during the 1996 biosurvey, when optimal channel flow status (19 out of a possible 20—water reaching base of both banks) resulted in better fish habitat (Fiorentino 1996). In addition, the instream sediment deposition and water column turbidity observed during the 2001 biosurvey here was virtually absent during the 1996 survey.

Benthos

Despite considerable habitat limitations, metrics for the TR06 benthos assemblage performed better than any other biomonitoring test station in the 2001 survey. Total metric scores of 30 and 32 were 71% and 76% comparable to reference conditions in the Canoe River. As a result, TR06 received an assessment of “slightly impacted” for biological condition. And while this assessment was not as good as that received following the 1996 biomonitoring survey at TR06, it is not clear if biological integrity has worsened here

since the 1996 biosurvey, as the macroinvertebrate data analysis methodology (RBPII) employed in 1996 was not as intensive as that performed on the 2001 benthos sample.

Low baseflow conditions—and probably to a lesser degree, sediment deposition—appear to influence aquatic health in this portion of the Rumford River more than water quality effects. And while low flow effects here may be naturally occurring, there also exists the possibility that these conditions are exacerbated by upstream water withdrawals (Sharon wellfields) in the vicinity of Gavins Pond.

TR06B—Rumford River, mile point 7.9, 500 m downstream from Willow St., Mansfield, MA

Habitat

The TR06B sampling reach began approximately 500 m downstream from Willow Street and immediately upstream from a small wooden footbridge in a forested area with light residential development. Hardwoods provided a 60% shaded canopy cover to the reach which was braided along its course due to two small but well vegetated islands. Estimated stream width was 2 m for each of the channels, while depth ranged from 0.2 m to 0.4 m in riffle/run areas and up to half a meter in the deepest pools. Cobble and gravel dominated substrates provided macroinvertebrates with good epifaunal habitat. Fish habitat was slightly less than optimal despite the presence of deep pools—the result of limited stable cover. Instream vegetation and algal cover were absent with the exception of free-floating watermeal (*Wolffia* sp.) that probably originated from upstream impoundments. Instream deposits of silt and FPOM were substantial. The sources of these deposits are unknown; however, TR06B's location immediately downstream from downtown Mansfield no doubt makes it susceptible to various forms of NPS pollution associated with urban runoff. In addition, a golf course is located adjacent to the river just a few hundred meters upstream. Instream turbidity observed during the biosurvey here also suggests suspect water quality in this portion of the Rumford River.

Riparian and bank parameters scored well. Banks were stable and well-vegetated with a dense shrub (*Viburnum* sp.; dogwood, *Cornus cornuta*; greenbriar, *Smilax rotundifolia*), vine (riverbank grape, *Vitis riparia*), and herbaceous (Japanese knotweed, *Polygonum cuspidatum*; ferns; skunk cabbage, *Symplocarpus foetidus*) layer along both banks and on the islands. Riparian vegetation consisted mainly of red maple (*Acer rubrum*) and oak (*Quercus* sp.) with ferns and skunk cabbage common in the understory of this "wet" forest, which extended undisturbed in both directions.

TR06B received a total habitat assessment score of 159/200 (Table A3). Instream habitat quality was mainly compromised by the effects of sediment loadings. In fact, habitat scores for sediment deposition (7) and embeddedness (13) were the lowest received by a biomonitoring station in the entire Taunton River watershed survey (Table A3).

Benthos

The TR06B macroinvertebrate community received a total metric score of 14, which represented only 33% comparability to the reference station and resulted in an assessment of "moderately impacted" for biological condition (Table A2).

The benthic community here is clearly structured in response to organic enrichment and associated low dissolved oxygen levels. Filter-feeders dominated the TR06B benthos assemblage, comprising 85% of the total sample. Net-spinning caddisflies (*Hydropsyche betteni* gr.; *Chimarra* sp.) and the filtering midge *Rheotanytarsus pellucidus* were especially numerous and contributed most to low scoring (score=0) values for Scrapers/Filterers and Percent Dominant Taxon metrics. The EPT Index metric also performed poorly (score=0)—not surprising given the susceptibility of these taxa to low dissolved oxygen levels and organic pollutants. Indeed, this segment of the Rumford River is 303(d)-listed (i.e., "Category 5 Waters") for organic enrichment/low DO (MA DEP 2003), with organic materials occurring as instream deposits and suspended as a food resource for resident biota.

An additional threat to the benthos at TR06B is instream sedimentation—presumably originating from upstream road crossings and other impervious surfaces located within this highly urbanized subwatershed. Sand and other fine sediments drastically reduce macroinvertebrate microhabitat by filling the interstitial spaces of epifaunal substrates. Reduced substrate microhabitat due to embeddedness and sediment deposition may contribute to the suppressed EPT community observed at TR06B, as these forms may be susceptible to increases in sediment loading due to their inability to burrow (Johnson et al. 1993). In addition, the filling of pools with sediment reduces fish cover and may be detrimental to fish spawning habitat and egg incubation at TR06B.

Robinson Brook

This small stream originates in Hersey Pond, just east of Interstate 95 in Foxborough. It flows in a southerly direction before joining the Rumford River just north of downtown Mansfield.

RB03—Robinson Brook, mile point 2.5, 200 m upstream from Rt. 140, Mansfield, MA

Habitat

The RB03 sampling reach began approximately 200 m upstream from route 140 at its merger with Central Street, near the Mansfield-Foxborough border. The stream was well-shaded, with red maple (*Acer rubrum*), oak (*Quercus* sp.), and white pine (*Pinus strobus*) providing a mostly (90% canopy cover) closed canopy. Riffle areas as wide as the stream (7 m) were common, albeit shallow (0.2 m), along the upper and lower portions of the reach, while large (0.2 – 0.5 m deep) pools comprised the middle. Boulder and cobble substrates provided macroinvertebrates with optimal epifaunal habitat. Sand, silt, and FPOM deposits were prevalent along much of the sampling reach, but these areas were avoided during kick sampling. Fish habitat was excellent, thanks in part to a mix of stable cover (logs, snags, anthropogenic debris) and deep pools. Aquatic vegetation and algae were not observed in the reach. Nonpoint source pollution inputs were observed throughout the reach; however, sources of instream deposits of sand, silt, and trash were not known. The stream crossings of major state (Rt. 140) and interstate highways (I-95) were located just upstream from the RB03 biomonitoring station. Both stream banks were stable and well-vegetated with grasses and herbaceous growth. Riparian vegetation was well established, with hardwoods, vines (poison ivy, *Rhus radicans*; greenbriar, *Smilax rotundifolia*), and shrubs (dogwood, *Cornus* sp.) providing a wide buffer along both sides of the stream.

RB03 received a total habitat assessment score of 162/200 (Table A3). About half the reach was affected by sedimentation—a score of 7 for the sediment deposition parameter was the lowest (along with station TR06B) received by a Taunton River watershed biomonitoring station (Table A3). Surprisingly, embeddedness of rocky substrates in the sampling reach was minimal (score=19) which suggests that the slower pool areas of RB03 are more vulnerable to the effects of instream deposition than the swifter riffle/run areas favored by benthic macroinvertebrates.

Benthos

The RB03 benthic community received a total metric score of 14, representing 33% comparability to the Canoe River reference station and resulting in a bioassessment of “moderately impacted” (Table A2). Filter-feeders were the dominant trophic guild, with particularly high densities (n=45) of hydropsychid caddisflies (Table A1). The resulting low-scoring (score=0) Scrapers/Filterers metric, coupled with reduced richness of total taxa and EPT taxa, was similar to metric peformance of the benthos assemblage collected during the last DEP biomonitoring survey conducted here in 1988 (Fiorentino 1996). That biosurvey also found the RB03 macroinvertebrate community to be “moderately impaired” compared to its Canoe River reference station (Fiorentino 1996).

Aquatic health appears to remain unchanged at RB03, then, since the 1988 biomonitoring survey. Benthic community structure and function continue to appear strongly influenced by organic enrichment, though sources of organic inputs are unknown. Sediment inputs responsible for instream habitat degradation at RB03 probably compromise biological potential here as well. A recent study by Zweig and Rabeni (2001)

found EPT density and EPT richness to be significantly negatively correlated with deposited sediment at their macroinvertebrate biomonitoring sites. As noted above, EPT richness was extremely reduced at RB03 during the 2001 biosurvey.

Wading River

The Wading River originates in a small wetland just north of West Street in Foxborough and ends at its confluence with the Rumford River, which then forms the Threemile River, in Norton. Land use in the Wading River subwatershed is mainly light residential with some industry—most notably clothing and fabrics manufacturer, Tweave, Inc. (NPDES Permit No. MA0005355) and metal plating company C. A. Richardson, Inc. (NPDES Permit No. 0001805)—both of which possessed an NPDES permit to discharge wastes to the Wading River during the time of the 2001 biomonitoring survey (MA DEP 2003a). MA DEP has documented whole effluent toxicity permit limit violations at both companies (MA DEP 1998). C. A. Richardson, Inc. has terminated all discharge activities since the last biomonitoring survey conducted in the Taunton River watershed (Paul Hogan, MA DEP, personal communication, 2003).

TR05B—Wading River, mile point 2.7, 1 km downstream from Barrows St., Norton, MA

Habitat

The TR05B sampling station was located approximately 1 km downstream from Barrows Street and about 200 m downstream of the Tweave, Inc. discharge. The reach was accessed via a footpath behind a private residence at 22 Fordham Road. The stream meandered through deciduous/evergreen woodland, with an expansive riparian zone along the right (south) bank providing a mostly closed (75% shaded) canopy. A few houses that are part of a new subdivision were set back from the relatively steep left (north) bank; however, the properties are separated from the channel by a high esker (probably man-made) which seems to buffer potential (e.g., yard waste, grass clippings, etc.) NPS pollution inputs to the stream. The combination of substrates and flow regime here provided excellent habitat for macroinvertebrates and fish—well developed riffles of varying (0.1 – 0.4 m) depths, interspaced with deep (0.3 – 0.5) runs and pools, flowed over cobble/pebble dominated substrates and woody materials. The stream was approximately 10 m wide and with optimal channel flow status—water reached the base of both banks. Some instream turbidity and substrate embeddedness were observed. Banks were well vegetated with grasses and herbaceous growth before giving way to a wide riparian buffer dominated by hardwoods (red maple, *Acer rubrum*; oak, *Quercus* sp.) and white pine (*Pinus strobus*). Bank stability was excellent along the right bank while the steepness of the left bank resulted in a few small areas of erosion. Algal cover and instream vegetation were minimal with the exception of mosses.

The TR05B biomonitoring station received a total habitat score of 173/200 (Table A3). As was the case during the 1996 biosurvey here, TR05B received one of the best habitat evaluations in the entire Taunton River watershed survey.

Benthos

The TR05B benthos assemblage received total metric scores of 26 and 28, representing 62% and 67% comparability to the reference community and resulting in an assessment of "slightly impacted" for biological condition (Table A2). Community structure and function were similar to that observed here in 1996 in that filter-feeding caddisflies were the numerically dominant taxa. Yet despite the abundance of filter-feeders in the 2001 sample, other feeding guilds were well represented also. The presence of numerous scrapers such as the elmid beetle, *Stenelmis* sp., helped contribute to a high scoring Scrapers/Filterers metric value. Interestingly, densities of Chironomidae and Pisidiidae—two families well represented (n=21 and 18 respectively) in the 1996 benthos sample—were much reduced in 2001, resulting in an improved Scrapers/Filterers ratio and a high scoring (score=6) EPT/Chironomidae metric value (Table A2). It is possible that decreases in the volume of effluent discharged by Tweave, Inc. (Paul Hogan, MA DEP, personal communication, 2003), and the termination of the discharge of C. A. Richardson, Inc. since the 1996 biosurvey have led to slight improvements in water quality in this portion of the Wading River.

Biological health probably remains relatively unchanged at TR05B since the last biosurvey conducted in 1996. Moderate levels of organic enrichment, or other water quality effects, continue to shape benthic community structure and function at TR05B. Upland wetlands and the impounded nature of much of this portion of the Wading River probably contribute significant amounts of particulate organic materials that are ultimately delivered to downstream aquatic communities such as TR05B. In lieu of an upstream control station, it is difficult to determine the impact—if any—that the Tweave, Inc. discharge may be having on aquatic health at TR05B.

Threemile River

The Threemile River is formed at the confluence of the Rumford and Wading rivers in the northwest portion of the Taunton River watershed. With many dams and impoundments along this system there are many slow-flowing segments as the river meanders southeast towards its tidally influenced mouth and confluence with the mainstem Taunton River in Taunton. The Threemile River receives the treated wastewater discharge of the Mansfield WWTP (NPDES Permit No. MA0101702). Effluent from the facility flows to the river via a wetland just upstream from the Norton-Taunton border. Since the last DEP biomonitoring survey conducted in this portion of the river in 1988, which documented a degraded benthic community downstream from the Mansfield WWTP (Fiorentino 1996), the facility has added dechlorination to their treatment process (MA DEP 1998).

TH09—Threemile River, mile point 8.5, 300 m downstream from Harvey Street, Taunton, MA

Habitat

The TH09 sampling reach began approximately 300 m downstream from Harvey Street in a lightly developed portion of the watershed. The reach was wide (14 m) and quite sinuous as it meandered through a well-established forest of oaks (*Quercus* sp.), maples (*Acer rubrum*), and pines (*Pinus strobus*) that provided a partially (45 %) shaded canopy. Riffle areas of varying (0.2 – 0.3 m) depths were common throughout the sampling area, while a deep (0.75 m) pool occupied the middle portion. An abundance of large rocky substrates coupled with the swift current velocity resulted in excellent epifaunal habitat for benthic organisms. Dense instream moss growth provided additional microhabitat for macroinvertebrates; Emergent and submergent forms of macrophytes, in addition to filamentous green algae, were also common. A variety of stable cover (especially snags, submerged logs, and boulders) and good depth in pool and run areas provided fish with excellent habitat as well. Channel flow status was optimal, with water easily reaching the base of both banks and resulting in deep riffle/run areas that made it difficult for DWM biologists to negotiate the channel during kick sampling. Some embeddedness of substrates was noted in the faster areas of the reach; however, overall sediment deposition throughout the sampling reach was minimal and affecting less than 5% of the bottom. Slight turbidity in the water column and a rather pronounced effluent odor were also observed during the biosurvey. Both stream banks were highly stabilized with boulders and well vegetated with vines (poison ivy, *Rhus radicans*; common greenbrier, *Smilax rotundifolia*), herbaceous growth (cardinal flower, *Lobelia cardinalis*; moss; grasses), and shrubs (riverbank grape, *Vitis riparia*; dogwood, *Cornus* sp.). Shrub and tree growth comprising most of the riparian vegetative zone extended undisturbed from both banks.

TH09 received a total habitat assessment score of 180/200 (Table A3). This was easily the best habitat evaluation for a biomonitoring station in the 2001 survey. Potential NPS pollution inputs originating from the upstream road crossing (Harvey Street) may be responsible for the fine sediments surrounding some substrates in the TH09 reach.

Benthos

The TH09 benthic community received a total metric score of 28, representing 67% comparability to the reference station and placing it in the “slightly impacted” category for biological condition (Table A2). While filter-feeders such as hydropsychid caddisflies remain the dominant trophic group in the TH09 benthos assemblage, the abundance of various species of scraping elmid beetles indicates the importance of other food resources (i.e., periphyton) besides suspended FPOM in this portion of the river.

The presence of these elmids not only resulted in a high scoring (score=6) Scrapers/Filterers metric value, but also contributed to a low Biotic Index (4.66), as several genera of Elmidae are relatively sensitive to organic pollution.

It appears that aquatic health may have improved here since the last biomonitoring survey conducted by DEP in 1988, which found a "moderately impaired" benthic community (Fiorentino 1996). The benthos assemblage collected during that survey was hyperdominated by hydropsychids, which displaced most other trophic groups such as algal scrapers. Also numerous in the 1988 sample was the chironomid, *Tvetenia vitracies* gr., a species group often numerous in nutrient enriched waters where filamentous algae predominate (Bode and Novak 1998). *Tvetenia* spp. were virtually absent from the macroinvertebrate community observed during the 2001 biosurvey at TH09 (Table A1). Recent improvements in effluent treatment at the Mansfield WWTP may contribute to observed improvements in biological integrity here (Paul Hogan, MA DEP, personal communication, 2003)

It is impossible to tell if the water quality degradation that does persist at TH09 is caused solely by the Mansfield WWTP or if other additional stressors farther upstream, such as the Wheaton College sanitary wastewater discharge (NPDES Permit No. MA0026182) or urban runoff originating from Norton center, may contribute pollutant loadings to the Threemile River as well. In addition, Norton Reservoir, a large 303(d)-listed impoundment located just upstream from TH09 (MA DEP 2003), probably contributes organic loads to downstream aquatic communities such as TH09 where the productive nature of the river is reflected in the abundant filter-feeders present, dense macrophyte and algae cover, and instream turbidity.

Tributary to Cedar Swamp River

This tributary originates in Cedar Swamp, a vast wetland located in Freetown-Fall River State Forest. The stream flows northward through extensive tracts of undeveloped forest and wetland before entering a large, active cranberry bog immediately upstream (south) of Howland Road in Freetown. After draining the bog, the tributary continues its northerly course. Upon entering Lakeville it meanders into another large wetland area before making its confluence with Cedar Swamp River, the headwater stream of the Assonet River.

CB00—Tributary to Cedar Swamp River, mile point 1.4, approximately 300 m downstream from Howland Rd., Freetown, MA

Habitat

The CB00 sampling reach began approximately 300 m downstream from Howland Road and the adjacent cranberry bog outlet. A mainly forested (oak, *Quercus* sp.; red maple, *Acer rubrum*; white pine, *Pinus strobus*) riparian zone provided almost a completely closed canopy over the narrow (2 – 4 m wide) stream channel. Gradient in this portion of the stream increases considerably downstream from the bog, resulting in a sampling reach comprised of a series of cascading riffles (0.2 – 0.4 m deep) and plunge pools. The combination of swift current velocity and deep (0.3 – 0.5 m) pools, coupled with substrates dominated by large cobble and boulder substrates, provided both fish and macroinvertebrates with excellent habitat throughout the reach. Instream algal growth was minimal and macrophytes were absent, though mosses covered nearly half the instream substrates. Channel flow status was slightly less than optimal—water filled greater than 75% of the channel and left minimal substrate exposed but did not quite reach the base of both banks. NPS pollution inputs were not observed in the sampling reach; however, localized road runoff (sand deposits) was noted immediately downstream from the Howland Road crossing. Slight turbidity of the water column and tea-stained water at CB00 gave the stream a somewhat murky appearance—it was nearly impossible to see the stream bottom during the biosurvey. Large boulders along the stream margins provided good stability along the left (west) bank while the steep nature of the right (east) bank resulted in some small areas of erosion. Shrubs (witchhazel, *Hamamelis virginiana*; sweet pepperbush, *Clethra alnifolia*; highbush blueberry, *Vaccinium corymbosum*) and herbaceous growth provided good bank vegetation along both sides of the stream. Footpaths resulted in a few small areas of disturbed bank vegetation. The riparian zone was fairly extensive along both sides of the

sampling reach and only occasionally interrupted by small footpaths. Some nearstream lawn area was maintained by an adjacent residence along the left bank; however, potential NPS pollution inputs related to yard wastes appeared well buffered by riparian vegetation.

CB00 received a total habitat assessment score of 171/200 (Table A3). Slight increases in baseflow would improve the scores for most of those parameters that performed less than optimally. It should be mentioned that several dead yellow bullhead (*Ameiurus natalis*) were observed during the macroinvertebrate biosurvey here.

Benthos

Resident benthos at the CB00 biomonitoring station, located in an unnamed tributary never before assessed by DEP, received a total metric score of 2, representing only 5% comparability to the reference station (Table A2). As a result, the macroinvertebrate community sampled here received a bioassessment of "severely impacted" despite the excellent habitat available (Table A3). This was by far the least healthy biomonitoring station assessed by DEP during the 2001 survey, with all but one metric scoring no points. The benthic assemblage was hyperdominated by a single taxon, the isopod *Caecidotea communis*—a generalist feeder. That this species occurred in such high densities in the benthos sample is disturbing in itself, as it is considered highly tolerant of organic pollution; however, the virtual absence of EPT taxa and significant reductions in other insect taxa (Table A1), further suggest the possibility of a toxic effect in this portion of the river. Pesticide toxicity studies have found insects to be generally the most sensitive class of macroinvertebrates, while the Asellidae (e.g., *Caecidotea communis*) have been shown to be considerably less sensitive than a variety of other invertebrate and vertebrate families (Mayer and Ellersieck 1986). In addition, the absence of fish documented here by DEP during a fish population survey conducted two weeks after the 2001 macroinvertebrate survey (MA DEP, unpublished data 2001), corroborates the severe water quality degradation apparent at CB00.

While the cranberry bog located immediately upstream from CB00 may provide a significant source of organic loadings to downstream lotic communities, other potential pollutants (e.g., organo-phosphates and other pesticides known to be toxic to aquatic life) that may originate from related cranberry farming activities here should be considered as well. Preliminary water quality data (in preparation) collected by DEP during summer 2001 water quality monitoring surveys (station AS05T) near CB00 found normal (i.e., range from 7.90 mg/l to 9.90 mg/l, which is within surface water quality standards for aquatic life) dissolved oxygen levels, which further supports that factors (e.g., pesticides or other toxicants) other than organic enrichment and associated low dissolved oxygen levels impact aquatic life here. In addition, DEP water quality data (in preparation)—though limited—did not reveal elevated nutrient (nitrates or total Phosphorus) levels, which suggests that nutrient loadings associated with fertilizer applications were not a detriment to the aquatic community in this portion of the river during the time of the biomonitoring survey.

Assonet River

The Assonet River is the last of the major Taunton River tributaries before it reaches its estuary. From its source in Lakeville the Assonet River flows westerly, remaining freshwater through Lakeville and most of Freetown. As the river approaches its confluence with the Taunton River it becomes tidally influenced, widening into a broad estuary that includes Assonet Bay and several small coves.

AR00—Assonet River, mile point 3.9, 100 m downstream from Locust St., Freetown, MA

Habitat

The AR00 sampling reach began approximately 100 m downstream from the Locust Street crossing and ended at a large fallen tree that crossed the river immediately downstream from the road. Closely paralleling Route 79, the mostly shaded (75% canopy cover) stream was fairly straight (channelization associated with mill operations exists just upstream from AR00) and wide (8 m) and with only marginal channel flow status—water filled less than 75% of the channel leaving much exposed substrates

(especially along the right bank) and woody materials. Despite the low baseflow, macroinvertebrates had ample productive epifaunal habitat, which was riffle and run (0.20 – 0.30 m depth) dominated and with an abundance of cobble substrates. Dense moss cover and occasional patches of burreed (*Sparganium* sp.) provided additional microhabitat for benthic organisms. Fish habitat was also optimal—despite the lack of deep pool (0.20 m) areas, snags, submerged logs, and boulder provided stable habitat throughout the reach. Stream banks were highly stable and well vegetated with ferns, grasses, vines (*Vitis riparia*), and shrubs (sweet pepperbush, *Clethra alnifolia*; dogwood, *Cornus* sp.; buttonbush, *Cephalanthus occidentalis*). Shrub growth extended into an undisturbed riparian zone dominated by deciduous trees (red maple, *Acer rubrum*; elm, *Ulmus* sp.; along the right (west) bank. And despite the adjacent road, the wooded riparian zone along the left (east) bank provided a good buffer from potential runoff related NPS pollution inputs. Slight instream turbidity and algal cover in 10% of the sampling reach were observed.

AR00 received a total habitat score of 173/200 (Table A3). This was the second highest habitat evaluation received by a biomonitoring station in the 2001 survey. Increased baseflow would have further improved this score—particularly for Channel Flow Status and Velocity-Depth Combination parameters, which were the only habitat attributes not to score in the "optimal" category.

Benthos

The macroinvertebrate community sampled at AR00 received a total metric score of 22, representing 52% comparability to the reference community and resulting in an assessment of "slightly impacted" for biological condition (Table A2). Filter-feeding clams (Pisidiidae) and caddisflies (*Hydropsyche betteni* gr.) were the co-dominant taxa in the AR00 benthos assemblage, indicating an abundance of FPOM in this portion of the river. The impounded nature of the Assonet River no doubt results in an ample supply of suspended particulate materials that are delivered over its numerous dams to downstream lotic communities as the river makes its course towards the estuary. The extensive wetlands—including over 400 acres of cranberry bog open space—that comprise much of the Assonet River subwatershed drainage area probably contribute significant organic inputs to both the impoundments and riverine segments of the Assonet River. In addition, anthropogenic sources (e.g., urban runoff) of organic enrichment or other forms of water quality degradation may exist in this portion of the river, as the lower segment of the Assonet River—which begins just downstream from AR00—is 303(d)-listed due to pathogens (MA DEP 2003).

Rattlesnake Brook

Rattlesnake Brook originates at the confluence of two first-order streams, Mill Brook and an unnamed tributary, in Freetown-Fall River State Forest in Freetown. From this merger, Rattlesnake Brook flows in a northerly direction through undeveloped forestland before crossing Route 24/79. The stream then continues north for approximately 1 km before reaching Paynes Cove—part of Assonet Bay in the estuarine portion of the Assonet River.

RA00—Rattlesnake Brook, mile point 0.9, at trail crossing approximately 400 m upstream from Rt. 24/79, Freetown, MA

Habitat

The RA00 sampling station was located approximately 400 m upstream from Route 24/79 in a fairly remote portion of Freetown-Fall River State Forest. The narrow (1 m) reach began about 100 m downstream from a hiking trail that was accessed via an unpaved road. The steep gradient in this portion of the stream, coupled with large moss-covered cobble and boulder substrates, provided macroinvertebrates with excellent riffle (0.2 – 0.3 m depth) dominated habitat. The large instream substrates, submerged woody materials, overhanging bank vegetation, and occasional pools (0.2 m depth) provided fish with stable cover and excellent overall habitat as well. Channel flow status was optimal, with water reaching the base of both banks and leaving minimal amounts of substrates exposed. Instream vegetation and algal cover were absent. Banks were well vegetated with a variety of grasses, herbaceous (ferns and mosses) growth, and shrubs and vines (*Viburnum* sp.; sweet pepperbush, *Clethra*

alnifolia; greenbrier, *Smilax rotundifolia*; mountain laurel, *Kalmia latifolia*). Boulders and roots provided good stability along both banks. Riparian vegetation extended undisturbed in all directions of this dense forest area—red maple (*Acer rubrum*), oak (*Quercus* spp.), and white pine (*Pinus strobus*) were the predominate riparian species and provided a mostly (90% shaded) closed canopy over the RA00 sampling reach.

RA00 received a total habitat assessment score of 172/200 (Table A3). One of the higher habitat evaluations in the 2001 biomonitoring survey, only the Velocity-Depth Combinations parameter scored less than optimal due to a lack of deep pools.

Benthos

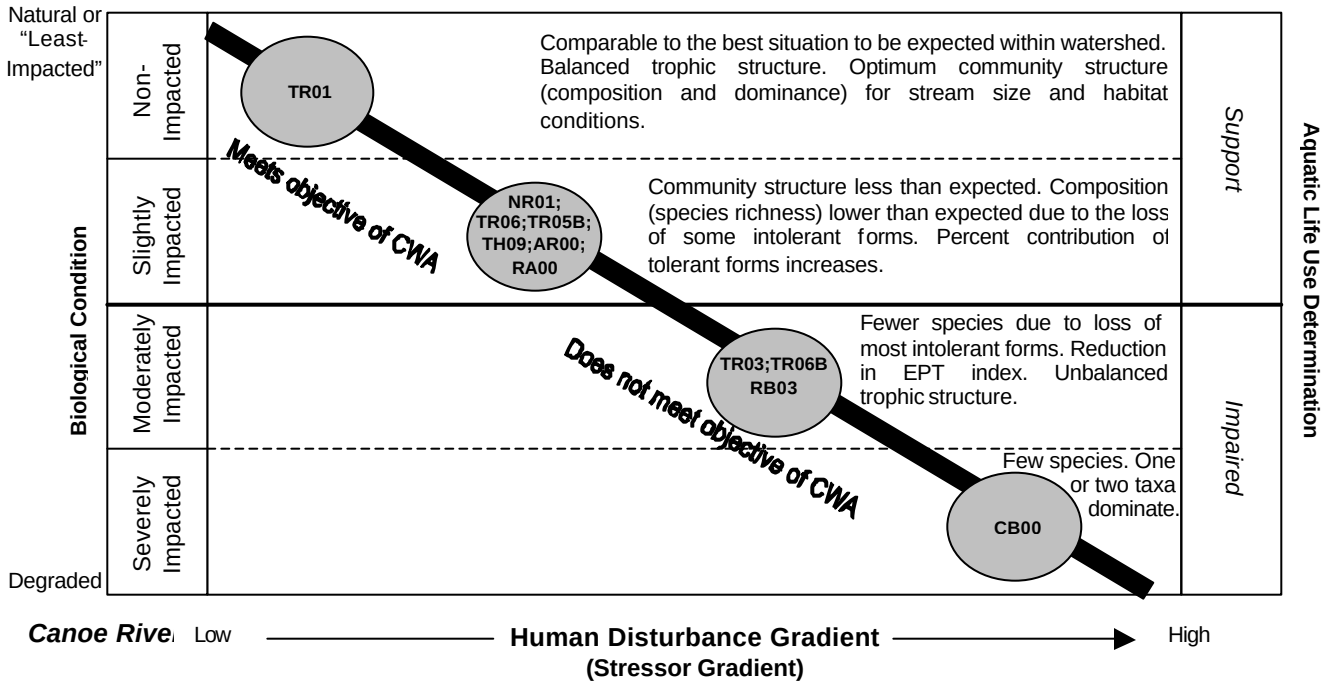
The RA00 benthic community received total metric scores of 28 and 30, representing 67% and 71% comparability to the reference station and resulting in an assessment of "slightly impacted" for biological condition (Table A2). Metric performance for EPT Index and Scrapers/Filterers, in particular, contributed most to the resulting bioassessment. It should be noted, however, that despite an EPT Index (5; score=0) that was only half that of the reference community, the majority of EPTs present here (*Leuctra* sp.; *Diplectrona modesta*) were highly sensitive taxa with a tolerance value of 0. These two co-dominants comprised well over half the assemblage at RA00, contributing to what was by far the lowest Biotic Index (3.08) received by a biomonitoring station in the Taunton River watershed survey (Table A2).

Point losses for some of the RA00 benthos metrics when compared to the reference may in fact be the result of natural conditions related to the small nature—both in terms of stream order and drainage area—of Rattlesnake Brook, a first-order stream draining considerably less area than the Canoe River subwatershed. As a headwater stream, naturally unproductive conditions may actually lead to slight reductions in total taxa richness—including the suppression of the EPT component of the benthos assemblage—at RA00. Likewise, the absence here of scrapers normally associated with periphyton-based benthic communities is not surprising, as algal food resources are generally not as prevalent in heavily forested headwater streams such as this. With the exception of four elmid beetles (*Oulimnius latiusculus*), scrapers were missing entirely from the RA00 assemblage, resulting in a low (score=2) scoring value for the Scrapers/Filterers metric (Table A2).

SUMMARY AND RECOMMENDATIONS

With the exception of a few tributaries (Canoe River, Rattlesnake Brook) that exhibited minimally impacted conditions for the Taunton River watershed, most biomonitoring stations investigated during the 2001 survey indicated various degrees of impairment. Impacts to the resident biota at these sites were generally a result of habitat degradation and/or nonpoint source-related water quality impairment, with occasional point source effects observed as well.

The schematic below is based on a proposed conceptual model that predicts the response of aquatic communities to increasing human disturbance. It incorporates both the biological condition impact categories (non-, slightly, moderately, severely impacted) outlined in the RBPIII biological assessment methodology currently used by MA DEP and the Tiered Aquatic Life Use (TALU) conceptual model developed by US EPA and refined by various state environmental agencies (US EPA 2003). The model summarizes the main attributes of an aquatic community that can be expected at each level of the biological condition category, and how these metric-based bioassessments can then be used to make aquatic life use determinations as part of the 305(b) reporting process. Minimally or non-impacted aquatic communities—such as those encountered at TR01, NR01, TR06, TR05B, TH09, AR00, and RA00—support the Massachusetts SWQS designated *Aquatic Life* use in addition to meeting the objective of the Clean Water Act (CWA), which is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters (Environmental Law Reporter 1988). Moderately and severely impacted communities observed at TR03, TR06B, RB03, and CB00 do not support the *Aquatic Life* use and fail to meet the goals of the CWA.



TR01

Benthos: Taunton River watershed reference station.
Habitat: Taunton River watershed reference station.

The TR01 macroinvertebrate community was thought to represent the "best attainable" (i.e., least-impacted) conditions in the watershed with respect to biological integrity and water quality. Despite instream habitat parameters that were compromised by naturally occurring low baseflow, the TR01 benthos assemblage was dominated by numerous pollution sensitive taxa and displayed balanced trophic structure. As a reference condition, biomonitoring is recommended here during the next DEP Taunton River watershed survey in 2006. Fish population sampling, which has not historically been performed by DEP at this station, should accompany the macroinvertebrate sampling effort.

Salisbury Plain River

TR03

Benthos: "Moderately impacted" compared to reference station.
Habitat: 100% comparable to reference station.

Despite the high quality benthos habitat available throughout the TR03 sampling reach, the macroinvertebrate community appeared structured in response to organic enrichment and possibly low dissolved oxygen levels, with low total taxa richness and a lack of pollution sensitive EPT taxa. The presence of indicator species of chironomids associated with organic materials and sewage "recovery zones" corroborates water quality degradation probably associated with the Brockton WWTP discharge. Dense (100%) algal and macrophyte cover here suggests considerable nutrient loads in this portion of the river.

Biomonitoring is recommended here during the next DEP Taunton River watershed survey in 2006. Fish population sampling should accompany the macroinvertebrate sampling effort. As water quality limits biological integrity in this portion of Salisbury Plain River, additional monitoring of various physico-chemical parameters would be instrumental in determining the specific types of water quality degradation

present here, as would a review of water quality data (in preparation) collected by DEP in 2001. In addition, a site investigation and NPDES permit review of the Brockton WWTP is recommended.

Satucket River

SR00

Benthos: Not compared to reference station.
Habitat: Not compared to reference station.

A qualitative sampling effort here yielded a seemingly diverse and well-balanced macroinvertebrate community typical of a healthy or minimally impacted low-gradient stream system. While habitat constraints made it impossible for DWM to effectively assess the aquatic community in this portion of the Satucket River, efforts should be made to re-assess biological status during the 2006 Taunton River biomonitoring survey—possibly after further development by DWM of macroinvertebrate sampling methodologies that accurately assess biological condition in low-gradient, wetland-dominated stream systems. Biomonitoring is recommended here again as part of the 2006 monitoring efforts for the Taunton River watershed. Additional monitoring of various physico-chemical parameters would help in determining the presence or absence of water quality impairment here, as would a review of water quality data (in preparation) collected by DEP in 2001.

Nemasket River

NR01

Benthos: "Slightly impacted" compared to reference station.
Habitat: 78% comparable to reference station.

Upstream impoundments probably supply an ample source of FPOM to the numerous filter-feeding macroinvertebrates that dominate the NR01 benthos assemblage. Other sources of organic enrichment, such as extensive upstream wetland/bog areas, numerous golf courses, and urban runoff associated with downtown Middleborough, may also be responsible for the delivery of the FPOM resource that shapes community structure and function at downstream macroinvertebrate populations in the Nemasket River. A review of water quality data (in preparation) collected by DEP in 2001 may help in determining the types of water quality impairment present here.

In addition, the removal of bank and riparian vegetation along both sides of the river here, and the severe alteration of channel morphology from historical mill activity, threaten biological health due to the potential for scouring and reduced buffering capacity from NPS pollution inputs. Improvements to the riparian zone through the re-establishment of streamside vegetation would help to minimize the effects of NPS pollution originating from adjacent lawn, road, and parking lots.

Rumford River

TR06

Benthos: "Slightly impacted" compared to reference station.
Habitat: 95% comparable to reference station.

Low baseflow conditions—and probably to a lesser degree, sediment deposition (which was not observed here in 1996)—appear to influence aquatic health in this portion of the Rumford River more than water quality effects. And while low flow effects here may be naturally occurring, there also exists the possibility that these conditions are exacerbated by upstream water withdrawals (Sharon wellfields) in the vicinity of Gavins Pond. Maintaining current baseflows here will be instrumental in minimizing low flow effects on the resident biota (periphyton and benthos). An investigation into the source of turbidity and sediment inputs to

the Rumford River is recommended. BMPs may help to alleviate the impacts of sand and other forms of road runoff in the vicinity of Cocasset Street and elsewhere in the subwatershed.

Because the level of bioassessment of the 2001 benthos data differed from DEP's 1988 efforts, it is difficult to determine if water quality has improved or worsened in this portion of the Rumford River. In an attempt to better discern trends in water quality conditions in the lower Rumford River, biomonitoring (RBPIII) is recommended during the next DEP Taunton River watershed survey in 2006. Fish population sampling should accompany the macroinvertebrate sampling effort.

TR06B

Benthos: "Moderately impacted" compared to reference station.
Habitat: 100% comparable to reference station.

The benthic community sampled here was clearly indicative of an overabundance of FPOM, with filter-feeders comprising 85% of the sample and displacing many of the more sensitive EPT taxa. The impacted aquatic community observed at TR06B was somewhat expected, as this segment of the Rumford River is 303(d)-listed for organic enrichment. Historical biomonitoring activities conducted near TR06B by DEP revealed a similarly impaired benthos assemblage, suggesting that water quality has not improved in the lower Rumford River since 1988. A review of water quality data (in preparation) collected by DEP in 2001 may help in determining the types of water quality impairment present here.

Instream deposits of sand and FPOM threaten habitat quality and biological potential here as well, although the urbanized nature of this portion of the Rumford River subwatershed may make it difficult to isolate specific sources (e.g., road runoff, stormwater, etc.) of inorganic and/or organic loadings. Turbidity is also an issue here.

Robinson Brook

RB03

Benthos: "Moderately impacted" compared to reference station.
Habitat: 100% comparable to reference station.

Aquatic health appears to remain unchanged at RB03 since the 1988 biomonitoring survey. Benthic community structure and function continue to appear strongly influenced by organic enrichment, though sources of organic inputs and turbidity are unknown. A review of water quality data (in preparation) collected by DEP in 2001 may help in determining the types of water quality impairment present here.

Sediment inputs responsible for instream habitat degradation at RB03 probably compromise biological potential here as well—though probably to a lesser degree than water quality effects. BMPs at the two major road crossings upstream from RB03—Routes 95 and 140—may be necessary to minimize the effects of sediment inputs and other NPS pollutants associated with road runoff. The effects of instream deposition on habitat quality, while mainly confined to pool areas, no doubt poses a threat to epifaunal riffle habitat here as well. If NPS pollution controls such as BMPs are in fact utilized upstream from RB03, DEP should consider conducting biomonitoring here during the next DEP Taunton River watershed survey in 2006. Fish population sampling should accompany the macroinvertebrate sampling effort.

Wading River

TR05B

Benthos: "Slightly impacted" compared to reference station.
Habitat: 100% comparable to reference station.

While the biological assessment of TR05B remains unchanged since the last DEP biosurvey conducted in 1996, the organic enrichment reflected in both surveys and responsible for shaping community structure may be less pronounced now than during DEP's original 1988 bioassessment here. Water quality degradation resulting from heavy organic loadings in this portion of the Wading River during the 1988 survey resulted in an overabundant food resource which supported an unbalanced and "moderately impaired" macroinvertebrate community at TR05B (Fiorentino 1996). Since the 1988 survey, however, TR05B has seen the reemergence of other trophic groups, such as algal scrapers, that may be less tolerant of organic enrichment. At the same time, some taxa fairly tolerant of organic pollution—most notably the Chironomidae and Pisidiidae—have seen declines in numbers even since the 1996 biosurvey. It is possible that decreases in the volume of effluent discharged by Tweave, Inc. (Paul Hogan, MA DEP, personal communication, 2003), and the termination of the discharge of C. A. Richardson, Inc. since the 1996 biosurvey has led to slight improvements in water quality in this portion of the Wading River.

To continue to document possible improvements in water quality (and hopefully biological integrity) in the lower Wading River, biomonitoring is recommended during the next DEP Taunton River watershed survey in 2006. A fish population survey should accompany the macroinvertebrate sampling effort.

Threemile River

TH09

Benthos: "Slightly impacted" compared to reference station.
Habitat: 100% comparable to reference station.

Based on the excellent habitat available here for macroinvertebrates, impacts to the biota can be attributed to water quality degradation; however, water quality may have improved here since the last biomonitoring survey conducted by DEP in 1988, which found a "moderately impaired" benthic community (Fiorentino 1996). The organic enrichment that appears to continue to shape benthic community structure and function in this portion of the river probably originates from multiple upstream sources—most notably, wastewater treatment facility discharges (Mansfield WWTP, Wheaton College) and productive impoundments (Norton Reservoir).

While recent improvements in effluent treatment at the Mansfield WWTP may contribute to observed improvements in biological integrity at RB03, an NPDES permit review may be warranted for the Wheaton College facility, as their treated wastewater quality is suspect and their current permit is scheduled for reissuance in 2004 (Paul Hogan, MA DEP, personal communication, 2003).

Biomonitoring is recommended here during the next DEP Taunton River watershed survey in 2006, especially if the Wheaton College WWTP is subjected to new permit limit requirements or treatment upgrades before then. Fish population sampling should accompany the macroinvertebrate sampling effort. As water quality appears to limit biological integrity in this portion of the Threemile River, additional monitoring of various physico-chemical parameters in 2006 would be instrumental in determining the specific types of water quality degradation present here, as would a review of water quality data (in preparation) collected by DEP in 2001.

Tributary to Cedar Swamp River

CB00

Benthos: "Severely impacted" compared to reference station.
Habitat: 100% comparable to reference station.

Despite the high quality epifaunal habitat available in the CB00 sampling reach, the aquatic community here was severely impacted. While the hyperdominance of isopods in the benthos assemblage suggests severe organic pollution, the absence of other taxa (both tolerant and intolerant), the low overall densities of organisms, and observed dead fish in the reach, may be indicative of water quality degradation associated with the presence of a toxicant. An investigation of the upstream cranberry farm is highly recommended, especially a review of herbicide, pesticide, and fertilizing applications associated with farming operations. Flow manipulation associated with cranberry farming activities, including the holding back and release of water at the bog outlet, should be considered as well.

To determine if in fact cranberry farming activities are directly responsible for water quality and biological impairment downstream, DEP should consider additional site-specific biomonitoring in this tributary—bracketing the cranberry bog with both an upstream and downstream macroinvertebrate sampling station. Topographic map examinations reveal a segment of this tributary upstream from the bog that (adjacent to the sand and gravel pit located off Slab Bridge Road in Freetown) may have the necessary gradient for applying the same kick sampling methodology utilized at CB00.

Due to the severity of impairment observed at CB00, DEP should consider the above recommended investigations before the next round of regularly scheduled monitoring in the Taunton River watershed.

Assonet River

AR00

Benthos: "Slightly impacted" compared to reference station.
Habitat: 100% comparable to reference station.

An abundance of suspended organic particulate material supports a filter-feeding dominated macroinvertebrate assemblage in this portion of the Assonet River. Wetlands and bogs probably contribute much of the organic load that shape community structure and function at AR00, though anthropogenic sources may exist as well. Productive instream conditions are probably exacerbated by the impounded nature of much of this river. A review of water quality data (in preparation) collected by DEP in 2001 may help in determining specific types of water quality impairment present here.

Rattlesnake Brook

RA00

Benthos: "Slightly impacted" compared to reference station.
Habitat: 100% comparable to reference station.

Despite a reduced EPT Index compared to the reference station, most taxa present at RA00—including 33 intolerant plecopterans—were highly sensitive to pollution and contributed to the lowest Biotic Index in the entire survey. The resulting "slightly impacted" bioassessment here may not be the result of water quality degradation; but rather, naturally unproductive conditions and an inappropriate reference station.

Biomonitoring is recommended here during the next DEP Taunton River watershed survey in 2006 to continue to assess the biological health in what appears to be a minimally-impacted tributary. Future

assessments should use a reference station more suitable (i.e., small, first-order headwater stream) than TR01 for biological comparisons to RA00. In addition to benthic macroinvertebrate biomonitoring, attempts should be made to conduct fish population sampling here to determine the stream's potential as a cold-water fishery. Furthermore, water quality monitoring here would help to establish baseline conditions while supplementing the biological data. To maintain the biological integrity of Rattlesnake Brook, every effort should be made to properly manage land development in this relatively pristine subwatershed.

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APPENDIX

Macroinvertebrate taxa list, RBPIII benthos analysis, and Habitat evaluations

Table 1. Species-level taxa list and counts, functional feeding groups (FG), and tolerance values (TV) for macroinvertebrates collected from stream sites during the 2001 Taunton River watershed biomonitoring survey between 30 July and 2 August 2001. An "x" indicates taxon presence at station sampled qualitatively. Refer to Table 1 for a listing and description of sampling stations.

TAXON	FG[1]	TV[2]	TR01 (Sub1)[3]	TR01 (Sub2)[4]	TH09	RA00	CB00	TR06	RB03	TR06B	NR01	NR01 (dup)[5]	TR05B	TR03	AR00	SR00[6]
Hydrobiidae	SC	8														x
Planorbidae	SC	6										1				x
Pisidiidae	FC	6	1		1			2					3		18	x
Nais behningi	GC	6													2	
Nais communis	GC	8						1	3		1	2				
Pristina aequiseta	GC	8					1									
Pristinella acuminata	GC	10					1									
Pristinella osborni	GC	10						3								
Tubificidae	GC	10					1									
Tubificidae IWB	GC	10					1	2				1	1	2		
Lumbriculidae	GC	7		1		1			2	2			3		1	
Caecidotea communis	GC	8					67							8		x
Crangonyx sp.	GC	6							13							
Gammarus sp.	GC	6						2	6	1	4	9				x
Hyalella azteca	GC	8														x
Hydrachnidia	PR	6			1	4	5		1			1	2			x
Baetidae	GC	4														x
Baetis (cerci only) sp.	GC	6									19	17				
Baetis (3-tailed) sp.	GC	6			3											
Ephemerellidae	GC	1									1					
Eurylophella sp.	GC	2	4	3												
Heptageniidae	SC	4									2	1				
Stenonema sp.	SC	3	7	8						1			8		7	x
Leptophlebiidae	GC	2		2				3								x
Aeschnidae	PR	3														x
Boyeria sp.	PR	2		1												
Calopterygidae	PR	5													1	x
Coenagrionidae	PR	9														x
Cordulegaster sp.	PR	3				1										
Lestidae	PR	9		1												
Plecoptera	GC	3				1										
Allocapnia sp.	SH	3	7	12		3		2								
Leuctra sp.	SH	0	1	7		27		1								
Leuctridae/Capniidae	SH	2	4													
Perlodidae	PR	2	1	4												
Corydalidae	PR	5														x
Nigronia sp.	PR	0		1				2	2						2	
Sialis sp.	PR	4														x
Brachycentrus sp.	FC	1			2											
Micrasema sp.	SH	2										1				
Glossosoma sp.	SC	0			1											
Hydropsychidae	FC	4	3						5				5			x
Cheumatopsyche sp.	FC	5	1			1			9	7	6	5	2	8		
Diplectrona modesta	FC	0	5	4		19	1	1								
Hydropsyche sp.	FC	4	1	1												
Hydropsyche betteni gr.	FC	6			19			22	31	41	22	29	20	1	29	
Hydropsyche morosa gr.	FC	6													4	
Macrostemum z ebratum	FC	3											12			x
Hydroptila sp.	GC	6		2												

TAXON	FG[1]	TV[2]	TR01 (Sub1)[3]	TR01 (Sub2)[4]	TH09	RA00	CB00	TR06	RB03	TR06B	NR01	NR01 (dup)[5]	TR05B	TR03	AR00	SR00[b]
Lepidostoma sp.	SH	1			4	1										
Leptoceridae	PR	4														x
Oecetis sp.	PR	5								2	3	1	2		2	
Triaenodes sp.	SH	6								1						
Pycnopsyche sp.	SH	4								2						x
Psilotreta sp.	SC	0													2	
Philopotamidae	FC	3						1								x
Chimarra sp.	FC	4	1	2	15			2	13	14	1	2	14		8	
Wormaldia sp.	FC	0											1			
Rhyacophila sp.	PR	1		1												
Elmidae	SC	4		1	2			1								x
Ancyronyx variegata	GC	5														x
Dubiraphia sp.	GC	6														x
Macronychus glabratus	SH	5														x
Optioservus sp.	SC	4			6											
Oulimnius latiusculus	SC	4		1	5	4		4								
Promoresia sp.	SC	2									1					
Promoresia tardella	SC	2			5											
Stenelmis sp.	SC	5			9			5			2	2	10		1	x
Dineutus sp.	PR	4														x
Psephenus herricki	SC	4													1	
Ceratopogonidae	PR	6		1												
Chironomidae	GC	6	9	4	2	12	1	6		3			2	7	3	x
Microtendipes pedellus gr.	FC	6	1	1												
Polypedilum sp.	SH	6							1							
Polypedilum aviceps	SH	4	3	2					1							
Polypedilum fallax	SH	6			1											
Polypedilum flavum	SH	6			2			3				1		22		
Polypedilum illinoense	SH	6				1	10							1		
Polypedilum laetum	SH	6													1	
Polypedilum scalaenum	SH	6												2		
Xenochironomus xenolabis	PR	0												1		
Tanytarsini	FC	6			1											
Micropsectra sp.	GC	7	19	16				2							6	
Micropsectra/Tanytarsus sp.	FC	7	3			6										
Paratanytarsus sp.	FC	6												2		
Rheotanytarsus exiguus gr.	FC	6	1		8	4				3			1	9		
Rheotanytarsus pellucidus	FC	5	10	2	1	1		1		20		1	4	25		
Stempellinella sp.	GC	2	2	1												
Tanytarsus sp.	FC	6	9	5		2		2			6				2	
Zavrelia/Stempellinella sp.	GC	4									1	1				
Diamesa sp.	GC	5							1							
Potthastia longimana gr.	GC	2						1								
Orthocladiinae	GC	5					1				2					
Brillia sp.	SH	5						1								
Cardiocladius sp.	PR	5										1				
Cardiocladius albiplumus	PR	5									3					
Corynoneura sp.	GC	4				1										
Cricotopus sp.	SH	7										1				
Cricotopus bicinctus	GC	7									1	1				
Cricotopus /Orthocladius sp.	GC	7					1		1		1	1				
Eukiefferiella sp.	GC	6				1									2	

TAXON	FG[1]	TV[2]	TR01 (Sub1)[3]	TR01 (Sub2)[4]	TH09	RA00	CB00	TR06	RB03	TR06B	NR01	NR01 (dup)[5]	TR05B	TR03	AR00	SR00[b]
Heterotrissocladius sp.	GC	4	1													
Orthocladius sp.	GC	6									1					
Parametriocnemus sp.	GC	5	2					10	2							
Rheocricotopus sp.	GC	6				1					3	1				
Synorthocladius sp.	GC	6			1						1	1				
Thienemanniella sp.	GC	6						1				1				
Tvetenia bavarica gr.	GC	5	7	4				9	1	1						
Tvetenia vitracies gr.	GC	5			2	1					5	5	1			
Tanypodinae	PR	7			1	1										
Conchapelopia sp.	PR	6	1	2		3		4	1			1		3	5	
Nilotanypus sp.	PR	6													1	
Thienemannimyia sp.	PR	6		1		3										
Thienemannimyia gr.	PR	6						2								
Trissopelopia sp.	PR	4		2												
Chelifera sp.	PR	6				1										
Hemerodromia sp.	PR	6		2		1		1		2						
Simuliidae	FC	6														x
Simulium sp.	FC	5		1				3			2					
Simulium jenningsi	FC	4									15	19	2			
Simulium vittatum cpl.	FC	9												4		
Tipulidae	SH	5						1								
Antocha sp.	GC	3											1			
Tipula sp.	SH	6				2										
TOTAL			**92**	**103**	**90**	**104**	**96**	**101**	**93**	**100**	**103**	**107**	**94**	**95**	**98**	**na**

[1]Functional Feeding Group (FG) lists the primary feeding habit of each species and follows the abbreviations: SH-Shredder; GC-Gathering Collector; FC-Filtering Collector; SC-Scraper; PR- Predator.
[2]Tolerance Value (TV) is an assigned value used in the calculation of the biotic index. Tolerance values range from 0 for organisms very intolerant of organic wastes to 10 for very tolerant organisms.
[3] Reference station – first 100-organism subsample
[4] Reference station – second 100-organism subsample
[5] Duplicate sample (collected at NR01)
[6] Qualitative sample collected at this station

Table 2. Summary of RBP III data analysis for macroinvertebrate communities sampled during the Taunton River watershed survey between 30 July and 2 August 2001. Shown are the calculated metric values, metric scores (in italics) based on comparability to the regional reference station (TR01), and the corresponding assessment designation for each biomonitoring station. Refer to Table 1 for a listing and description of sampling stations.

STATION	**TR01***		**TR03**		**NR01**		**NR01** (duplicate)		**TR06**		**TR06B**		**RB03**		**TR05B**		**TH09**		**CB00**		**AR00**		**RA00**	
STREAM	Canoe River		Salisbury Plain River		Nemasket River		Nemasket River (duplicate)		Rumford River		Rumford River		Robinson Brook		Wading River		Threemile River		Cedar Swamp River trib.		Assonet River		Rattlesnake Brook	
HABITAT SCORE	153		168		119		119		146		159		162		173		180		171		173		172	
TAXA RICHNESS	25	*6*	13	*2*	20	*4*	24	*6*	27	*6*	13	*2*	15	*2*	17	*4*	19	*4*	8	*0*	19	*4*	22	*6*
BIOTIC INDEX	4.37	*6*	5.97	*4*	5.36	*4*	5.50	*4*	5.32	*4*	5.37	*4*	5.42	*4*	4.69	*6*	4.66	*6*	7.58	*2*	5.39	*4*	3.08	*6*
EPT INDEX	10	*6*	2	*0*	7	*0*	7	*0*	6	*0*	7	*0*	3	*0*	7	*0*	6	*0*	1	*0*	6	*0*	5	*0*
EPT/CHIRONOMIDAE	0.82	*6*	0.13	*0*	2.25	*6*	3.50	*6*	0.76	*6*	2.52	*6*	7.25	*6*	8.00	*6*	2.32	*6*	0.08	*0*	2.60	*6*	1.41	*6*
SCRAPERS/FILTERERS	0.41	*6*	0	*0*	0.10	*2*	0.07	*0*	0.29	*6*	0.01	*0*	0	*0*	0.28	*6*	0.60	*6*	0	*0*	0.18	*4*	0.12	*2*
% DOMINANT TAXON	18%	*6*	26%	*4*	21%	*4*	27%	*4*	22%	*4*	41%	*0*	33%	*2*	21%	*4*	21%	*4*	74%	*0*	30%	*2*	26%	*4*
COMMUNITY SIMILARITY**	100%	*6*	76% 60%	*6* *4*	45% 58%	*2* *4*	37% 49%	*2* *2*	59% 68%	*4* *6*	40% 43%	*2* *2*	20% 27%	*0* *0*	29% 38%	*0* *2*	36% 39%	*2* *2*	17% 24%	*0* *0*	39% 48%	*2* *2*	60% 81%	*4* *6*
TOTAL METRIC SCORE	*42*		*16* *14*		*22* *24*		*22* *22*		*30* *32*		*14* *14*		*14* *14*		*26* *28*		*28* *28*		*2* *2*		*22* *22*		*28* *30*	
% COMPARABILITY TO REFERENCE STATION			38% 33%		52% 57%		52% 52%		71% 76%		33% 33%		33% 33%		62% 67%		67% 67%		5% 5%		52% 52%		67% 71%	
BIOLOGICAL CONDITION (DEGREE OF IMPACT)	**REFERENCE**		**MODERATELY IMPACTED**		**SLIGHTLY IMPACTED**		**SLIGHTLY IMPACTED**		**SLIGHTLY IMPACTED**		**MODERATELY IMPACTED**		**MODERATELY IMPACTED**		**SLIGHTLY IMPACTED**		**SLIGHTLY IMPACTED**		**SEVERELY IMPACTED**		**SLIGHTLY IMPACTED**		**SLIGHTLY IMPACTED**	

*Reference station; metric values represent mean of values for each of two 100-organism subsamples
**Test stations receive two values for this metric because similarity is calculated against each of the two reference station subsamples. As a result, two Total Metric Scores are possible.

Table 3. Habitat assessment summary for biomonitoring stations sampled during the 2001 Taunton River watershed survey. For primary parameters, scores ranging from 16-20 = optimal; 11-15 = suboptimal; 6-10 = marginal; 0-5 = poor. For secondary parameters, scores ranging from 9-10 = optimal; 6-8 = suboptimal; 3-5 = marginal; 0-2 = poor. Refer to Table 1 for a listing and description of sampling stations.

STATION	TR01*	TR03	SR00	NR01	TR06	TR06B	RB03	TR05B	TH09	CB00	AR00	RA00
PRIMARY PARAMETERS (range is 0-20)	**SCORE**											
INSTREAM COVER	6	20	20	5	7	11	17	18	19	18	18	17
EPIFAUNAL SUBSTRATE	12	19	6	19	17	17	18	16	19	18	19	18
EMBEDDEDNESS	20	14	13	19	16	13	19	14	13	18	19	20
CHANNEL ALTERATION	20	16	20	5	20	20	20	18	20	19	19	17
SEDIMENT DEPOSITION	18	16	17	18	10	7	7	18	16	17	19	16
VELOCITY-DEPTH COMBINATIONS	8	20	11	10	9	15	13	16	16	14	11	11
CHANNEL FLOW STATUS	9	18	16	20	15	17	12	16	17	15	9	16
SECONDARY PARAMETERS (range is 0-10 for each bank)	**SCORE**											
BANK VEGETATIVE PROTECTION left	10	10	8	1	6	10	9	10	10	9	10	9
BANK VEGETATIVE PROTECTION right	10	7	10	1	10	10	9	10	10	8	10	9
BANK STABILITY left	10	10	10	10	8	10	9	8	10	9	10	9
BANK STABILITY right	10	5	10	10	10	9	9	10	10	8	10	10
RIPARIAN VEGETATIVE ZONE WIDTH left	10	10	4	1	8	10	10	9	10	9	9	10
RIPARIAN VEGETATIVE ZONE WIDTH right	10	3	10	0	10	10	10	10	10	9	10	10
TOTAL SCORE	**153**	**168**	**155**	**119**	**146**	**159**	**162**	**173**	**180**	**171**	**173**	**172**

*Reference station

APPENDIX E

TECHNICAL MEMORANDUM TM-62-2
Taunton River Watershed Benthic Macroinvertebrate Biomonitoring

To: Taunton River Watershed Team
From: John Fiorentino
Date: 25 November 1996

INTRODUCTION

Biological monitoring is a useful means of detecting anthropogenic impacts on the aquatic community. Resident biota (e.g. benthic macroinvertebrates, fish, periphyton) in a water body are natural monitors of environmental quality and can reveal the effects of episodic as well as cumulative pollution and habitat alteration (Plafkin et al. 1989, Barbour et al. 1995). Biological surveys and assessments are the primary approaches to biomonitoring.

Robert Nuzzo and I attempted to conduct biomonitoring at 9 sites requested by the Taunton River Watershed Team as part of the 1996 basin survey. Where possible, biosurveys were conducted--incorporating the collection of macroinvertebrates with an assessment of habitat--to evaluate habitat and water quality. At some sites, however, habitat considerations made in inappropriate to apply our standard monitoring protocol. In these cases we are able only to provide notes from our field observations, in the event that they may help in your evaluation of the status of these sites.

METHODS

A 100 m stream reach was evaluated for availability of productive habitat for benthic macroinvertebrates. Ten "kicks" or "jabs" (for a total of 2 m^2) were apportioned to productive habitats representing at least 10% of such habitat within the reach. For purposes of this sampling, habitats with adequate current velocity passing over rocky substrate, "snags," aquatic vegetation, or exposed root masses were considered "productive." A kick-net with an opening approximately 0.45 m wide and with a mesh size of 590 microns was used.

A subsample of 100 macroinvertebrates was separated from the original sample collected at each site, and specimens were identified to family (Rapid Bioassessment Protocol II, or RBP II), to the extent their condition allowed. Based on this family-level taxonomy, various community, population, and functional parameters, or "metrics," are calculated which allow us to measure important aspects of the biological integrity of the community. This integrated approach provides more assurance of a valid assessment because a variety of parameters are evaluated. Deficiency of any one metric should not invalidate the entire approach (Plafkin et al. 1989). The percent comparability of study site metric scores to those for a selected unimpaired regional reference (i.e. "best attainable" situation) station and/or upstream control station yields an impairment score for each site. RBP II analysis separates sites into three categories: nonimpaired, moderately impaired, and severely impaired. Impairment of the benthic community may be indicated by the absence of generally pollution-sensitive macroinvertebrate taxa such as Ephemeroptera, Plecoptera, and Trichoptera (EPT); dominance of a particular taxon, especially the pollution-tolerant Chironomidae and Oligochaeta taxa; low taxa richness; or shifts in community composition relative to the reference station (Plafkin et al. 1989).

RBP II also utilizes a habitat assessment matrix for rating habitat quality, an integral component to the final evaluation of impairment. The habitat assessment approach is intended to support the biosurvey and enhance the interpretation of the biological data. The matrix used to assess habitat quality is based on key physical characteristics of the water body and surrounding land use. All parameters evaluated are related to overall land use and are potential sources of limitation to the aquatic biota (Plafkin et al. 1989). The habitat parameters included in the matrix were evaluated at all sites sampled in the Taunton River Watershed. Ratings were then totaled and compared to either a regional reference station or a site-specific (i.e. upstream control) reference station to provide a final habitat ranking.

RESULTS

The taxonomic list of macroinvertebrates obtained from the subsamples from each site is attached as an appendix (Appendix 1). Included in this list are total organism counts and the biotic index (HBI) calculated for each station. Summary tables of the RBP II biological metric calculations, including impairment scores, are attached as Appendix 2. Habitat assessment scores for each site are also included in the summary tables.

TR01--Canoe River, Foxborough MA (1 August 1996)

HABITAT

We originally approached the potential sampling reach from East St. in Foxborough on 31 July 1996. Hiking several hundred meters upstream from East St. we found the stream to be of generally excellent habitat quality, with nice cobble/boulder-dominated substrates and a natural meander through dense woodland. We lost the main channel in an area of dense shrubs and inadvertently found ourselves following a small, slow moving tributary through an extensive wetland area. Several properties abutted the wetland and appeared to have been using the land for dumping trash and yard waste for quite some time. We attempted to establish our sampling reach upstream of the majority of these anthropogenic disturbances and the channel that flows through them.

On 1 August 1996 we approached the stream from the next road crossing upstream from East St., at Willow St. The river corridor above and below Willow St. is designated conservation land by the town of Foxborough; however, a quick hike upstream of Willow St. found Canoe River to be of insufficient gradient, lacking the flow regimes necessary to apply our sampling protocol. These flow restraints were unfortunate, as immediately downstream of Willow St. was a small horse farm and riding paddock, with obvious evidence of manure spreading. While the farm itself is situated quite close to Canoe River, it appears to be well buffered from the river by dense shrub cover and grape vines. With that said, we followed the stream a few hundred meters downstream of Willow St. and the horse farm to a suitable reach to be sampled. Habitat here was very good--dominated by cobble/gravel substrates and good velocity throughout. We concentrated our sampling efforts in these well-oxygenated rocky areas, although a single jab was apportioned to a snag habitat as well. Channel morphology seemed natural, meandering through woodland with a low-lying floodplain. The overall habitat assessment score was 181 out of a possible 200.

This station was designated a regional reference station for the Taunton River Watershed by virtue of its high habitat assessment score, and minimal upstream and surrounding gross land use abuses (e.g. few if any point sources, lack of near stream agriculture and channelization activity, relatively little development, undisturbed riparian zones with woody vegetation) relative to the overall watershed. While the horse farm no doubt is a potential contributor to nonpoint source pollution, we still felt TR01 best represented the watershed as a “least impacted” site in terms of habitat and water quality.

BENTHOS

Because TR01 is a reference station, it does not receive an impairment score. The total metric score is a 39 out of a possible 42, which seems to reflect the healthy invertebrate community one would expect to find in a “least impacted” stream site.

TR02--Salisbury Plain River, Brockton MA (18 July 1996)

HABITAT

A site-specific (upstream/downstream) sampling approach was implemented in an attempt to bracket the effects of the Brockton WWTP discharge on the Salisbury Plain River. TR02, located upstream of the treatment plant, was used as the site-specific reference, or “control” site for TR03, located downstream of the discharge. In addition, both stations were compared to the regional reference station TR01.

TR02 was immediately downstream of the footbridge at the Trinity apartment complex, and was easily accessed via a footpath across the stream from the complex. While recent channelization was not evident, the reach was quite straight and obviously not flowing in a natural pattern. An extensive parking lot serving the apartments ran adjacent to the river, with only a very narrow buffer zone of “false bamboo” along a steep embankment to the water. Just above the reach, from the footbridge to Grove St., the river was severely

channelized with concrete embankments. It was difficult to find enough suitable invertebrate habitat to produce a 2 m^2 sample area. While current velocity was good throughout the reach, substrates were instable, comprised mainly of shifting sand. Considerable deposition of sand was prevalent in pools and on new bars. Where larger rocky substrates existed, severe embeddedness had displaced most of the available habitat. Much of the substrate was of anthropogenic origin, including glass, ceramic, pipe, metals, plastics, etc. Finally, storm drain discharges entered the river from both banks midreach.

The overall habitat assessment score for TR02 was 140. This was the lowest score received by a station where biomonitoring was conducted during the 1996 survey.

BENTHOS

The total metric score for TR02 was 15--the lowest received by a station in the 1996 survey, and only 38% comparable to the Canoe River reference station. Those scores for the most statistically reliable (i.e. lowest inherent variability) metrics--specifically taxa richness, EPT index, and biotic index (Resh 1988)--are particularly low, indicative of decreasing water quality, habitat suitability, and habitat diversity. The dominance of only a few, tolerant taxa (biotic index= 6.28; % contribution dominant family= 67%) is further indication of environmental stress to the aquatic community here. RBP II analysis placed this site in the moderately impaired category.

Several factors associated with its urban setting probably contribute to the degraded status of TR02. Urban runoff from the parking lot adjacent to the stream reach and from Grove St. just upstream of the reach, as well as storm drain discharges into the stream midreach, are probably the primary nonpoint sources affecting water quality. In addition, the stream is being subjected to considerable habitat degradation. Sand, possibly entering the stream from the parking lot or further upstream, is being deposited in pools and on hard substrates, reducing the availability of suitable habitat for macroinvertebrates and fish. An abundance of anthropogenic debris throughout the reach is also responsible for habitat alteration, and probably water quality impairment as well.

TR03--Salisbury Plain River, East Bridgewater MA (18 July 1996)

HABITAT

This station was located approximately 2500 m downstream of the Brockton WWTP. We accessed the stream at Belmont St. in West Bridgewater and followed it downstream for approximately 300 m until we found a suitable reach to conduct sampling. Here the stream appeared to meander naturally, although the right bank was rip-rapped where the road (Matfield St.) came within a few meters of the channel. Across the stream the riparian zone was quite wide and heavily wooded. Current was generally fast, with deep riffle/runs predominant throughout the reach and pool habitats virtually absent. The majority of sampling consisted of kicks in the rocky substrates in these riffle/run areas, however, a few jabs were made in the dense aquatic vegetation (*Elodea* sp., *Calitriche* sp., *Potamogeton* sp.) found in some riffles. Although cobble and boulder dominated the bottom substrate, much of it (50-75%) was surrounded by sand, which may be entering the stream from the road adjacent to the stream and separated by only a narrow vegetated buffer.

TR03 received a habitat assessment score of 150, which was higher than that received by its upstream counterpart (TR02), and 83% comparable to the regional reference station at Canoe River.

BENTHOS

When using the Canoe River (TR01) station as a regional reference site, TR03 received a total metric score of 21 out of a possible 42. This score represents a 54% comparability to the reference station, placing TR03 in the moderately impaired category. When compared to its upstream reference station TR02, however, TR03 received a total metric score of 27--representing a 75% comparability to the reference, and placing the station intermediate to the non-impaired/moderately impaired categories. Due to the low habitat assessment score and apparent state of water quality degradation, I recommend omitting TR02 as an upstream reference site and instead using the regional reference station TR01 as the primary reference for TR03. With an EPT index of 1 and a taxa richness of only 6, it would seem unconscionable to place TR03 anywhere near the non-impaired category.

The relatively high habitat assessment score (83% comparable to the regional reference station) received by TR03, coupled with its low metric scores, lead me to believe that impairment to the invertebrate community is primarily due to degradation of water quality. The Brockton WWTP seems the likely pollution source here, although a horse farm adjacent to the stream at Belmont St. may be a possible source of nutrient loading.

TR04A, TR04B--Wading River, Mansfield MA (30 July 1996)

HABITAT

At the request of the Taunton River Basin Team leader, we attempted to bracket the effects of Charles A. Richardson, Inc.--a metal plating industry--on the Wading River. TR04A, located immediately upstream of the plant discharge, was to serve as the upstream control site. The top of the proposed reference reach was intersected by Otis St., at the outlet of an unnamed impoundment. Unfortunately, a lack of any appreciable current velocity coupled with minimal productive habitat rendered it impossible to apply our standard sampling protocol anywhere between the Richardson discharge and the impoundment.

An investigation of potential downstream sampling sites (to be designated TR04B) proved equally unsuccessful. We accessed the stream from the railroad crossing which runs perpendicular to Gilbert St. While flow conditions were adequate for kick sampling, the majority of the potential reach was not wadable. In addition, productive benthic habitats encountered immediately above and below the railroad line were markedly different than anything found upstream of the Richardson discharge. A marshy, heavily vegetated riparian zone also posed problems with regards to stream accessibility. If the need for macroinvertebrate data from this site is imperative, artificial substrate samplers (e.g.. rock baskets, Hester-Dendy multiplate samplers) could be utilized; however, finding a suitable upstream reference station could be difficult.

While we were unable to conduct biomonitoring and associated habitat assessments at TR04A and TR04B, it should be mentioned that we did observe a rather dubious situation in the upstream reach which may contribute to habitat and water quality degradation. A small channel of unknown source running parallel to Barrows St. enters the Wading River approximately 10-15 m below the reservoir outlet. The channel substrate consists of extremely “mucky,” orange-stained (and presumably of a ferric origin) sediment. A considerable amount of this sediment is being carried into the main stem, as evident by the orange plume and heavy deposition visible in the upstream reach near the confluence. Sedimentation is particularly heavy for approximately 15 m downstream of the confluence--all rocky substrates here are covered by a fine layer of silt. It would probably be worthwhile for the Taunton River Basin Team to investigate possible anthropogenic origins to this apparent nonpoint source input.

TR05A--Wading River, Norton MA (30 July 1996)

HABITAT

TR05A served as the upstream reference station for TR05B, in an attempt to bracket discharge effects from Tweave, Inc.--a clothing manufacturer located on the Wading River in Norton, just downstream of Barrows St. and the Barrowsville Pond outlet. Both stations were also compared to the regional reference station TR01.

After walking the stream for several hundred meters down to Fordham St., we were unable to locate Tweave’s effluent discharge to the river. The only two possibilities seemed to be a pair of pipes approximately 200-300 m downstream from Barrows St., or via a small channel running through Tweave’s property and joining the river immediately upstream of the pipes. There was no flow coming out of the pipes, and very little in the channel at that time. We sampled the reach between the channel and Barrows St., assuring that we were upstream of the discharge. The majority of sampling was conducted in shallow riffle areas, the dominant productive habitat here for invertebrates; however, a few jabs were made in the occasional patches of submerged *Sparganium* sp. Cobble/gravel substrates, and an adequate flow regime throughout the reach, provided optimal habitat for macroinvertebrates; however, fish cover was probably less favorable due to lack of pools and deep riffles. The habitat assessment rating (a score of 153) was further marred by the proximity of residential properties to the stream reach, with a lack of an adequate riparian vegetative buffer.

BENTHOS

Benthic community integrity at TR05A, with a total metric score of 33, was found to be 85% comparable to the regional reference station. With a relatively high taxa richness (13) and EPT index (7), and the lowest biotic index of any station, it is not surprising that TR05A falls into the non-impaired category. The only low scoring metric was the community similarity index, which may be explained by TR05A's vastly different stream setting and associated invertebrate functional feeding groups compared to TR01. While TR01 is in a heavily wooded, closed-canopy setting dominated by a "shredder" and "gathering collector" community, TR05A lies below an impoundment (and probably a substantial source of FPOM) in a non-wooded, open canopy setting. Not surprisingly, the invertebrate community here is dominated by "scrapers" and "filtering collectors." Nevertheless, the apparent healthy aquatic community here further justifies the use of TR05A as an upstream reference station for TR05B.

TR05B--Wading River, Norton MA (30 July 1996)

HABITAT
The reach designated as station TR05B began approximately 200 m downstream of the Tweave, Inc. discharge. We accessed the site via the property at 22 Fordham Drive, followed by a short streamside hike about 100 m downstream from that point. The stream meandered through woodland, with an expansive riparian zone along the right bank. A few houses that are part of a new subdivision were set back from the relatively steep left bank; however, the yards are separated from the channel by a high esker (probably man-made) which seems to buffer potential erosional effects or NPS inputs to the stream. The combination of substrates and flow regime here provided excellent habitat for invertebrates and fish--well developed riffles, interspaced with runs and deep pools, flowed over a variety of rocky substrates and occasional patches of *Sparganium* sp.

TR05B received a habitat assessment score of 183--the highest score assigned to a sampling reach in the Taunton River Watershed. Clearly, habitat is not the limiting factor in the health of the aquatic community at this site.

BENTHOS
Compared to the regional reference station TR01 and the upstream reference station TR05A, TR05B is 69% and 62% comparable respectively. A moderate impairment classification, coupled with a high habitat assessment score, indicates that water quality degradation is the primary environmental stress here. The apparent absence of nonpoint source pollution inputs to the reach (although septic system inputs from the adjacent subdivision should probably be considered), then, leads me to believe that the Tweave, Inc. discharge may indeed be having a detrimental effect on the downstream aquatic community. An investigation of their effluent is advisable.

TR06--Rumford River, Foxborough MA (19 July 1996)

HABITAT
Sampling was conducted in the Rumford River to investigate possible environmental stress on the sub-basin in the vicinity of the Sharon wellfields at Gavins Pond. This concern was brought to the Taunton River Basin Team's attention by the Foxborough Conservation Commission, who feels that water withdrawals in Gavins Pond (photographs showing a "bone dry" pond in 1994 and 1996 were presented to the Taunton River Basin Team) represent an excessive use of the aquifer by the Town of Sharon.

At the request of the Taunton River Basin Team leader, we attempted to conduct biomonitoring in the reach which flows from Gavins Pond to unnamed "Pond #1" and "Pond #2," adjacent to the pumping station and a large tract of housing subdivisions. Unfortunately, an extensive wetland margin and substrates inappropriate for RBP II made it impossible to apply our sampling methodology anywhere in the Rumford River from Gavins Pond to Vandys Pond approximately 1500m downstream. We were, however, able to access the river immediately downstream of Vandys Pond. A short hike about 200 m downstream from Cocasset St. took us into a very nice woodland setting where a series of riffles and runs meandered through excellent habitat. Substrates composed of gravel, sand, and cobble, with occasional snags and patches of macrophytes (*Sparganium* sp., *Calitriche* sp.), provided optimal habitat for benthic invertebrates. Submerged logs, undercut banks, occasional large rubble, and pools provided good instream cover for fish as well. A heavily

wooded riparian zone, with a flat-forested wetland along the right bank and a steep-sloping hardwood forest along the left bank, provided a virtually unlimited vegetated buffer along the reach. TR06 received a habitat assessment score of 182, which was higher than that of the regional reference station.

BENTHOS
The RBP II analysis indicates that this is a healthy benthic community. A total metric score of 36 represents a 92% comparability to the regional reference station TR01, placing TR06 in the non-impaired category. In fact, with a taxa richness of 17 and an EPT index of 7, TR06 represents the highest biodiversity of any station sampled in the Taunton River Basin survey.

It appears, then, that environmental pressures on Gavins Pond--specifically in the form of draw downs and increased development of the surrounding area--have not impacted the aquatic community downstream of Vandys Pond. We cannot, however, draw any conclusions as to the biological integrity of the Rumford River between Gavins Pond and Vandys Pond. If additional information is desired, a specific sampling design--probably utilizing introduced substrates and an upstream/downstream of pond comparison--could be implemented.

TR07--Nemasket River, Middleboro MA (July 1996)

HABITAT
The Taunton River Watershed Team requested that biomonitoring be conducted immediately downstream of Assawompset Pond--the likely reach established somewhere between the dammed pond outlet and Vaughan St. or Bridge St. The Team's primary concerns regarding anthropogenic impacts to the river were: 1) nonpoint source pollution in the form of nutrient loads or pesticide residues related to the numerous cranberry bogs along the periphery of the pond; and 2) dam-induced low flow downstream of the pond, and potential effects on the benthic invertebrate and anadromous fish community.

During field reconnaissance conducted for the Nemasket River, it quickly became evident that the RBP II sampling methodology would be inappropriate for much of this sub-basin do to habitat constraints. The river flows through an extensive wetland area from the Assawompset Pond outlet to downtown Middleboro. In the few areas where access to the river channel was possible, non-wadable depths (>1m) and unfavorable flow/habitat types (slow, laminar flow over sandy, muddy substrates) made both RBP II sampling and adequate comparisons to our regional reference station impossible.

BENTHOS
Due to the excessive amount of time and effort required to design an appropriate sampling plan for this portion of the Nemasket River, I recommend instead contacting Dr. Kevin Curry in the Biology Department at Bridgewater State College. Dr. Curry has conducted extensive biological assessments of the Nemasket River benthic community using kick-net and multiplate sampling (In fact, he presented a paper on this subject at the 1996 NEAEB Meeting), and he has offered to make this data available to OWM.

CONCLUSION
It is important to realize that Rapid Bioassessment Protocol II (RBP II) is merely a semi-quantitative screening tool which allows agencies to evaluate a large number of sites with relatively limited time and effort. The protocol is best used to prioritize sites for more intensive evaluation, such as RBP III, toxicity testing, or quantitative replicate sampling. The information derived from RBP II provides a basis for ranking sites as non, severely or moderately impaired. This classification can then be used to focus on additional study or regulatory action.

Three of the sites investigated in the Taunton River Watershed received RBP II scores indicating moderate impairment--TR02, TR03, and TR05B. Because the moderate impairment category offers a wide ranging and somewhat ambiguous assessment, this suggests that the basin team may want to gather more information on the aquatic invertebrate assemblage collected at these stations. To achieve this, I recommend applying Rapid Bioassessment Protocol III (RBP III), a more rigorous bioassessment technique than RBP II, which allows detection of more subtle degrees of impairment.

By increasing the level of taxonomic resolution; that is, by performing taxonomic identification to the lowest practical level (thereby providing information on population as well as community level effects), the ability to discriminate the level of impairment is enhanced. While this additional taxonomy (genus/species level identification) requires considerably more time, discrimination of four levels of impairment--non, slight, moderate, and severe--becomes possible following recalculation of metrics. If the Taunton River Basin Team wishes to have this taxonomy and subsequent metric analysis completed, a written request should be made to Bob Nuzzo and/or myself.

Cc: K. Keohane
A. Johnson

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APPENDIX 1

Table 1. List of macroinvertebrate taxa collected from stream sites in the Taunton River Watershed between 28 July and 1 August 1996. The sampling sites were in: Canoe River (01), Foxborough; Salisbury Plain River (02 and 03), Brockton; Wading River (05A and 05B), Norton; Rumford River (06), Foxborough--all in Massachusetts.

TAXON	FFG	TV	TR01	TR02	TR03	TR05A	TR05B	TR06
Gastropoda (undet. dextral)	SC	6		1				
Physidae	GC	8		3				
Planorbidae	SC	6				1		
Unionidae	FC	5				X*	X*	
Pisidiidae	FC	6	14			11	21	10
Lumbricina	GC	8						3
Tubificidae	GC	10		4	10			2
Naididae	GC	9			4			
Lumbriculidae	GC	7	2					
Glossophoniidae	PR	7		2				
Erpobdellidae	PR	8		1				1
Asellidae	GC	8		5		2		
Gammaridae	GC	6						6
Hyalellidae	GC	8	9					
Hydracarina	PR	6		5				
Baetidae	GC	4				1		
Heptageniidae	SC	4	1			1	5	2
Ephemerellidae	GC	1	1					
Leptophlebiidae	GC	2						1
Leuctridae/Capniidae	SH	0	5					7
Perlodidae	PR	2	3					
Corydalidae	PR	5					1	1
Philopotamidae	FC	3				25	12	
Psychomyiidae	GC	2	10					2
Hydropsychidae	FC	4	4	5	52	41	32	39
Brachycentridae	FC	1				4	2	
Limnephilidae	SH	4						1
Uenoidae	SC	2				2		
Odontoceridae	SH	0	3					2
Leptoceridae	PR	4				1		
Elmidae	SC	4	3			11	8	6
Tipulidae	SH	5						1
Ceratopogonidae	PR	6	1					
Simuliidae	FC	6	3	3	3	3		7
Chironomidae	GC	6	34	63	31	6	18	11
Empididae	PR	6		2	5			
TOTAL			**93**	**94**	**105**	**109**	**99**	**102**

* 3 Unionidae present in sample from TR05A, 4 Unionidae present from TR05B; none included in final subsample

APPENDIX 2

Table 1. Summary of RBP II data analysis for macroinvertebrate communities sampled at six stream sites in the Taunton River Watershed. Seven biological metrics were calculated for taxa collected at each station, and scored (in parentheses). Scores were totaled and compared to the reference station TR01. The percent comparability to the reference station yields a final impairment score for each station.

RBP II DATA SUMMARY FOR **TAUNTON RIVER** WATERSHED; DATE: **28 JULY- 1 AUGUST, 1996**

STATION #	TR01*	TR02	TR03	TR05A	TR05B	TR06
STREAM	Canoe River	Salisbury Plain River	Salisbury Plain River	Wading River	Wading River	Rumford River
HABITAT SCORE	181	140	150	153	183	182
TAXA RICHNESS	14 (6)	11 (3)	6 (3)	13 (6)	8 (3)	17 (6)
BIOTIC INDEX	4.91 (6)	6.28 (3)	5.5 (6)	4.08 (6)	4.58 (6)	4.45 (6)
EPT INDEX	7 (6)	1 (0)	1 (0)	7 (6)	4 (0)	7 (6)
EPT/CHIRONOMIDAE	.79 (6)	.08 (0)	1.68 (6)	12.5 (6)	2.83 (6)	4.91 (6)
RIFFLE COMMUNITY: SCRAPERS/FILT. COLL.	.19 (6)	.13 (6)	0 (0)	.18 (6)	.19 (6)	.14 (6)
% CONTRIBUTION (DOM. FAM.)	37% (3)	67% (0)	50% (3)	38% (3)	32% (3)	38% (3)
COMMUNITY SIMILARITY	100% (6)	44% (3)	37% (3)	27% (0)	42% (3)	42% (3)
TOTAL METRIC SCORE	39	15	21	33	27	36
% COMPARABILITY TO REFERENCE STATION	100%	38%	54%	85%	69%	92%
BIOLOGICAL CONDITION - DEGREE IMPAIRMENT	REF	MODERATE	MODERATE	NON	MODERATE	NON

* Regional reference station for all

Table 2. Summary of RBP II data analysis for macroinvertebrate communities sampled at four stream sites (TR02, TR03, TR05A, TR05B) in the Taunton River Watershed. Seven biological metrics were calculated for taxa collected at each station, and scored (in parentheses). Scores were totaled and compared to the upstream reference station. The percent comparability to the reference station yields a final impairment score for each station.

RBP II DATA SUMMARY FOR **TAUNTON RIVER** WATERSHED; DATE: **28 JULY- 1 AUGUST 1996**

STATION #	**TR02 ***	**TR03**		**TR05A ****	**TR05B**
STREAM	Salisbury Plain River	Salisbury Plain River		Wading River	Wading River
HABITAT SCORE	140	150		153	183
TAXA RICHNESS	11 (6)	6 (3)		13 (6)	8 (3)
BIOTIC INDEX	6.28 (6)	5.5 (6)		4.08 (6)	4.58 (6)
EPT INDEX	1 (6)	1 (6)		7 (6)	4 (0)
EPT/CHIRONOMIDAE	.08 (6)	1.68 (6)		12.5 (6)	2.83 (0)
RIFFLE COMMUNITY: SCRAPERS/FILT. COLL.	.13 (6)	0 (0)		.18 (6)	.19 (6)
% CONTRIBUTION (DOM. FAM.)	67% (0)	50% (3)		38% (3)	32% (3)
COMMUNITY SIMILARITY	100% (6)	44% (3)		100% (6)	71% (6)
TOTAL METRIC SCORE	36	27		39	24
% COMPARABILITY TO REFERENCE STATION	100%	75%		100%	62%
BIOLOGICAL CONDITION - DEGREE IMPAIRMENT	REF	NON/ MODERATE		REF	MODERATE

* Upstream reference station for TR03
**Upstream reference station for TR05B

APPENDIX F

MassDEP OWM/DEP FISH TOXICS MONITORING IN THE TAUNTON RIVER WATERSHED 1994, 1995, 2001, AND 2003

Introduction

Fish toxics monitoring is a cooperative effort between three Massachusetts Department of Environmental Protection Offices/Divisions- Watershed Management, Research and Standards (ORS), and Environmental Analysis, the Massachusetts Department of Fisheries, Wildlife, and Environmental Law Enforcement, and the Massachusetts Department of Public Health (MDPH). Fish toxics monitoring is typically conducted to assess the concentrations of toxic contaminants in freshwater fish, identify waterbodies where those concentrations may pose a risk to human health, and identify waters where toxic contaminants may impact fish and other wildlife.

Between September 1995 and August 2001, fish were collected by the MA DEP, Office of Watershed Management (OWM)/Division of Watershed Management (DWM), at three sites in the Taunton River Watershed: Lake Mirimichi, Plainville/Foxborough, in July 1995; Ames Long Pond, Stoughton, and Monponsett Pond (East Basin), Halifax, in August 2001. Additionally, Elders Pond and Little Quitticas Pond in Lakeville/ Rochester; Middle Pond, Taunton; Prospect Hill Pond, Taunton/Raynham; Somerset Reservoir, Somerset; Watson Pond, Taunton; and West Meadow Pond, West Bridgewater, were sampled in 1994 as part of an ORS mercury study. In 2003 Lake Nippenicket, Bridgewater/Raynham, was also sampled during an ORS mercury study.

Project Objectives

Fish tissue monitoring is typically conducted to assess the levels of toxic contaminants in freshwater fish, identify waterbodies where those levels may impact human health, and identify waters where toxic chemicals may impact fish and other aquatic life. Nonetheless, human health concerns have received higher priority and, so, fish tissue analysis has been restricted to edible fillets. The fish toxics monitoring was designed to screen the edible fillets of several species of fish representing different feeding groups (i.e., bottom dwelling omnivores, top-level predators, etc.) for the presence of heavy metals, Polychlorinated biphenyls (PCB) and chlorinated pesticides. In 2001 MA DEP DWM fish toxics monitoring was conducted under an EPA-approved Fish Toxics Quality Assurance Project Plan (MA DEP 2001). Data Quality Objectives are presented in the above-mentioned QAPP. There were no deviations from the QAPP.

Methods

Uniform protocols, designed to assure accuracy and prevent cross-contamination of samples, were followed for collecting, processing, and shipping fish collected for the fish toxics monitoring. In 1995 fish were collected on 12 July from Lake Mirimichi, on 7 August 2001 from Monponsett Pond (east basin), and on 27 August 2001 from Ames Long Pond. All fish were collected using boat-mounted electroshocking gear and/or gill nets. Fish selected for analysis were placed in an ice filled cooler and brought back to the OWM/DWM laboratory for processing. Processing included measuring lengths and weights and visually inspecting fish for tumors, lesions, or other indications of stress or disease. Scales, spines, or pectoral fin ray samples were obtained from each sample to determine the approximate age of the fish. Fish were filleted (skin off) with stainless steel knives on glass cutting boards.

1994 ORS Mercury Study

A directed mercury study of fish from some of Massachusetts's least impacted (no active point sources) waterbodies was performed by ORS in 1994. Fish were sampled to determine the patterns of variation in edible tissue mercury concentrations. Yellow perch, largemouth bass, and brown bullhead were selected as test species because they encompass a range of fish trophic levels. Fish were obtained by electroshocking, gill netting, and trot lines. Fish were rinsed with ambient water, chilled on ice, wrapped individually in aluminum foil, placed inside polyethylene "zip lock" bags and delivered to the laboratory within 24 hours of collection. Methods for analysis of mercury in lateral muscle were in accordance with EPA procedures (MA DEP 1996).

1995 Fish Toxics

Details related to the collection, handling, and processing of samples were excerpted from the report entitled *1995 Public Request Fish Toxics Monitoring Surveys* (Maietta 1995).

> Fillets targeted for metals analysis were placed in VWR high-density polyethylene (HPDE) cups with covers. The opposite fillets were wrapped in aluminum foil for % lipids, PCB and organochlorine pesticide analysis. In the case of composite samples, two or three fillets from like-sized individuals of the same species were wrapped together in aluminum foil or stored in the single sample container. Samples were tagged and frozen for subsequent delivery to WES. All equipment used in the filleting and storage process was rinsed in accordance with USEPA procedures (1993). Methods used at WES for metals analysis include a cold vapor method using a VGA hydride generator for mercury and Varian 1475 flame atomic absorption for all remaining metals. PCB/organochlorine pesticide analysis was performed on a gas chromatograph equipped with an electron capture detector.

2001 Fish Toxics

Details related to the collection, handling, and processing of samples were excerpted from the report entitled *2001 Fish Toxics Monitoring Public Request and Year 2 Watershed Surveys* (Maietta and Colonna-Romano 2002).

> All equipment used in the filleting process was rinsed in tap water and then rinsed twice in de-ionized water before and or after each sample. Samples (individual or composite) targeted for % lipids, PCBs and organochlorine pesticide analysis were wrapped in aluminum foil. Samples targeted for metals analysis were placed in VWR high-density polyethylene (HDPE) cups with covers. Composite samples were composed of three fillets from like-sized individuals of the same species (occasionally the same genus). Samples were tagged and frozen for subsequent delivery to the Department's Wall Experiment Station (WES).
>
> Methods used at WES for metals analysis include the following:
> Mercury is analyzed by a cold vapor method using a Perkin Elmer, FIMS (Flow Injection Mercury System), which uses Flow Injection Atomic Absorption Spectroscopy. Cadmium and lead are analyzed using a Perkin Elmer, Optima 3000 XL ICP - Optical Emission Spectrophotometer. Arsenic and selenium are analyzed using a Perkin Elmer, Zeeman 5100 PC, Platform Graphite Furnace, Atomic Absorption Spectrophotometer.
>
> PCB Arochlor, PCB congener, and organochlorine pesticide analysis was performed on a gas chromatograph equipped with an electron capture detector "according to the modified AOAC 983.21 procedure for the analysis of PCB Arochlors, Congeners, and Organochlorine Pesticides." Additional information on analytical technique used at WES is available from the laboratory. According to standard practice, all laboratory analytical results were forwarded to the Massachusetts Department of Public Health.

2003 ORS Mercury Study

A study by ORS, beginning in 2001, to monitor fish mercury in selected lakes was initiated to determine whether the levels of mercury in fish are decreasing over time as a result of increased controls on mercury emissions sources. Data collection and analysis is ongoing. Methods for analysis of mercury in lateral muscle were in accordance with EPA procedures (Rose 2004).

Results

The results of MA DEP Taunton River Watershed fish toxics monitoring surveys are described below for each sampling event. Data for DWM surveys is presented in tables F1 and F2. All raw data files, field sheets, lab reports, chain of custody forms, and other metadata are maintained in databases at the MA DEP Division of Watershed Management office in Worcester. Quality assurance data are available in a data validation report (MA DEP 2004).

1994 ORS Mercury Study

During the summer of 1994, seven lakes were sampled in the Taunton River Watershed for inclusion in the ORS study: Elders Pond, Little Quittacas Pond, Middle Pond, Prospect Hill Pond, Somerset Reservoir, Watson Pond, and West Meadow Pond. Because of elevated mercury concentrations, MDPH issued a fish consumption advisory due to mercury contamination for Somerset Reservoir in Somerset (MDPH 2004). The advisory recommends the following:

1. "Children younger than 12 years or age, pregnant women, women of childbearing age who may become pregnant, and nursing mothers should not eat any of the affected fish species (largemouth bass) from this water body. "

2. "The general public should limit consumption of affected fish species (largemouth bass) to two meals per month."

1995 Fish Toxics

Lake Mirimichi

Lake Mirimichi was sampled on 12 July 1995 resulted in the collection of largemouth bass, yellow perch, brown bullhead, American eel, pumpkinseed, and bluegill.

Mercury in the fish tissue from Lake Mirimichi ranged from <0.0002 to 0.325 mg/kg wet weight. Selenium levels ranged from 0.072 to 0.238 mg/kg wet weight. Arsenic levels were below detection limits. PCB arochlors and congeners, pesticides, cadmium, and lead were not detected in the edible fillets of all samples analyzed from the Ipswich River.

2001 Fish Toxics

The results of MA DEP 2001 Taunton River Watershed fish toxics monitoring surveys described below are excerpted from *2001 Fish Toxics Monitoring Public Request and Year 2 Watershed Surveys* (Maietta and Colonna-Romano 2002). Method detection limits (MDLs) can also be found in Maietta and Colonna-Romano (2002).

Ames Long Pond

This 65-acre meso-eutrophic pond is located within the Taunton River watershed in the towns of Stoughton and Easton. Land use in the immediate watershed is a mix of forest, medium density residential, and agricultural. The shoreline is approximately 60 percent developed with residences.

Electrofishing at Ames Pond in Stoughton on 27 August 2001 resulted in the collection of three largemouth bass, three yellow perch, three bluegill, three pumpkinseed, and three black crappie. Additional species observed included: chain pickerel, American eel, brown bullhead, and golden shiner.

Mercury concentrations were below the MDPH trigger level of 0.5 mg/kg in the five samples analyzed. The largemouth bass sample was found to contain 0.94 mg/kg of lead. All remaining metals were either below MDLs or at concentrations that do not appear to be of concern.

PCB and organochlorine pesticides were below MDLs in all samples analyzed from Ames Long Pond.

Monponsett Pond (east basin)

Electrofishing and gill netting at Monponsett Pond in Halifax on 8/7/01 resulted in the collection of three largemouth bass, three white perch, and three pumpkinseed. Additional species observed included: chain pickerel, golden shiner, bluegill, and yellow perch.

This 244-acre mesotrophic pond is located within the Taunton River watershed in the town of Halifax. Land use in the immediate watershed is a mix of forest and high/medium density residential. The shoreline is approximately 80 percent developed with residences.

Mercury exceeded the MDPH trigger level of 0.5 mg/kg in largemouth bass. In light of elevated mercury concentrations, the MDPH issued the following fish consumption advisory in June of 2002:

1. "Children younger than 12 years or age, pregnant women, women of childbearing age who may become pregnant, and nursing mothers should not eat any of the affected fish species (largemouth bass) from this water body. "

2. "The general public should limit consumption of affected fish species (largemouth bass) to two meals per month."

Arsenic, lead, cadmium and selenium were either below MDLs or at concentrations, which do not appear to be of concern.

PCB and most organochlorine pesticides were below MDLs. The largemouth bass sampled contained a trace amount (0.024 mg/kg) of DDE. The USFDA Action Level for DDT and its metabolites (DDE and DDD) is 5.0 mg/kg.

2003 ORS Mercury Study

During the summer of 2003, Lake Nippenicket, Bridgewater/Raynham, was sampled in the Taunton River Watershed. Because of elevated mercury concentrations, MDPH issued a fish consumption advisory due to mercury contamination for Lake Nippenicket (MDPH 2004). The advisory recommends the following:

1. "Children younger than 12 years or age, pregnant women, women of childbearing age who may become pregnant, and nursing mothers should not eat any of the affected fish species (largemouth bass) from this water body. "

2. "The general public should limit consumption of affected fish species (largemouth bass) to two meals per month."

Table F1. Analytical Results for 1995 Fish Toxics Monitoring Public Request and Year 2 Watershed Surveys. Results, reported in wet weight, are from composite samples of fish fillets with skin off.

Sample ID	Collection Date	Species Code[1]	Length (cm)	Weight (g)	Sample ID (laboratory sample #)	Cd (mg/kg)	Cu (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	As (mg/kg)	Se (mg/kg)	% Lipids (%)	PCB Arochlors and Congeners (µg/g)	Pesticides (µg/g)
Lake Mirimichi, Plainville/Foxborough														
LMF95-1	07/12/95	LMB	33.2	450	--	<0.20	<0.60	<1.0	0.325	<0.040	0.072	0.046	Not detected	Not detected
LMF95-2	07/12/95	LMB	32.2	490										
LMF95-3	07/12/95	LMB	30.9	400										
LMF95-4	07/12/95	YP	23.4	150	--	<0.20	<0.60	<1.0	0.191	<0.040	0.109	0.078	Not detected	Not detected
LMF95-5	07/12/95	YP	21.8	130										
LMF95-6	07/12/95	YP	24.5	170										
LMF95-7	07/12/95	BB	37.9	740	--	<0.20	<0.60	<1.0	<0.0002	<0.040	0.057	0.21	Not detected	Not detected
LMF95-8	07/12/95	BB	37.5	700										
LMF95-9	07/12/95	BB	33.5	470										
LMF95-10	07/12/95	P	18.6	150	--	<0.20	<0.60	<1.0	<0.0002	<0.040	0.155	0.13	Not detected	Not detected
LMF95-11	07/12/95	B	20.0	140										
LMF95-12	07/12/95	P	17.9	130										
LMF95-13	07/12/95	AE	55.9	340	--	<0.20	<0.60	<1.0	0.238	<0.040	0.238	12	Not detected	Not detected
LMF95-14	07/12/95	AE	59.5	400										
LMF95-15	07/12/95	AE	58.7	380										

[1] Species (LMB) largemouth bass *Micropterus salmoides*
(YP) yellow perch *Perca flavescens*
(BB) brown bullhead *Ameiurus nebulosus*
(P) pumpkinseed *Lepomis gibbosus*
(AE) American eel *Anguilla rostrata*
(B) bluegill *Lepomis macrochirus*

Table F2. Analytical Results for 2001 Fish Toxics Monitoring Public Request and Year 2 Watershed Surveys. Results, reported in wet weight, are from composite samples of fish fillets with skin off.

Sample ID	Collection Date	Species Code[1]	Length (cm)	Weight (g)	Sample ID (laboratory sample #)	Cd (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	As (mg/kg)	Se (mg/kg)	% Lipids (%)	PCB Arochlors and Congeners (µg/g)	Pesticides (µg/g)
Ames Long Pond, Stoughton, Taunton River Watershed													
APF01-01	8/27/01	LMB	37.4	820	2001038 (L2001423-1) (L2001426-1)	<0.040	0.94	0.43	<0.060	0.20	0.07	ND	ND
APF01-02	8/27/01	LMB	30.6	410									
APF01-03	8/27/01	LMB	39.0	900									
APF01-04	8/27/01	YP	25.5	210	2001039 (L2001423-2) (L2001426-2)	<0.040	<0.20	0.21	<0.060	0.24	0.10	ND	ND
APF01-05	8/27/01	YP	19.5	110									
APF01-06	8/27/01	YP	23.1	150									
APF01-07	8/27/01	B	18.1	110	2001040 (L2001423-3) (L2001426-3)	<0.040	<0.20	0.20	<0.060	0.24	0.20	ND	ND
APF01-08	8/27/01	B	18.5	120									
APF01-09	8/27/01	B	16.8	110									
APF01-10	8/27/01	P	15.6	100	2001041 (L2001423-4) (L2001426-4)	<0.040	<0.20	0.16	<0.060	0.30	0.11	ND	ND
APF01-11	8/27/01	P	15.5	100									
APF01-12	8/27/01	P	16.2	110									
APF01-13	8/27/01	BC	19.0	120	2001042 (L2001423-5) (L2001426-5)	<0.040	<0.20	0.14	<0.060	0.20	0.10	ND	ND
APF01-14	8/27/01	BC	18.0	100									
APF01-15	8/27/01	BC	18.2	100									
Monponsett Pond (East Basin), Halifax, Taunton River Watershed													
EMF01-1	8/7/01	LMB	38.5	910	2001024 (L2001359-1) (L2001362-1)	<0.08	<0.8	0.53	<0.060	0.44	0.11	ND	DDE – 0.024
EMF01-2	8/7/01	LMB	33.6	640									
EMF01-3	8/7/01	LMB	39.5	890									
EMF01-4	8/7/01	WP	28.0	280	2001025 (L2001359-2) (L2001362-2)	<0.08	<0.8	0.36	<0.060	0.70	0.21	ND	ND
EMF01-5	8/7/01	WP	25.1	210									
EMF01-6	8/7/01	WP	24.4	200									
EMF01-7	8/7/01	P	20.2	160	2001026 (L2001359-3) (L2001362-3)	<0.08	<0.8	0.28	<0.060	0.42	0.09	ND	ND
EMF01-8	8/7/01	P	18.4	160									
EMF01-9	8/7/01	P	17.9	140									

[1] Species (LMB) largemouth bass *Micropterus salmoides*
(YP) yellow perch *Perca flavescens*
(WP) white perch *Morone americana*
(P) pumpkinseed *Lepomis gibbosus*
(B) bluegill *Lepomis macrochirus*
(BC) black crappie *Pomoxis nigromaculatus*

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APPENDIX G

SUMMARY OF NPDES AND WMA PERMITTING INFORMATION
TAUNTON RIVER WATERSHED

Information from open permit files located in MA DEP Boston, Worcester, and Lakeville Offices.

Table G1. Taunton River Watershed Municipal Major NPDES Wastewater Discharge Facilities.

Permittee	NPDES#	Issuance	Flow (MGD)	Dilution Factor	Special Conditions/ Notes	Receiving Water (Segment)
Bridgewater WWTF, Brockton	MA0100641	2003	1.44	≥0.5	Permittee is authorized to discharge treated sanitary wastewater from outfall 001. The maximum daily copper limit is 0.011 mg/L.	Town River (MA62-13)
Brockton Advanced Water Reclamation Facility, Brockton	MA0101010	2005	No limit in permit		A 3-phase facility-wide upgrade has begun in 2004. A new draft permit is under review.	Salisbury Plain River (MA62-06)
City of Fall River Sewer Commission	MA0100382	2000	CSO outfalls: Outfall 014 at the Shell Oil Terminal Dock, Alton St. Outfall 013 at Cove St. Outfall 011 at President Ave/ Bicentennial Park Outfall 010 at Davol Street#1and#2, City Pier			Taunton River (MA62-04)
Mansfield WPAF, Mansfield	MA0101702	2004	3.14	2.2:1	Sodium hypochlorite has replaced gaseous chlorine for disinfection.	Threemile River (MA62-56)
Middleborough WWTP, Middleborough	MA0101591	2003	2.16*	1.9:1	A new phosphorus monthly average limit of 0.20 mg/L will be effective on April 1, 2005.	Nemasket River (MA62-26)
Somerset WPCF, Somerset	MA0100676	2004	4.2*	22.9:1	NA	Taunton River (MA62-04)
Taunton WWTP, Taunton	MA0100897	2001	8.4*	4.2	During wet weather, stormwater/wastewater is authorized for discharge via CSO #004	Taunton River (MA62-02)

* limit is annual average limit reported as a rolling average.

Table G2. Taunton River Watershed Industrial Major NPDES Wastewater Discharge Facilities.

Permittee	NPDES#	Issuance	Flow (MGD)/Types of Discharge	Receiving Water (Segment)
C.A. Richardson, Inc., Mansfield	MA0001805	2000	Plant discontinued discharging into the Wading River in 2001.	Wading River (MA62-48)
MCI Bridgewater Water Pollution Control Facility (WPCF), Bridgewater	MA0102237	1998	0.55 MGD treated sanitary wastewater The plant is permitted to use advanced 2nd treatment limits from 5/1 to 10/31, and 2nd treatment limits from 11/1 to 4/30. The difference between these two limits are in the BOD and TSS limits for the advanced 2nd treatment: they both have an average monthly limit of 30 mg/l and an average weekly limit of 45 mg/l; for the 2nd treatment they both have an average monthly limit of 14 mg/l and an average weekly limit of 23 mg/l.	Sawmill Brook (MA62-36)

Table G2 (cont). Taunton River Watershed Industrial Major NPDES Wastewater Discharge Facilities.

Permittee	NPDES#	Issuance	Flow (MGD)/Types of Discharge	Receiving Water (Segment)
Somerset Power LLC, Somerset	MA0001856	1994	Outfall #002 - 0.126 MGD treated wastewater Outfall #002a - 0.215 MGD treated wastewater Outfall #007 - 142 MGD condenser cooling water Outfalls #006, 013, 014, 015, 016, 017, SD1, SD2, SD3, SD4, SD5 – Stormwater	Taunton River (MA62-04)
Taunton Municipal Lighting Plant, Taunton	MA0002241	1994	Cooling water discharges: Outfall #001 - 39.5 MGD Outfall #002 – 0.26 MGD Outfall #003 – 0.35 MGD Outfall #004 – monitored when in use Stormwater is discharged from Outfalls #005 - #007, #009 and #011	Taunton River (MA62-02)
Texas Instruments	MA0001791	Facility tied in all wastewater to Attleborough WPCF (permit will be terminated)	Outfall 003 treated industrial wastewater to Coopers Pond	Wading River (MA62-49)
Tweave Inc, Barrowsville	MA0005355	2000	0.008 MGD average monthly and 0.01 MGD maximum daily of treated process wastewater.	Wading River (MA62-49)
Zeneca, Inc., Dighton	MA0005291	Terminated 11/2003	Non-contact cooling water, stormwater runoff, and/or steam condensate via several outfalls (MA62-52) Treated wastewater discharge (011A) was moved to the Taunton River in 1992 (MA62-51) Treated wastewater discharge (011A) (MA62-03)	Muddy Cove Brook (MA62-52, and MA62-51) Taunton River (MA62-03)

Table G3. Taunton River Watershed Minor NPDES Wastewater Facilities.

Permitee	NPDES#	Issuance	Flow (MGD)/Types of Discharge	Receiving Water (Segment)
Abington/Rockland Joint Water Works (Myers Avenue Water Treatment Plant), Abington	MAG640009	2001	Treated Filter Backwash Water	Wetland adjacent to the Shumatuscacant River (MA62-33)
Avon Custom Mixing Services, Inc. (Division of Chase and Sons), Holbrook	MA0026883	2001	Outfall 001 – 0.0015 MGD of treated sanitary effluent Outfall 002 – 0.15 MGD of non-contact cooling water and stormwater runoff	Trout Brook (MA62-07)
Bay State Gas, Taunton	MAG250040	2000	Non-contact Cooling Water (terminated effective 3/26/04)	Taunton River (MA62-02)
BIW Cable Systems Inc, Dighton	MA0028649	1986	Outfall 001a – 0.0017 MGD of Process wastewater Outfall 001b – 0.006 MGD of wastewater from the electrical test tank	Threemile River (MA62-56)

Table G3 (cont). Taunton River Watershed Minor NPDES Wastewater Facilities.

Permitee	NPDES#	Issuance	Flow (MGD)/Types of Discharge	Receiving Water (Segment)
Dighton-Rehoboth Regional School District, Rehoboth	MA0022586	1987	0.01 MGD - Discharge water	Unnamed tributary to Segregansett River (MA62-53)
East Bridgewater Public Schools, E. Bridgewater	MA0022446	2004	0.012 MGD - Treated effluent	Unnamed tributary to Matfield River (MA62-32)
Equity Industrial GHEB Limited Partnership. E. Bridgewater (permit transferred from Foxboro Co.	MA0004103	1990 Facility currently collects and has wastewater treated offsite.	Outfall 001 – 0.12 MGD average monthly, 0.175 MGD maximum daily processed wastewater and treated sanitary waste. Outfall 001a – 0.02 MGD average monthly, 0.025 MGD max daily treated sanitary waste	Meadow Brook (MA62-38)
Gorham Silver Company (Former), Mansfield	MA0035700	Applied for permit	May be eligible for coverage under the Remediation General Permit	Wetland Area to Rumford River (MA62-39)
Harodite Finish Co, Dighton	MA0000761	Terminated 2004	Outfall #001 – 0.2 MGD processed and sanitary wastewater discharges Outfall #002, 003, 004, 005 non-contact cooling water – maximum temperature 32.2°C Outfall #006 boiler blowdown – maximum temperature 66°C	Threemile River (MA62-56)
Harodite Finish Co, Dighton	MAG250032	2004	Outfall #004, and 005 non-contact cooling water – 0.036 MGD, maximum temperature 83°F	Threemile River (MA62-56)
Howard School, W. Bridgewater	MA0101753	2003	0.005 MGD - Treatment plant effluent	Town River (MA62-11)
Rose L. MacDonald School, West Bridgewater	MA0102061	2003	0.003 MGD - Treated effluent	West Meadow Brook to Town River (MA62-11)
Hybripac Inc (former), Avon	MA0036951	1997	Issued an emergency exclusion in 1997 for groundwater remediation (no longer in effect)	Unnamed tributary to Trout Brook (MA62-07)
Kilburn Glass Industries Incorporated, Norton (Now Isotronics)	MA0030724	Terminated 6/2004	Unknown	Pond to Swamp to Wading River (MA62-49)
Morton Hospital, Taunton	MA0027529	Permit not yet issued	Unknown	Mill River (MA62-29)
Oak Point Retirement Community formerly White Oak Island Trust, Middleborough	MA0032433	2004	0.185 average monthly - Treated Sanitary Wastewater	Taunton River (MA62-01)
Reed & Barton Corporation, Taunton	MA0001422	Terminated 11/ 2004	Non-contact Cooling Water Discharges (connected to Taunton WWTP)	Mill River (MA62-29)

Table G3 (cont). Taunton River Watershed Minor NPDES Wastewater Facilities.

Permitee	NPDES#	Issuance	Flow (MGD)/Types of Discharge	Receiving Water (Segment)
Richmond Park Water Treatment Plant, Halifax	MAG640008	2002	Treated Filter Backwash Water	Turkey Swamp adjacent to Palmer Mill Brook which flows into the Winnetuxet River (MA62-24)
Sinclair Manufacturing Company, Norton	MAG250030	2004	0.0075 MGD average, 0.0125 MGD maximum - Non-contact Cooling Water	Chartley Brook which flows into the Wading River (MA62-49)
Shell Oil Co, Fall River	MA0004871	1978	Oil and grease 15mg/l	Taunton River (MA62-04)
Sun Chemical Corporation/GPI Division, Mansfield	MAG250244	2000	Non-contact cooling water	Ditch to Hodges Brook, a tributary to the Wading River (MA62-48)
Waters Association Inc., Taunton	MA0026867	Terminated 1/ 2004	Non-contact cooling water discharge is now a closed-loop system.	Threemile River (MA62-56)
Wheaton College, Norton	MA0026182	1978	0.12 MGD average monthly, 0.16 MGD maximum daily - Sanitary wastewater and cooling water	Rumford River (MA62-40)
Whitman Metal Products Division, Whitman	MA0036919	Terminated 3/2003	Connected to the Brockton municipal sewerage system	Shumatuscacant River (MA62-33)

Table G4. Taunton River Watershed Multi-sector General Stormwater Permits.

Facility Name	Permit Number	Municipality
First Student Inc.	MAR05C310	Abington
Engineered Materials Solutions	MAR05B860	Attleboro
Fedex Freight East Avon	MAR05C428	Avon
George's Garage	MAR05B810	
Roadway Express Inc.	MAR05B804	
T.L. Edwards Inc.	MAR05C042	
Berkley Used Auto Parts	MAR05B738	Berkley
Bridgewater	MAR05B857	Bridgewater
Chuckran Auto Parts Inc.	MAR05C177	
First Student Inc.	MAR05C311	
Safety-Kleen Systems Inc.	MAR05C293	
Stonemeadow 55+ Community	MAR05C349	
Brisco Baling Corp.	MAR05C141	Brockton
Brockton Auto Parts Inc.	MAR05B829	
Brockton Plant	MAR05C093	
Brockton VMF	MAR05B744	
Browning Ferris Ind. Of Mass.	MAR05C136	
Everett's Auto Parts	MAR05B755	
First Student Inc.	MAR05C312	
FootJoy	MAR05B932	
Lebaron Foundry Inc.	MAR05C392	
Ups-Brockton	MAR05B894	

Table G4 (cont). Taunton River Watershed Multi-sector General Stormwater Permits.

Facility Name	Permit Number	Municipality
Aggregate Industries Northeast	MAR05C114	Carver
Dighton Power Associates	MAR05B901	Dighton
Zeneca, Inc.	MAR05B053	
Regal Used Auto Parts Inc.	MAR05B780	East Bridgewater
Collins Crane & Rigging Service	MAR05B751	
Dm Auto Enterprises	MAR05B809	East Freetown
600 Turnpike Street Realty	MAR05C226	Easton
600 Turnpike Street Realty	MAR05C260	
Bayside Laminating	MAR05B964	Fall River
Duro Plant No2	MAR05B947	
Main Street Textiles LP	MAR05B958	
Invensys Systems Inc.	MAR05C285	Foxborough
Invensys Systems Inc.	MAR05C286	
Remco Concrete	MAR05B614	Lakeville
T.L. Edwards Inc.	MAR05C041	
Eastern Container Corp.	MAR05C234	Mansfield
Hub Folding Box Company Inc.	MAR05B837	
Hank Zion Auto Salvage	MAR05C216	Middleborough
Ocean Spray Cranberries Inc.	MAR05B675	
Walter Zion Used Auto Parts Inc.	MAR05B950	
Middleborough Landfill	MAR05C506	
Middleborough WPCF	MAR05C453	
Acushnet Rubber Co. Inc.	MAR05C166	New Bedford
Acushnet Rubber Co. Inc.	MAR05C167	
AFC Cable Systems	MAR05C228	
AFC Cable Systems	MAR05C439	
Allegheny Rodney	MAR05C155	
America Cable Systems	MAR05C438	
Deputy A Johnson & Johnson Co.	MAR05B888	
Global Companies LLC	MAR05B694	
Goyette's Inc.	MAR05B913	
Maritime International Inc.	MAR05C371	
New Bedford Regional Airport	MAR05B668	
Polaroid Corporation	MAR05B909	
Titleist and FootJoy	MAR05B929	
Titleist and FootJoy	MAR05B934	
Titleist Pilot Production	MAR05B933	
Norton DPW	MAR05C504	Norton
First Student Inc.	MAR05C325	Pembroke
Recycling Center	MAR05C505	
Lorusso Corporation	MAR05B991	Plainville
Masslite Division	MAR05B990	
Aggregate Industries Northeast	MAR05C109	Raynham
Depuy A Johnson & Johnson Co.	MAR05B889	
Federal Express	MAR05C281	
Raynham Transfer Facility	MAR05C541	

Table G4 (cont). Taunton River Watershed Multi-sector General Stormwater Permits.

Facility Name	Permit Number	Municipality
Slips Capeway Marine Inc.	MAR05B699	Raynham
Rotondo Precast	MAR05C258	Rehoboth
Rochester Environmental Park	MAR05B937	Rochester
Brayton Point Station	MAR05C592	Somerset
Somerset Highway Department	MAR05C522	
Aggregate Industries Northeast	MAR05C105	Stoughton
Consolidated Freightways	MAR05B717	
Waste Management of MA Inc.	MAR05C040	
Al's Auto Parts	MAR05B737	Swansea
Swansea Plant	MAR05C096	
Kirkhill-Ta Co. Haskon Division	MAR05C442	Taunton
Aggregate Industries-Northeast	MAR05C103	
Dyecraftsmen Inc.	MAR05C037	
Federal Express	MAR05C149	
General Cable Industries Inc.	MAR05B794	
General Dynamics	MAR05C092	
Quebecorworld Book Services	MAR05B844	
Quebecorworld Retail Printing	MAR05C560	
Taunton Municipal Lighting	MAR05B919	
Taunton Sanitary Landfill	MAR05C045	
Waters Technology Corporation	MAR05C455	
Waters Technology Corporation	MAR05C539	
Taunton Municipal Airport	MAR05B828	
Quebecorworld Press	MAR05C367	West Bridgewater
J Saccone and Sons	MAR05C224	Whitman
First Student Inc.	MAR05C213	

Table G5. Taunton River Watershed WMA User Data.

Permit	Registration	PWSID	Name/Location [Municipality]	Registered Volume (MGD)	20 Year permitted Volume (MGD)	Source Name	Source Type G = ground S = surface	Withdrawal Location [Segment]
9P442504203			Olde Scotland Links Golf Course, Bridgewater		0.14	Irrigation Well #1	G	MA62-01
	42514601		Poquay Brook Golf Course, Lakeville	0.10		Irrigation pond on Poquay Brook	S	MA62-01
	42507603		Zeneca Specialties, Dighton	1.19		Well at 333 Main St.	G	MA62-23
						Pond at 333 Main St.	S	
	V42504401		Churchill Linen Service, Brockton	0.09		Well	S	MA62-05
	42508301		Cameron Woodard Sod Farm, East Bridgewater	0.24		C-3	S	MA62-38
						C-1	S	MA62-10
						C-2	S	MA62-34
	42504403		Brockton Country Club, Brockton	0.09		Irrigation well	G	MA62-11
	42504404		Thorny Lea Golf Club, Brockton	0.15		Irrigation Pond #1	S	MA62-11
						Irrigation Pond #2	S	
9P442521802			Tournament Players Club of Boston, Norton		0.23	Irrigation Well RW-3	G	MA62-40
						Irrigation Well RW-4	G	
						Irrigation Well RW-5	G	
						Irrigation Well RW-6	G	
						Irrigation Well RW-9	G	
						Irrigation Well RW-11	G	
						Irrigation Well RW-13	G	
	42507602		Harodite Finishing Company, North Dighton	0.16		Well #1	G	MA62-56
						Well #2	G	
						Well #3	G	
						Threemile River	S	
	V42509903		Law Greenhouses & Gardens, Foxborough	0.01		Perkins Field	S	MA62-47
	42509901		Foxborough Country Club, Inc., Foxborough	0.07		Irrigation Well #1	G	MA62-14
						Irrigation Well #2	G	
						Irrigation Well #3	G	
						Irrigation Pond	S	

Table G5 (cont). Taunton River Watershed WMA User Data.

Permit	Registration	PWSID	Name/Location [Municipality]	Registered Volume (MGD)	20 Year permitted Volume (MGD)	Source Name	Source Type G = ground S = surface	Withdrawal Location [Segment]
	42501601		Texas Instruments	0.37		Well #1	G	MA62-49
						Well #3	G	
						Well #7	G	
						Well #11	G	
9P42529303			Segregansett Country Club, Taunton		0.12	Irrigation Pond	S	MA62-53
	V42510204		Town Line Farm, Freetown	0.03		On-site Reservoir	S	MA62-20
	42511803		Country Club Halifax, Halifax	0.23		Well #1	G	MA62-24
						Irrigation Pond	S	
9P442514603			LeBaron Hill Golf Club, Lakeville		0.17	Irrigation Well	G	MA62-25
	42529304		Lakeville Country Club, Lakeville	0.17		Irrigation Pond	S	MA62-25
	42518233		Thurston Burns, Middleboro	0.01		Nemasket River	S	MA62-25
	42518226		Byrne Sand and Gravel, Middleboro	0.25		On-site Reservoir	S	MA62-25
	V42516701		Benjamin W. Flint – Flintland Farm	0.02		Canoe River	S	MA62-27
9P442529306			Infinity Holding LLC, Taunton		0.576	Mill Pond on Mill River	S	MA62-29
	42508306		C.N. Smith Farm, Inc., East Bridgewater	0.1		Matfield River	S	MA62-32
	42533801		Ridder Farm Incorporated, Whitman	0.09		Irrigation Pond #1 on Shumatusacant River	S	MA62-33
						Irrigation Pond #2	S	
	V42508803		Pine Oaks Golf Course, South Easton	0.02		Black Brook	S	MA62-35
	42508802		Easton Country Club, Easton	0.07		Cedar Swamp	S	MA62-35
	42525101	4001000	Abington/Rockland Joint Water Works	0.46		Myers Ave. Well #1	4001000-01G	MA62-33
						Myers Ave. Well #2	4001000-02G	
						Myers Ave. Well #3	4001000-03G	
						Myers Ave. Well #4	4001000-04G	
9P42501601	42501602	4016000	Attleboro Department Public Works	1.62	0.47	Wading River Wells	016-05S	MA62-47

Table G5 (cont). Taunton River Watershed WMA User Data.

Permit	Registration	PWSID	Name/Location [Municipality]	Registered Volume (MGD)	20 Year permitted Volume (MGD)	Source Name	Source Type G = ground S = surface	Withdrawal Location (segment)
9P42501801	42501801	4018000	Avon Water Department	0.45	0.16	Memorial Well #1	4018000-01G	MA62-07
						GP Well #2	4018000-02G	
						Porter Well	4018000-03G	
						Theater Well #3	4018000-04G	
						Connelly Road Well #4	4018000-05G	
						Trout Brook Wellfield	4018000-06G	
9P42504201	42504201	4042000	Bridgewater Water Department	1.66	0.74	High St. #3	4042000-02G	MA62-32
						High St. #6	4042000-05G	
						High St. #8	4042000-09G	
						High St. #9	4042000-10G	
						Carver's Pond #1	4042000-03G	MA62-12
						Carver's Pond #2	4042000-04G	
						Carver's Pond #4	4042000-06G	
						Carver's Pond #5	4042000-07G	
						Carver's Pond #7	4042000-08G	
9P42504401	42504402	4044000	Brockton DPW-Water Division	0.04	0.83	Hubbard Ave. Well	4044000-01G	MA62-05
						Avon Reservoir	4044000-02S	MA62023
						Monponsett Pond	4044000-04S	MA62218
	42507601	4076000	Dighton Water District	0.37		Walker St. Well #1	4076000-04G	MA62-53
						Walker St. Well #2	4076000-05G	
9P42508301	42508304	4083000	East Bridgewater Water Department	0.85	0.36	Well #1Pond St.	4083000-01G	MA62-10
						Well #4 Washington St.	4083000-04G	
						Well #2 Crescent St.	4083000-02G	MA62-34
						Well #3 Hudson St.	4083000-03G	
						Well #5 Off East St.	4082000-05G	MA62-32

Table G5 (cont). Taunton River Watershed WMA User Data.

Permit	Registration	PWSID	Name/Location [Municipality]	Registered Volume (MGD)	20 Year permitted Volume (MGD)	Source Name	Source Type G = ground S = surface	Withdrawal Location (segment)
9P42508801	42508801	4088000	Easton Water Department	1.44	1.01	Station #1 Gary Lane	4088000-01G	MA62-21
						Station #2 Washington St.	4088000-02G	
						Station #4 Washington St.	4088000-04G	
						Station #3 Red Mill Road	4088000-03G	MA62-27
						Station #5 Washington St.	4088000-05G	
						Wheaton Farm Well	4088000-06G	MA62-31
9P42509901	42509902	4099000	Foxborough Water Department	1.60	0.22	Station #2, Well #4	4099000-04G	MA62-47
						Station #2, Well #5	4099000-05G	
						Station #2, Well #6	4099000-06G	
						Station #4	4099000-12G	
						Station #3, Well #7	4099000-07G	MA62-39
						Station #3, Well #8	4099000-08G	
						Station #3, Well #9	4099000-09G	
						Station #3A, Well #10	4099000-10G	
9P42511801	42511801	4118000	Halifax Water Department	0.35	0.33	Richmond Park Well #1	4118000-01G	MA62-24
						Richmond Park Well #2	4118000-02G	
						YMCA Well #3	4118000-03G	
9P42512301	42512301	4123000	Hanson Water Department	0.51	0.27	Crystal Springs Well	4123000-01G	MA62-34
						Crystal Springs Wellfield	4123000-03G	
						Crystal Springs Wellfield	4123000-04G	
						Crystal Springs Wellfield	4123000-05G	
9P42516701	42516701	4167000	Mansfield Water Department	1.59	0.40	Cate Springs #1	4167000-01G	MA62-27
						Dustin #7	4167000-08G	
						Prescott #8	4167000-09G	
						Prescott #9	4167000-10G	
						Ash Property	4167000-11G	MA62-48

Table G5 (cont). Taunton River Watershed WMA User Data.

Permit	Registration	PWSID	Name/Location [Municipality]	Registered Volume (MGD)	20 Year permitted Volume (MGD)	Source Name	Source Type G = ground S = surface	Withdrawal Location (segment)
9P42518201	42518203	4182000	Middleboro Water Supply	1.53	1.50	Rock Well #1	4182000-01G	MA62-25
						Rock Well #2	4182000-02G	
						East Main St. Well #1	4182000-03G	
						East Grove St. Well	4182000-04G	
						Tispaquin Well #1	4182000-05G	
						Miller St. Well	4182000-06G	
						East Main St. Well #2	4182000-07G	
						Tispaquin Well #2	4182000-10G	
						Spruce Well	4182000-11G	
						Plympton St. Well	4182000-08G	MA62-24
						Cross St. Well	4182000-09G	MA62-01
9P42520101	42520101	4201000	New Bedford Water Department	18.27	2.52	Great Quittacas Pond	4201000-01S	MA62083
						Little Quittacas Pond	4201000-02S	MA62107
						Assawompsett Pond	4201000-03S	MA62003
						Pocksha Pond	4201000-04S	MA62145
						Long Pond	4201000-05S	MA62108
9P342521801	42521801	4218000	Norton Water Department	1.21	0.64	GP Well #1	4218000-01G	MA62-56
						GP Well #2	4218000-02G	
						GP Well #3	4218000-03G	MA62-27
						GP Well #4	4218000-04G	
						GPWell #5	4218000-05G	
						GP Well #6	4218000-06G	
9P42523801	42523801	4238000	Plainville Water Department	0.39	0.0	Well #1	4238000-01G	MA62-47
						Well #2	4238000-02G	
						Well #5	4238000-05G	
9P442524502	42524501	4245002	North Raynham Water District	0.32	0.0	King Philip St. Well #1	4245002-01G	MA62-37
						King Philip St. Well #2	4245002-03G	
						King Philip St. Well #3A	4245002-04G	
						King Philip St. Well #3B	4245002-05G	
						First St. Well	4245002-06G	

Table G5 (cont). Taunton River Watershed WMA User Data.

Permit	Registration	PWSID	Name/Location [Municipality]	Registered Volume (MGD)	20 Year permitted Volume (MGD)	Source Name	Source Type G = ground S = surface	Withdrawal Location (segment)
9P42524501	42524502	4245000	Raynham Center Water District	0.40	0.42	Lake Nip Well #1	4245000-02G	MA62-35
						Lake Nip Well #2	4245000-03G	
						Lake Nip Well #1A	4245000-04G	
						Lake Nip Well #2A	4245000-05G	
						Lake Nip Well #2B	4245000-06G	
						Lake Nip Well #1B2	4245000-08G	
						Johnson St. Well	4245000-01G	MA62-37
						Gushee Pond Well #1	4245000-07G	
						Gushee Pond Well #2	4245000-09G	
9P42526601	42526601	4266000	Sharon DPW-Water Division	0.55	0.31	Well #5	4266000-04G	MA62-39
						Well #7	4266000-06G	
						Well #6	4266000-05G	MA62-27
9P42527301	42527301	4273000	Somerset Water Department	2.81	1.61	Somerset Reservoir	4273000-01S	MA62174
						GP Well #2	4273000-05G	MA62-23
						Segreganset River	4273000-02S	MA62-53
9P42528501	42528502	4285000	Stoughton DPW-Water Division	1.14	0.13	Fennell Well	4285000-02G	MA62-21
						McNamara Well	4285000-03G	
						Gurney Well	4285000-04G	
						Goddard Hospital Well	4285000-07G	MA62-22
9P42529304	42529302	4293000	Taunton DPW-Water Division	5.87	1.42	Assawompsett Pond	4293000-01S	MA62003
						Elders Pond	4293000-02S	MA62-25
						Long Pond	4293000-03S	MA62108
						Pocksha Pond	4293000-04S	MA62145
9P42532201	42532201	4322000	West Bridgewater Water Department	0.73	0.08	Cyr #1, Wells 1 & 2	4322000-01G	MA62-06
						Norman #2, Wells 1 & 2	4322000-02G	
						Cyr #4	4322000-04G	
						Cyr #5	4322000-05G	
						Manley #3, Wells 1 & 2	4322000-03G	MA62-35
9P42535001	42535001	4350000	Wrentham DPW-Water Division	0.38	0.23	Well #4 Thurston St.	4350000-02G	MA62-47

APPENDIX H

Technical Memorandum TM-62-6

TAUNTON RIVER WATERSHED 2001 PERIPHYTON REVIEW

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TAUNTON RIVER WATERSHED PERIPHYTON COMMUNITY EXAMINATION-2001

INTRODUCTION

During the week of July 30-August 2, 2001, MA DEP personnel collected periphyton samples along with macroalgae (visible forms of attached algae) from stations in the Taunton River Watershed as part of the Year 2 Water Quality Monitoring. Microalgae, bacteria and/or fungi attached to submerged substrates are referred to as periphyton. The microalgae are typically represented by diatoms and cyanobacteria (also referred to as blue-green algae) and the macroalgae refer primarily to the green and yellow-green algae. The algal periphyton is further described by the substrate they are attached to, such as epilithic algae on gravel, cobbles and boulders; epiphytic algae on plants; and episammic algae on sand. Besides periphyton the biological assessment of the Taunton River included macroinvertebrate, habitat and fish community analyses. These analyses are all typically conducted within the same reach established for the macroinvertebrate sampling.

Algae are good indicators of water quality conditions since they absorb nutrients and contaminants solely from the water column. The algal community species composition, as well as growth rates and biomass production, can be altered by their differing responses to the kinds or amounts of nutrients or toxic substances to which they are exposed. Other environmental factors are important in defining algal habitats. These include: stream velocity, substrate composition, sunlight and some biological factors, such as the number and kind of grazers present and strategies for resource competition.

The objectives of the algal sampling in the Taunton River Watershed were to:

- examine the percent cover of the periphyton community in riffles and/or runs as a means of evaluating the water and habitat quality;
- identify the dominant algae present in the streams and rivers of Massachusetts, especially those known to potentially be "nuisance" algae; and
- examine whether certain uses (such as Aesthetics) of the surface waters are being maintained and protected as described in the Massachusetts Surface Water Quality Standards (SWQS)(MA DEP 1996).

The use of a particular stream segment may be affected by environmental conditions that favor the growth and reproductive success of the green macroalgae. Nuisance amounts of macroalgal (green or yellow-green algae) growth can impact the aesthetics of an area, reduce recreational use, or harm aquatic life by altering habitats or food sources for fish or macroinvertebrates (Barbour et.al. 1999).

The estimation of the percent cover of green macroalgae is a way to determine if nuisance algal growth is impacting the Aesthetics or Aquatic Life uses. Cover greater than 40% in a riffle or run is an indication of excessive algal growth (Barbour et al., 1999) which may be considered a threat to the aesthetic quality of the stream segment (Biggs 1996). Aquatic Life can also be impacted by excessive growth of macroalgae. Dissolved oxygen concentrations may be reduced by the breakdown of the algal biomass. While decomposing the larger particles can clog interstitial areas in the substrates that are important to the meiofauna. Macroinvertebrates with low tolerance for these reduced oxygen levels are replaced by more tolerant organisms that are indicative of reduced water quality.

The green macroalgae can grow faster and taller, thus out competing the microalgal diatom populations. This creates a canopy that shades and often reduces the closely adhering algae below. Loss of the diatom films is a major impact on the algal community.

Site Selection

Table 1 (Fiorentino 2004) is a synopsis of the significant issues for including specific locations in the sampling plan and a description of the location of the periphyton sampling stations and dates.

Requests were made by agency personnel and citizen groups for sites to be included in the biological sampling. Personnel from the MA DEP DWM reviewed the list and conducted site visits to determine

whether substrates, water depths, velocities and access were suitable for biological sampling. Stations were included with potential nonpoint pollution problems, such as TR06B on the Rumford River that is situated downstream from the urbanized area of Mansfield, and RB02 on Robinson Brook located below Foxborough and Interstate Route I-95. Nonpoint sources of pollution from urban areas [e.g. the city of Mansfield to the Rumford River (TR06B)], or agricultural runoff from cranberry bogs in the Cedar Swamp River tributary (AS05T) and Satucket River (SA03) systems may contribute nutrients as well as other contaminants to their receiving waters. Point sources were also included in the site selection. Station TR03 on the Salisbury Plain River is located below the Brockton POTW discharge, and TM01 on the Threemile River is downstream from the Mansfield POTW discharge. Changes in water quality conditions, as well as alterations in habitat, resulting from all of these pollution sources may be reflected in the algal community.

In selecting sampling sites consideration was also given to stream reaches that had either not been sampled before or not sampled for a long time. Examples include two rivers that were unassessed for aquatic life: SA03 on the Satucket River and AR00 on the Assonet River. Other rivers and streams selected for study had been assessed and are on the 303(d) list of impaired waters (now Category 5 of the Integrated List of Waters). The Wading and Nemasket Rivers are listed for low dissolved oxygen. The Wading River, Threemile River, and Salisbury Plain River are all listed for pathogens. TR01 on the Canoe River was included because it historically had been a reference station for the MADEP-indicating a station in a fairly unchanged watershed with a similar stream order and flow regime to other streams and rivers that were being examined, but without a lot of changes in the watershed so that the periphyton population could be used for comparison.

The algal periphyton were collected at all sites where macroinvertebrate sampling was performed. This provided wide spatial coverage of the Taunton River Watershed. Results from these analyses were used to determine if nuisance amounts of algal biomass were present (Barbour 1999).

Table H1. Taunton River Watershed Periphyton Station Descriptions, Rationale and Sampling Date.

Waterbody	Station ID	Site description	Relevant Issues	Sampling Date
Canoe River	TR01	200 m downstream from Willow Street, Foxborough, MA.	watershed reference condition[1, 2, 3]	31 July 2001
Salisbury Plain River	TR03	300 m downstream from Belmont Street, East Bridgewater, MA.	NPS pollution[2, 3]; pathogens[4]; Brockton WWTP[2, 3, 5]	2 August 2001
Satucket River	SA03	Immediately upstream from Washington Street, Bridgewater, MA.	active cranberry bogs[3]; "unassessed" for aquatic life[4]; NPS pollution	2 August 2001
Nemasket River	NR01	200 m upstream from Route 44, Middleborough, MA.	active cranberry bogs[1,3]; low DO[3]; NPS pollution-urban runoff[3]; "unassessed" for aquatic life[4]	1 August 2001
Rumford River	TR06	200 m downstream from Cocasset Street, Foxborough, MA.	water withdrawals upstream[1, 2, 3]; organic enrichment/low DO/pathogens[4]	31 July 2001
Rumford River	TR06B	500 m downstream from Willow Street, Mansfield, MA.	NPS pollution-urban runoff (Mansfield, golf course)[1]; organic enrichment/low DO/pathogens[4]	31 July 2001
Robinson Brook	RB02	200 m upstream from Route 140, Mansfield, MA.	Foxboro Co. WWTP (inactive)[1]; NPS pollution-urban runoff (Foxborough; I-95)[1]	31 July 2001
Wading River	TR05B	1 km downstream from Barrows Street, Norton, MA.	industrial discharges (Richardson, Inc.; Tweave, Inc.)[1, 2, 3, 5]; organic enrichment/low DO[4]	1 August 2001
Threemile River	TM01	300 m downstream from Harvey Street, Taunton, MA.	Mansfield WWTP[1, 3, 5]; impoundment effects (Norton Reservoir)[4]; Wheaton College WWTP[5]	31 July 2001

Waterbody	Station ID	Site description	Relevant Issues	Sampling Date
Unnamed Tributary to Cedar Swamp River	AS05T	300 m downstream from Howland Road, Freetown, MA.	active cranberry bog[3]; "unassessed" for aquatic life[4]; NPS pollution	30 July 2001
Assonet River	AR00	100 m downstream from Locust Street, Freetown, MA.	"unassessed" for aquatic life[4]; NPS pollution	2 August 2001
Rattlesnake Brook	RA00	At trail approx. 400 m upstream from Route 24, Freetown, MA.	reference potential; "unassessed" for aquatic life[4]	30 July 2001

[1](Fiorentino 1996a); [2](Fiorentino 1996b); [3](MA DEP 1998); [4](MA DEP 2003a); [5](MA DEP 2003b)

MATERIALS and METHODS

Periphyton Identifications and Relative Abundance

Periphyton samples were collected in riffle or pool areas of a designated reach following the macroinvertebrate sampling to avoid scraping organisms off of substrates before they could be collected. The methods for periphyton collection are described in SOP: *CN 60.2 Benthic Algae: Micro and Macro Identifications and Biomass Determinations* (MA DEP 2002). The collections consisted of scraping randomly collected rocks and cobble substrates with a knife or by hand and putting the material into a labeled glass vial. The samples were brought back to the Microscopy Lab at MADEP-DWM for identifications. If they could not be completed within a week, they were preserved in lugols solution (M^3 Magic Mix) (MA DEP 2001).

Processing the samples followed the SOP: *CN:60.2 Benthic Algae: Micro and Macro Identifications and Biomass Determinations* (MA DEP 2002). A modified method for periphyton analysis developed by L. Bahls (1993) is used. The scheme for determining the relative abundance of the soft-bodied algae is as follows:

R (rare)	fewer than one cell per field of view at 200x, on the average;
C (common)	at least one, but fewer than five cells per field of view;
VC (very common)	between 5 and 25 cells per field;
A (abundant)	more than 25 cells per field, but countable;
VA (very abundant)	number of cells per field too numerous to count.

This determination of abundance provides a relative approximation of the taxa that contribute the most to the cell count in the riffle or pool habitats. Appendix A contains the alga taxa found at each station and their relative abundance.

RESULTS

Information obtained during habitat assessment, in particular the canopy cover and percent algal cover, is used in conjunction with algal identifications and relative abundance of algal genera to evaluate the condition of the algal community. Assessment personnel (MADEP) use the algal information along with other water quality and biological findings to evaluate if segments of the rivers are attaining their highest use potential. Designated uses are described in the *Massachusetts Surface Water Quality Standards* (MA DEP 1996).

The canopy cover was greater than 50% (Table 2) at most of the stations included in the biological assessment. Three stations: NR01 on the Nemasket River, TM01 on the Threemile River and SA03 on the Satucket River had 50% or less canopy cover. This shading appears to have affected the constituents and production of the algal community. At the majority of the sampling stations the algal cover was sparse (Table 2), while the two stations located below wastewater treatment facilities (TR03 and TM01) had 40% or greater algal cover.

The filamentous, macroalgal genera that dominated these sites include: *Microspora* sp. (TR03), *Cladophora* sp. (NR01) and *Vaucheria* sp. (TM01) (Appendix A). The macroalgae can have the greatest impact on water uses, in part, because of their ability to produce large amounts of biomass.

DISCUSSION

A combination of biological and physical factors, rather than the availability of nutrients, likely contributed to the development of low amounts of algal biomass at most stations in the Taunton River Watershed. Some disturbance factors that affect algal production include: herbivory, scouring, water velocity, substrate size and light availability. In the Taunton River Watershed the physical stressors scouring and light limitation may have influenced the structure and biomass of the algal community since there are few areas where algal coverage is greater than 10%. The EPA criteria indicating nuisance levels of algal biomass (Barbour, et al. 1999) are for any of the following measures to be met: >10 µg chlorophyll a/cm^{-2}, >5 mg ash free dry weight cm^{-2}, and >40% cover by macroalgae. The percent algal cover on the natural substrates within the riffle can be used to determine if aesthetics has been degraded since people view in an adverse way green filamentous algae streaming off of macrophytes or boulders (Biggs 1996). Appendix A lists the algal taxa that were found on the natural substrates.

The USGS flow station for the Taunton River Watershed near Bridgewater, MA (01108000) recorded high flows on June 18, 2001 (1040 cfs) and on July 2, 2001 (547 cfs). These flow rates may have represented scouring events that could have affected both tributaries and the mainstem stations throughout the watershed. The discharge after July 2 continued to decline until the July 31 sampling date when it was 103 cfs. The discharge information was found at the following website maintained by the US Geological Survey: http://nwis.waterdata.usgs.gov/ma/nwis/discharge?site_no=01108000.

Table H2. Taunton River Watershed 2001- Dominant Algae with Relative Abundance, Percent Canopy Cover and Percent Algal Cover.

Station	Location	Dominant Alga - Relative Abundance	% Canopy Cover	% Algal Cover
TR01	Canoe River, downstream from Willow St., Foxboro. Reference station.	Not Applicable	60%	0*
TR03	Salisbury Plain River, downstream from Belmont St., E. Bridgewater.	*Microspora* sp. - VA** Blue-green - VA	60%	>50%
SA03	Satucket River, immediately upstream from Washington St., E. Bridgewater.	Not Applicable	50%	0*
NR01	Nemasket River, upstream from Rte. 44, Middleborough.	*Cladophora* sp. - VA** Filamentous	<5%	Not recorded, probably <10%
TR06	Rumford River, downstream from Cocasset St., Foxboro.	Diatoms - R Blue-green - C	75%	<1%
TR06B	Rumford River, 300 m downstream from Willow St., Mansfield.	Not Applicable	60%	0*
RB02	Robinson Brook, tributary to Rumford River, upstream from Rte.140, Mansfield.	Not Applicable	90%	0*
TR05B	Wading River, downstream from Barrows Street, Norton, MA.	Diatoms - R	75%	Not recorded
TM01	Threemile River, downstream from Harvey St., Taunton.	*Vaucheria* sp. - A Filamentous Diatoms - A	45%	40%
AS05T	Unnamed Tributary to Cedar Swamp River, 275 m downstream from Howland Rd., Freetown.	Diatoms - R	95%	<5%
AR00	Assonet River, 100 m downstream from Locust St., Freetown.	*Melosira* sp. - R	75%	10%
RA00	Rattlesnake Brook, Freetown State Forest, Freetown.	*Fragilaria* sp. - A	90%	<5%

* visual estimate, no sample collected
** green filamentous

Stations with Nuisance Macro Algae Taxa Present

TM01, located on the Threemile River below the Mansfield WWTP, was dominated by the filamentous alga *Vaucheria* sp. which is "nutrient demanding" (Biggs 1996). However, nuisance growths were not observed. The 40% algal cover had visible patches of *Vaucheria* sp. as well as patches predominantly covered by diatoms and moss. The reach was partially shaded with an estimated canopy cover of 45%. The shade was produced by a mixture of oaks (*Quercus* sp.), white pine (*Pinus strobus)* and red maple trees (*Acer rubrum*). The nutrients were found to be elevated at this location by the MADEP which sampled it three times during the summer of 2001. The range of total phosphorus values was 0.098-0.12 mg/l and of nitrate-nitrite 1.7-7.3 mg/l (MA DEP 2005). Maintenance of the vegetated buffer is important to keep the macroalgae from responding to the available light and nutrients by increasing their coverage of the bottom substrates. Also, the buffer helps to intercept additional nutrients in the runoff that would otherwise reach the river.

The primary periphyton taxon at the time of sampling station NR01 on the Nemasket River, Middleborough was the green macroalgae, *Cladophora* sp. This is a nuisance alga that can grow prolifically given the right conditions. The diatom population at this station was not a major contributor of periphyton biomass; present were primarily planktonic diatoms that were filtered from the water column by the moss. The reason for the lack of algal cover is not known; it was estimated at <10%, while the canopy cover was <5%, so light limitation would not appear to be a problem. Fiorentino (2004) described this channelized reach as, "…a sluiceway delivering swift water over an area of fairly uniform depth (0.30 m)…". The swift water is not a good habitat for the green macroalgae and during runoff conditions the additional sediment load might contribute to scouring. In other areas of the reach, rooted macrophytes, especially water buttercup (*Ranunculus trichophyllus*), cover >90% of the stream bottom (Fiorentino 2004) which reduced available substrates for algal growth.

The percent algal cover of the macroalgae was highest at station TR03, on the Salisbury Plain River below the Brockton POTW. This site was relatively shaded by canopy plants and yet the macroalgal cover was greater than 50%. "Luxuriant" was used to describe (Fiorentino 2004) the growth of the green, macroalga-*Microspora* sp. This alga was present in nuisance amounts (Barbour 1999).

Stations Without Any Evident Algal Problems

Many locations throughout the watershed, such as stations on Robinson Brook, Rumford River, tributary to Cedar Swamp River, Rattlesnake Brook, and the Satucket River, had reduced or absent algal populations. The lack of visible algal growth is not always indicative of a healthy community and good water quality; it may indicate the opposite. Reduced light availability due to the canopy cover (Quinn et al. 1997) likely limited algal growth at several Taunton River stations. However, the absent or minimal algal growth may only indicate the time elapsed since the last period of algal accrual (Stevenson 1996).

Three sampling stations representing the Rumford River system - TR06, downstream from Cocasset St., Foxboro, TR06B approximately 300 m downstream from Willow St., Mansfield, and RB02 Robinson Brook, tributary to Rumford River, upstream from Rte.140-Mansfield - all lacked periphyton cover. At station TR06 algal cover was estimated at <1 % cover, while TR06B and RB02 were devoid of algae. The mainstem Rumford River is on the 303(d) List (MA DEP 2003) for organic enrichment and low DO, but since the algal population was so reduced its impact on DO was minimal at the time of sampling. The canopy at Robinson Brook was almost completely closed at RB02. At 90% canopy cover light was limited for photosynthesis. Station TR06B, on the mainstem Rumford River, had 60% canopy cover but also had no visible algae. Urban runoff that carries street sands and silt from Mansfield may have had a significant effect on algal growth at TR06B or RB02 by scouring or burying algal substrates. About half the reach was affected by sedimentation; this was highlighted by the reach receiving the lowest score for this parameter of any station in the Taunton River Watershed included for biomonitoring.

Station AS05T, on an unnamed tributary to the Cedar Swamp River, is located in a shaded reach (canopy cover is 95%) below a functioning cranberry bog. There was limited light that could influence the algal cover at <5%. The only algal taxa found were some pennate diatoms (e.g. *Fragilaria* sp.) that were present in abundance (Appendix 1).

The Satucket River sampling location, SA03, is located in the southwestern corner of the Taunton River Watershed. It was not sampled for algae since none were observed and suitable hard substrates were not abundant. There was mostly a soft bottom of mud and organic muck; the predominant hard substrates used by algal germlings were primarily the bridge abutments. The availability of sunlight was not much of a problem at this reach since 50% was open canopied. The slow flows and muddy bottom were more conducive for the growth of phytoplankton rather than periphyton, although the phytoplankton, if present, were not creating visible scums or mats.

The Canoe River (TR01) is the reference station for the macroinvertebrate analysis. Because of the watershed characteristics (lack of major sources of point or nonpoint pollution and the relative stability of its landuse), good water quality and suitable aquatic habitats, it was to be used for the periphyton reference station as well. Unfortunately, no algae were observed on the cobbles and rocks when the reach was sampled for macroinvertebrates, so no sample was collected. The reach has a relatively closed canopy that would limit available light for algal growth. If grazing by the macroinvertebrates is responsible for the sparse algal population at this location, it cannot be determined using the present collection techniques for both the macroinvertebrate and the algal communities. The listing of several grazers under "functional feeding groups" and counts of their representatives (Fiorentino 2004), at least indicates that environmental conditions did not preclude the presence of grazers.

The condition of the Taunton River stations recorded during the 2001 sampling is primarily one of limited algal production, perhaps caused by limited light, grazing pressure and scouring. Waterbodies on the 303(d) list for pesticides include the Rumford River, so toxicity should be examined as a possibility for reduced algal growth. At the Rumford River and one tributary - Robinson Brook - there were little or no visible algae present. Also, station AS05T was located on an unnamed tributary to the Cedar Swamp River downstream from an active cranberry bog. Pesticides and/or herbicides, as well as habitat limitations, must be considered as possible causes of the reduced periphyton population.

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Appendix 1
Taunton River Watershed 2001 Periphyton Data

Date	Habitat	Class	Genus	Abundance
Location: Salisbury Plain River (TR03) downstream from Belmont Street, E. Bridgewater.				
2 August 2001	pool-rock	Chlorophyceae	*Microspora* sp.	VA
	riffle-rock	Bacillariophyceae	*Synedra* sp.	R
		Chlorophyceae	*Cladophora* sp.	R
		Chlorophyceae	*Microspora sp.*	VA
		Cyanophyceae	blue-green filaments	VA
			bacterial rods	VA
Location: Nemasket River (NR01) upstream from Route 44, Middleboro.				
1 August 2001	riffle-rock	Chlorophyceae	*Cladophora glomerata*	VA
	moss	Bacillariophyceae	*Rhyzosolenia* sp.	R
		Bacillariophyceae	diatoms	VA
Location: Rumford River (TR06) downstream from Cocasset Street, Foxboro.				
31 July 2001	cobble-pool	Bacillariophyceae	*Achnanthes* sp.	R
		Bacillariophyceae	*Meridion* sp.	R
		Cyanophyceae	ui blue-green chains	C
		Cyanophyceae	*Lyngbya* sp.	R
		Euglenophyceae?	*Haematococcus* sp.	R
Location: Wading River (TR05B) downstream from Barrows Street, Norton.				
1 August 2001	riffle-cobble	Bacillariophyceae	diatoms	R
		Chlorophyceae	Ui Chlorophyceae filaments	R
Location: Threemile River (TM01) downstream from Harvey Street, Taunton.				
30 July 2001	cobble-riffle	Xanthophyceae	*Vaucheria* sp.	A
	sand	Bacillariophyceae	*Amphiprora* sp.	C
		Bacillariophyceae	diatoms	A
		Bacillariophyceae	*Cocconeis* sp.	C
		Bacillariophyceae	*Gyrosigma* sp.	R
		Bacillariophyceae	*Synedra* sp.	R
		Bacillariophyceae	*Surirella* sp.	R
		Chlorophyceae	*Scenedesmus* sp.	R
		Cyanophyceae	*Lyngbya* sp.	R
Location: Unnamed Tributary to Cedar Swamp River (AS05T) downstream from Howland Road, Freetown.				
30 July 2001	moss-riffle	Chlorophyceae	*Arthrodesmus* sp.	R
		Chlorophyceae	*Spirogyra* like	R
		Chlorophyceae	ui green filament	R
Location: Assonet River (AR00) downstream from Locust Street, Freetown.				
2 August 2001	riffle-rock	Bacillariophyceae	*Melosira* sp.	R
			Bacteria	VA
Location: Rattlesnake Brook (RA00) upstream from Route 24, Freetown.				
30 July 2001	moss-riffle	Bacillariophyceae	diatoms	C
		Cyanophyceae	*Phormidium* sp.	C
	rock-riffle	Bacillariophyceae	*Fragilaria* sp.	A
		Bacillariophyceae	*Tabellaria* sp.	C
		Chlorophyceae	*Microspora* sp.	C

APPENDIX I
MassDEP GRANT AND LOAN PROGRAMS

Excerpted from the MassDEP/DWM World Wide Web site, http://www.mass.gov/dep/water/grantsfi.htm

604(b) WATER QUALITY MANAGEMENT PLANNING PROGRAM

This Grant Program is authorized under Section 604(b) of the Federal Clean Water Act. The program is designed to assist eligible recipients in providing water quality assessment and planning assistance to local communities. Priority is given to projects that provide diagnostic information to support the MA DEP's watershed management activities and to projects located in one of the priority watersheds targeted for assessment work by the MA DEP.

01-03/604 *Assessment of Land Use Activities, Nonpoint Source Pollution and Water Quality in the Taunton River Watershed.* This project will assess land use activities and identify nonpoint source (NPS) pollution areas for a minimum of six subwatersheds in the Taunton River watershed. Local water quality protection measures will be assessed and subwatershed action plans developed to address identified NPS pollution problems.

04-04/604 Mt. Hope Bay – Estuarine Water Quality Monitoring. The Southeastern Regional Planning and Economic Development District (SRPEDD), in collaboration with the University of Massachusetts' School of Marine Science and Technology (SMAST), will conduct a water quality monitoring program in Mt. Hope Bay and Taunton River sub-watersheds consistent with the Massachusetts Estuaries Project (MEP) water quality data requirements. The data collected will be used to prepare these areas for entry in the Commonwealth's Estuaries Project. The specialized marine water quality analysis will be conducted at the SMAST laboratories.

319 NONPOINT SOURCE COMPETITIVE GRANTS PROGRAM

This grant program is authorized under Section 319 of the CWA for implementation of projects that address the prevention, control, and abatement of nonpoint source (NPS) pollution. In order to be considered eligible for funding projects must: implement measures that address the prevention, control and abatement of NPS pollution; target the major source(s) of nonpoint source pollution within a watershed/subwatershed; have a 40 percent non-federal match of the total project cost (match funds must meet the same eligibility criteria as the federal funds); contain an appropriate method for evaluating the project results; and address activities that are identified in the Massachusetts NPS Management Program Plan.

01-12/319 *Cranberry Bog Phosphorus Dynamics for TMDL Development*. This project will study phosphorus dynamics in selected Massachusetts cranberry bogs to assist the Department in formulating Total Maximum Daily Load (TMDL) performance standards. Specifically, this project will (1) determine phosphorus and nitrogen import and export from representative cranberry beds associated with water management, including floods, irrigation, and rain events; (2) determine nitrogen and phosphorus export from a natural freshwater wetland; (3) determine phosphorus and nitrogen export from beds where phosphorus fertilizer rates are reduced to less than 20 pounds phosphorus/acre; and (4) determine the impact of reduction in phosphorus fertilization on cranberry sustainability.

03-04/319 *South Coastal Inter-Municipal Water Quality Improvement Project*. This project is part of a multi-community effort to work collectively in reducing stormwater contaminants from entering 15 303d-listed waterbodies in the towns of Pembroke, Hanover, and Hanson. The principle activity of the project will be to purchase and share a Johnston 605 PM-10 vacuum street sweeper to remove roadside sediment, nutrients, toxics, and other pollutants that currently enter stormwater infrastructure. Storm drain markers, signage, and an intensive public education and outreach program will also be implemented under this proposal.

MASSACHUSETTS WATERSHED INITIATIVE PROJECT

Each year EOEA Watershed Team Leaders, in conjunction with State and Federal agencies, municipal governments and regional planning agencies, universities, local watershed associations, businesses and other groups, develop work plans that identify the most important goals for each watershed and the specific projects and programs that are needed to meet those goals.

02-14/MWI *Matfield River Sub-Watershed Stormwater Assessment and Plan*. This project will assess stormwater and other nonpoint source pollution contribution to water quality impairment and develop a stormwater management plan including recommendations for remedial actions and best management practices to restore water quality in the Matfield River Sub-Basin of the Taunton River Watershed.

02-17/MWI *Identification and Mapping of Perennial and Intermittent Streams in the Taunton River Watershed*. This project will identify and map perennial and intermittent streams in the Taunton River Watershed using statistically based hydrologic methodologies.

PROJECT MASS – *Watershed Biodiversity Enhancement on the Three Mile River.* This project consists of the installation of two (2) fish ladders on two (2) dams (Harrodite and Raytheon) located on the Three Mile River, which is the municipal boundary for the town of Dighton and city of Taunton, and a study of the resulting effect on fish migration. The installation of these ladders will allow river herring and shad to access a 1000 acre plus impoundment, known as the Gertrude Boyden Impoundment. The fish ladder for the Harrodite Dam has been already purchased. The access of these fish to new areas of habitat will be a significant measure of improved watershed health.

104(b)(3) WATER QUALITY AND WETLANDS PROGRAM DEVELOPMENT GRANTS

This Grant Program is authorized under Wetlands and Clean Water Act Section 104(b)(3) of the federal Clean Water Act. The Water Quality proposals received by MA DEP under this National Environmental Performance Partnership Agreement (NEPPA) with the U.S. Environmental Protection Agency is a results oriented approach that will focus attention on environmental protection goals and the efforts to achieve them. The goals of the NEPPA are to 1) achieve clean air, 2) achieve clean water, 3) protect wetlands, 4) reduce waste generation, and 5) clean up waste sites.

97-09/104 *Project on Numeric Biocriteria.* This proposal was designed to address two issues relating to the then current Biocriteria Pilot Study; specifically, to evaluate subecoregion difference in stream biota, if any, and formulate the biological indicators (fish and macroinvertebrates) that are essential to assess conditions and monitor changes in streams. Study expects to establish reference streams in 5 of the 13 Massachusetts Ecological Subregions.

Numeric Biocriteria sampling the Taunton River Watershed.

Biocriteria Development Project Files. Massachusetts Department of Environmental Protection, Division of Watershed Management, Worcester, MA.

Stream	Station	Sampling Dates
Forge River	NB05FOR	September/October 1996
Rumford River	NB16RUM	October 1996
Segregansett River	NB09SEG/NB10SEG	October 1996
Wading River	NB06WAD	September 1996

99-06/104 *Lake Surveys for TMDL Development*. The objective for this statewide study is to provide a database for lakes listed as impaired on the 303d list. Data such as Secchi disk transparency, bathymetry, nutrients, aquatic plant species composition, and plant coverage will be compiled to determine optimal plant coverage for fisheries. Additionally, the Division will provide technical assistance and transfer of fisheries data to government agencies and private organizations involved in watershed management and assist in the development of volunteer and watershed participant action plans. Two ponds in the Taunton River Watershed, Ames Long Pond and West Meadow Pond, were sampled as part of this project in 2000.

00-09/104 *Site Specific Metals Criteria.* This pilot project will develop site-specific water quality criteria (SSWQC) for metals (copper) for the Taunton River. This includes developing SSWQC values for copper for the Taunton River that can be used to evaluate current compliance of the river with the SSWQC and determine NPDES permit limits for Taunton River copper discharges, as well as evaluating a new technique for cost-effective SSWQC development.

SOURCE WATER PROTECTION GRANT PROGRAM

The Source Water Protection Grant Program provides funds to public water suppliers and third party technical assistance organizations that assist public water suppliers in protecting local and regional ground and surface drinking water supplies.

99-02/SWT *Assawompsett Pond Source Water Protection Project*. This project will develop a Surface Water Supply Protection Plan, including an Emergency Response component, to address resource management and protection issues for surface and ground waters within the Assawompsett Pond Complex watershed.

99-02/SWT *Robbins Pond Source Water Protection Project*. This project will develop a Surface Water Supply Protection Plan for the Robbins Pond Subwatershed. The focus will be Monponsett Pond, a drinking water source for the city of Brockton and the towns of Hanson and Halifax. This project will also identify surface flow into the pond in an effort to address the issue of water elevations and dam management, provide up to three public meetings to provide outreach and education for the community, and develop comprehensive multi-town recommendations.

99-14/SWT *Resource Planning for Cranberry Bogs within Drinking Water Supply Areas*. This project will provide direct technical assistance to cranberry growers in the Cape Cod, Buzzards Bay, Taunton, South Coastal, and Nantucket Basins in an effort to conserve and protect water resources. Resource planning for cranberry bogs located within or adjacent to public drinking water supply areas will provide cranberry growers with the information necessary for the protection of public surface and groundwater drinking water supplies in Southeastern Massachusetts.

00-11/SWT *Canoe River Aquifer Source Water Protection Project.* This project will develop and implement a model public outreach campaign to promote responsible and environmentally sustainable approaches to residential pesticide and fertilizer use. Implementation efforts will focus on towns that draw water from the Canoe River aquifer: Norton, Mansfield, Easton, Foxborough, and Sharon.

02-04/SWT *Bridgewater Source Water Protection Project.* This project will provide water supply protection outreach and education to existing businesses, abutting residents, and an elementary school complex located within the Town of Bridgewater's Aquifer Protection District for four public drinking water wells at Carver's Pond.

WELLHEAD PROTECTION GRANT PROGRAM

The Wellhead Protection Grant Program provides funds to assist public water suppliers in addressing wellhead protection through local projects and education

99-20/WHP *Avon Wellhead Protection Project*. This project will install a fence to restrict access to the Trout Brook where it flows upstream from four of the Town's five wells. Illegal disposal of oil, gas, and other contaminants has occurred in the project area. Installation of a fence will discourage will discourage illegal disposal of hazardous materials within the Zone II and the Watershed Protection District.

02-02/WHP *Bridgewater Wellhead Protection Project*. This project will install security fencing around six of the town of Bridgewater's drinking water wells (02G, 03G, 04G, 05G, 06G, 07G, 09G, and 10G) and metal window grates on the windows of the water treatment facility for wells 03G, 04G, 06G, and 7G, and develop GIS data layers of the Town's water system and water resources. These tasks will address the Town's immediate and long-term source protection needs.

CLEAN WATER STATE REVOLVING LOAN FUND (SRF) PROGRAM

The Massachusetts State Revolving Loan Fund for water pollution abatement projects was established to provide a low-cost funding mechanism to assist municipalities seeking to comply with federal and state water quality requirements. The focus of the SRF Program is to provide incentives to communities to undertake projects with meaningful water quality and public health benefits and that address the needs of the communities and the watershed. Projects for 2003 including the following:

CWSRF-1731 *Dighton Comprehensive Wastewater Management Plan*. Through this project the Town of Dighton will identify areas of the community where existing on-site sewage disposal systems are inadequate for wastewater disposal, and develop recommendations for wastewater management to protect groundwater and surface waters, including the Three Mile River, Taunton River, and Muddy Cove Brook.

CWSRF-1798 *East Bridgewater Hydrogeologic Studies for Effluent Disposal Sites*. The objective of this project is to perform additional hydrogeologic studies at selected locations in order to identify preferred effluent disposal sites for the Town's proposed limited sewering program, as proposed in the draft comprehensive wastewater management plan. The sewer study was prompted by the large number of septic system failures, which have caused degradation of environmental receptors town wide.

CWSRF-1102 *Raynham Sewer System Construction*. This is a carry-over project for sewer construction that was initially approved for SRF financial assistance in Calendar Year 2002.

CWSRF-1714 *Taunton Purchase of Water Resource Lands*. The objective of this project is to purchase land in the watershed of the Assawompsett Pond complex. The purchase will prevent development of the land and as a consequence protect the pond complex from introduction of pollutants. Pollution prevention within the complex, the largest water supply in Southeast Massachusetts, is a vital component to protecting the public health.

CWSRF-1723 *Hanson Storm Water Management*. The proposed Stormwater Management and Water Supply Protection Plan will identify pollution prevention measures and Best Management Practices (BMPs) necessary to protect and enhance the watershed.

CWSRF-1736 *Whitman Phase II Stormwater Management Plan*. The project will develop measures to reduce point and non-point source impacts of stormwater to the Taunton River watershed. Work will include a drain and sewer inventory using GIS technology, investigation to identify illicit discharges, a public outreach program, development of preferred runoff control measures, and implementation of a GIS-based infrastructure management system.

CWSRF-1722 *Brockton Collection System and WWTF Improvements*. The project proposes to rehabilitate its troubled aging Collection System and Wastewater Treatment Facility (WWTF). The project objective is to eliminate the environmental and public health issues associated with the Sewer System overflows and discharge violations at the WWTP. Contract #1 will implement the recommended improvements in the July 2000 WWTF Project Evaluation Report, while Contract #2 will implement improvements in the August 2000 city wide sewer system evaluation report.

SRF projects in the Taunton River Watershed:

YEAR	COMMUNITY	PROJECT #	PROJECT TITLE
1999	Taunton	CWSRF-202	WPCF Upgrade and modifications
1999	Brockton	CWSRF-146	City Wide Sewer System Evaluation Survey
1999	Abington	CWSRF-298	Phase 3 Sewer Extension
1999	Foxborough	CWSRF-293	Greenview Estate Sewers
2000	Norton	CWSRF-620	Combined Low Pressure Sewer
2000	Avon	CWSRF-615	Comprehensive Wastewater Management Plan
2000	Easton	CWSRF-586	Comprehensive Wastewater Management Plan
2000	Foxborough	CWSRF-584	Comprehensive Wastewater Management Plan
2000	Taunton	CWSRF-649	Comprehensive Wastewater Management Plan
2000	Taunton	CWSRF-648	Integrated Collection System/NPS
2000	Wrentham	CWSRF-597	Comprehensive Wastewater Management Plan /Project Evaluation Report
2001	Fall River	CWSRF-955	CSO Construction
2001	Mansfield	CWSRF-942	Comprehensive Wastewater Management Plan
2001	Norton	CWSRF-929	Comprehensive Water Resource Management Plan
2001	Mansfield	CWSRF-941	Stormwater Phase II Management Plan
2001	Taunton	CWSRF-902	Lake Sabbatia Area Collectors
2001	Middleborough	CWSRF-934	Comprehensive Wastewater Management Plan
2002	Fall River	CWSRF-955	CSO Construction
2002	Attleboro	CWSRF-1114	Phase II Stormwater Management Plan
2002	West Bridgewater	CWSRF-1112	Project Evaluation Report

DRINKING WATER STATE REVOVLING FUND (SRF) PROGRAM

The Massachusetts Drinking Water State Revolving Fund (DWSRF) provides low-cost financing to help community public water suppliers comply with federal and state drinking water requirements. The DWSRF Program's goals are to protect public health and strengthen compliance with drinking water requirements, while addressing the Commonwealth's drinking water needs. The program incorporates affordability and watershed management priorities. The DWSRF Program is jointly administered by the Division of Municipal Services of the Department of Environmental Protection and the Massachusetts Water Pollution Abatement Trust (Trust). Project for 2003 include the following:

DWSRF1704 *Avon Construction Finished Bedrock Well*. The project consists of creating a new source of water southwest of Harrison Boulevard. A new bedrock well, pump station, treatment facility and water main to connect it to the distribution system will be constructed.

DWSRF1695 *Dighton WTF & Transmission Main*. The project proposes to build a new filtration plant that will treat all the system's groundwater wells and add 25,000 feet of new main.

DWSRF1696 *Fall River Water Main Improvements.* The project will replace 6 miles of 130-year-old main to help address bacterial issues. Additionally, all lead connections will be replaced. The project area encompasses the following streets: Beattie, Beauregard, Chavenson, Davis, Cherry, Durfee, North Main, Orange, Pine, Plain, Platt, South Main, Spencer.

DWSRF1694 *Mansfield Construction of WTF*. The project consists of building a green sand filtration plant, rehabbing 3 wells with new pumps, laying new pipeline, adding corrosion control with potassium hydroxide and adding disinfection with sodium hypochlorite.

DWSRF1654 *Plainfield Construction Pumping Station*. The project will upgrade their existing Treatment Plant to meet Ground Water Under the Influence/Surface Water Treatment Rule requirements. Specifically, coagulant will be added, a 0.5 million-gallon storage tank for chlorine contact will be installed and a pump station will be replaced.

DWSRF1693 *Somerset Water System Improvements and Upgrades to WTP.* The project consists of various upgrades to the town's water system including the following: installation of new deeper bed filters, rehabilitation of the sedimentation process and sludge collection, installation of SCADA, electrical and mechanical upgrades to the Segregansett River Intake Station, upgrades to the Hot and Cold Lane Tank, electrical upgrades to the Booster Pump Station, replacement of the raw water pipeline bridge crossing, and replacement of 5,000' of 6 inch asbestos cement main.

COMMUNITY SEPTIC MANAGEMENT PROGRAM

The enactment of the Open Space Bond Bill in March of 1996 provided new opportunities and stimulated new initiatives to assist homeowners with failing septic systems that threaten ground and surface waters. The law appropriated $30 million to the MA DEP for a state & locally administered revolving fund known as the Community Septic Management Program. Working together, the MA DEP and the Massachusetts Water Pollution Abatement Trust provide this permanent loan program with three options from which a local government can provide low interest loans to eligible homeowners for septic system improvements. Currently, there are 13 municipalities in the Taunton River Watershed participating in the Community Septic Management Program. They are Berkley, Bridgewater, East Bridgewater, Halifax, Hanson, Lakeville, Middleboro, Norton, Raynham, Taunton, West Bridgewater, Whitman and Wrentham.