



Technical Memorandum CN 290.3

**TEN MILE RIVER WATERSHED
2007 BENTHIC MACROINVERTEBRATE BIOASSESSMENT**

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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. 1995, Plafkin et al. 1989). Impacts to the benthic community are typically 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 total taxa richness; or shifts in community composition relative to the reference station (Plafkin et al. 1989).

As part of the Massachusetts Department of Environmental Protection/Division of Watershed Management's (MassDEP/DWM) 2007 Ten Mile River Watershed assessment, aquatic benthic macroinvertebrate biomonitoring was conducted to evaluate the biological health of selected streams to determine their status with respect to the support of the *Aquatic Life* use, as designated in the *Massachusetts Surface Water Quality Standards* (SWQS) (MassDEP 2006). These assessments form the basis for reporting and listing waters pursuant to sections 305(b) and 303(d) of the Clean Water Act (CWA). Four sites on the Ten Mile River and one site on the Bungay River were sampled to investigate the effects of potential point and nonpoint sources of pollution—both historical and current—on the aquatic invertebrate populations throughout the watershed (Figure 1). While specific monitoring locations and protocols governing sample collection and data analysis differed over time, MassDEP biologists had previously assessed five of the sampling stations studied in 2007 (Nuzzo 1997; MassDEP 2000; Fiorentino 2005) and an additional goal of the present study was to determine whether the biological condition of these streams had changed over time. The 2007 sampling location descriptions, along with station identification numbers, sampling dates and biomonitoring history are presented in Table 1.

To provide information for making *Aquatic Life* use-support determinations, macroinvertebrate communities present at biomonitoring stations on the Ten Mile and Bungay rivers were compared with the community occurring at a reference station unaffected by point sources of water pollution, and assumed (based on historical water quality data, topographic map examinations, and field reconnaissance) to be minimally impacted (relative to other portions of the Ten Mile River Watershed) by nonpoint sources. Station SM00 on the Sevenmile River was considered most representative of “least disturbed” conditions in the Ten Mile River Watershed and served as the reference condition to which the other sites were compared. The Sevenmile River at Station SM00 is designated Class A (Public Water Supply, Outstanding Resource Water) and this site had also served as the reference condition for earlier investigations.

METHODS

Macroinvertebrate Sampling - RBP/III

Macroinvertebrate sampling activities employed for the 2007 Ten Mile River Watershed survey were conducted in accordance with the Sampling & Analysis Plan (SAP) for the Ten Mile River Watershed (MassDEP 2007). The sampling procedures are described in the standard operating procedures *Water Quality Monitoring in Streams Using Aquatic Macroinvertebrates* (Nuzzo 2003), and are based on US EPA Rapid Bioassessment Protocols (RBPs) for wadeable streams and rivers (Plafkin et al. 1989). The macroinvertebrate collection procedure utilized kick-sampling, a method of sampling benthic organisms by kicking or disturbing the substratum and catching the dislodged organisms in a net as the current carries them downstream. Sampling was conducted by MassDEP/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 m². Samples were labeled and preserved in the field with denatured 95% ethanol, then brought to the MassDEP/DWM lab for further processing.



Figure 1. Location of sites where benthic macroinvertebrate samples were collected during the 2007 Ten Mile River Watershed survey.

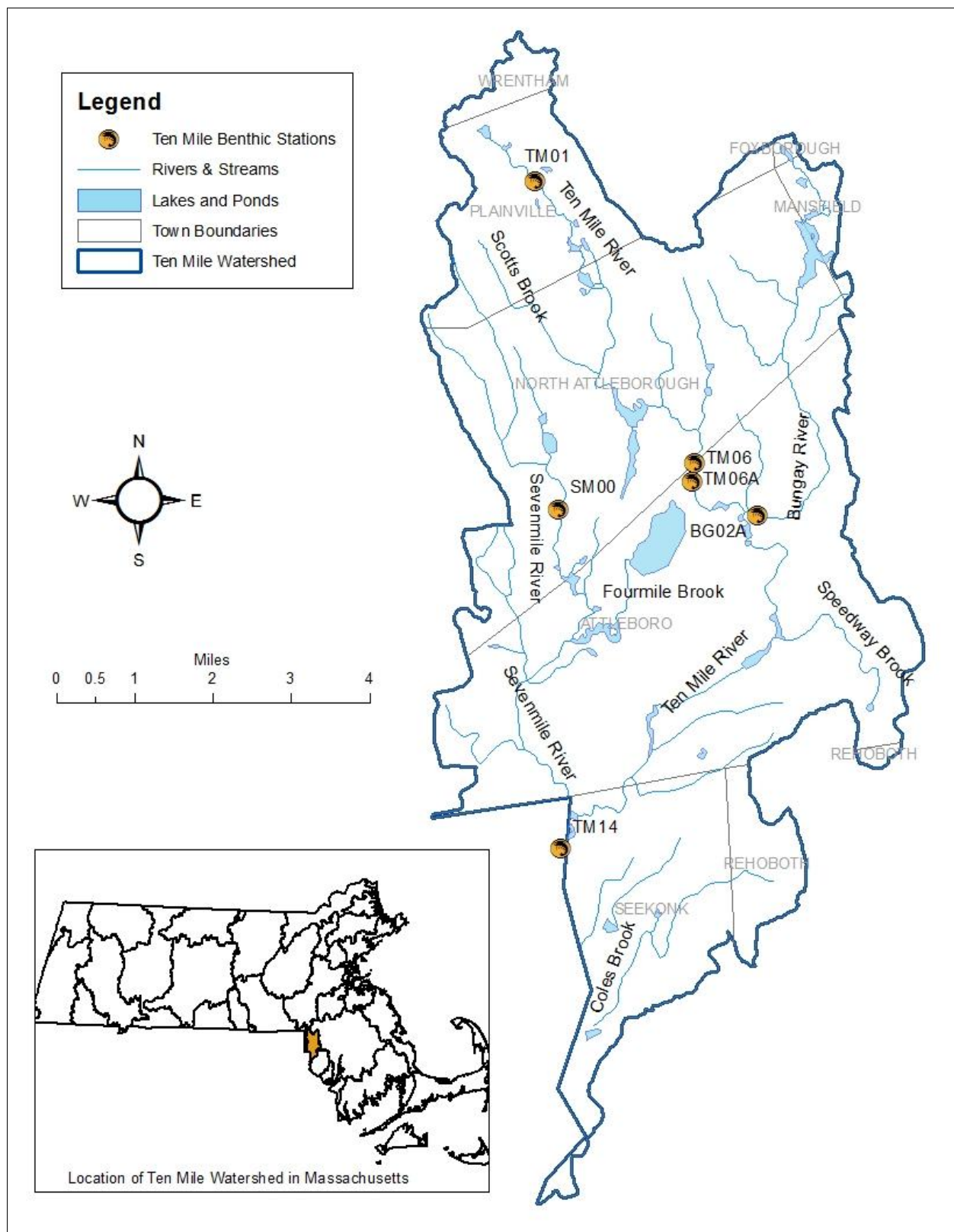


Table 1. List of biomonitoring stations sampled during the 2007 Ten Mile River Watershed survey, including station and unique identification numbers, drainage areas, sampling site descriptions, and sampling dates. Sites at or near which the MassDEP performed previous benthic macroinvertebrate assessments using EPA's Rapid Bioassessment Protocols are also indicated.

Station ID	Unique ID	Drainage Area (mi ²)	Sampling Site Description	Sampling Date
SM00 ^{1,2,3}	B0052	3.47	Sevenmile River, ~50 m upstream/north from Draper Avenue, North Attleborough, MA	20-Sep-2007
TM01 ^{1,2,3}	B0045	1.97	Ten Mile River, Downstream/southeast of Fuller Street, Plainville, MA	19-Sep-2007
TM06 ^{1,2,3}	B0048	11	Ten Mile River, ~100 m downstream/south from Cedar Road, North Attleborough, MA (~100m upstream/north from North Attleborough POTW discharge)	19-Sep-2007
TM06A ^{1,2,3}	B0631	11	Ten Mile River, ~160 m upstream/north of Route 295, Attleboro, MA	19-Sep-2007
TM14 ^{1,2,3}	B0051	42	Ten Mile River, ~200 m downstream/southwest from Central Avenue, Pawtucket, RI	20-Sep-2007
BG02A	B0611	6.7	Bungay River, ~200 m downstream/west from Route 152, Attleboro, MA	20-Sep-2007

¹ RBP II performed here by MassDEP/DWM in 1990 (Nuzzo 1997)

² RBP III performed here by MassDEP/DWM in 1997 (MassDEP 2000)

³ RBP III performed here by MassDEP/DWM in 2002 (Fiorentino 2005)

Macroinvertebrate Sample Processing and Data Analysis

The macroinvertebrate sample processing and analysis procedures employed for the 2007 Ten Mile River Watershed biomonitoring samples are described in the standard operating procedures (Nuzzo 2003). Macroinvertebrate sample processing entailed distributing whole samples in pans, randomly selecting grids within the pans, and sorting specimens from the other materials in the sample until approximately 100 organisms ($\pm 10\%$) were extracted. Specimens were identified to genus or species as allowed by available keys, specimen condition, and specimen maturity.

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 macroinvertebrate community. This integrated approach provides more assurance of a valid assessment because a variety of biological parameters are evaluated, and the deficiency of any one metric should not invalidate the entire approach (Plafkin et al. 1989). Taxonomic data were analyzed using a modification of Rapid Bioassessment Protocol III (RBP III) metrics and scores (Plafkin et al. 1989). The modifications were: substitution of "reference site affinity" (RSA) for the Community Loss Index and elimination of the shredder/total ratio (no separate leaf-pack material was collected). The reference site affinity metric is a modification of Percent Model Affinity (Novak and Bode 1992). Instead of using the model's percentages for Oligochaeta, Ephemeroptera, Plecoptera, Trichoptera, Coleoptera, Chironomidae, and "other," these percentages were taken from the reference site data. The RSA score is then calculated as:

$$100 - (\times 0.5)$$

where is the difference between the reference percentage and the sample percentage for each taxonomic grouping. RSA percentages convert to RBP III scores as follows: 0 points for <35%; 2 points in the range from 35 to 49%; 4 points for 50 to 64%; and 6 points if 65%. The entire suite of metrics used for the analysis was:

- Richness—the total number of different species present in the subsample plus those detected from a "large/rare" search of the whole sample (those taxa missed in subsampling);



- HBI—Hilsenhoff Biotic Index (Hilsenhoff 1982, 1987), as modified in Nuzzo (2003); the HBI is the sum of the products of each taxon's abundance and its corresponding pollution tolerance value, divided by the total count in the subsample;
- EPT—sum of richness among the orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) as determined from the specimens in the subsample plus those detected in a "large/rare" search of the whole sample; these orders tend to be dominated by species generally considered to be pollution sensitive;
- $EPT_a/Chiro_a$ —ratio of total abundance among EPT taxa to total abundance among Chironomidae taxa;
- SC/FC—ratio of the proportion of sample that is represented by individuals that predominantly feed by scraping to those that are primarily filter-feeders;
- % Dominant—most abundant taxon as a percent of the assemblage; >20% is generally considered hyperdominant and indicative of a stressor impact;
- RSA—reference site affinity (described above).

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 the selected "least-impacted" reference station yielded an impairment score for each site. RBP III analysis separates sites into four categories: "non-impaired", "slightly impaired", "moderately impaired", and "severely impaired". Each impairment category corresponds to a specific *Aquatic Life* use-support determination used in the CWA Section 305(b) water quality reporting process—non-impaired and slightly impaired benthic invertebrate communities are generally indicative of conditions supporting the *Aquatic Life* use, whereas water bodies exhibiting moderately or severely impaired communities are generally assessed as "non-support."

Habitat Assessment

Habitat qualities were scored for each sampling reach using the assessment procedure in Plafkin et al. (1989), as modified in Barbour et al. (1999). An evaluation of physical and biological habitat quality is critical to any assessment of ecological integrity (Karr et al. 1986; Plafkin et al. 1989). 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). The matrix used to assess habitat quality is based on key physical characteristics of the water body and the immediate riverfront area. Most parameters evaluated are instream physical attributes that are potential sources of limitation to the aquatic biota (Plafkin et al. 1989). 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 bank vegetative protection, right and left bank stability and right and left bank riparian vegetative zone width. Habitat parameters are scored, totaled, and compared to the reference station to infer the extent to which the condition of the habitat, rather than water quality effects, may account for differences in macroinvertebrate community structure at the study sites.

RESULTS AND DISCUSSION

The results of the habitat assessment at all of the biomonitoring sites are summarized in Appendix 1. The habitat quality score at the reference site on the Sevenmile River (162 out of the maximum attainable value of 200) was the highest of all of the sites assessed. Despite a good overall habitat score, instream cover and bank stability were suboptimal, and velocity-depth combinations and channel flow status were rated as marginal (Appendix 1). The mean total habitat score for the remaining five sites was 140 and habitat scores for all of the sites compared favorably with that of the reference station (Table 2). Total



habitat scores for the four main stem Ten Mile River sites ranged from 140 at TM14 to 148 at TM01. Although overall scores were consistent, scores for individual habitat parameters varied among these sites. For example, whereas instream cover and velocity-depth combinations received the lowest scores at TM01, sediment deposition was more problematical at TM06A. Except for the reference site, most sites exhibited some bank instability and limited riparian vegetative zone width. While still acceptable, the habitat was most limited at Station BG02A on the Bungay River. Instream cover, sediment deposition and channel flow status were only marginal, and riparian vegetative zone width on the right bank scored poorly (Appendix 1).

A taxonomic list of the macroinvertebrate organisms collected at each sampling station during the 2007 biomonitoring survey is provided in Appendix 2. Included in the list are total organism counts, the functional feeding group designation (FFG) for each macroinvertebrate taxon, and the tolerance value (TV) of each taxon. Table 2 presents summaries of the habitat and RBP III macroinvertebrate data analyses. Included for each sampling site are the habitat comparability to the reference condition, biological metric calculations, metric scores, and impairment designations.

The benthic macroinvertebrate community at Station SM00 on the Sevenmile River ranked first of all of the sites investigated in several key metrics (e.g., Total and EPT richness, Biotic Index, scraper/filterer ratio, and % Dominant taxon). The % Dominant taxon metric, while outperforming the other sites, was just above the 20% value generally considered to be hyperdominant. If this is indicative of the presence of an actual stressor, the benthic community in the Sevenmile River at Station SM00 may not represent the best biological conditions attainable in the Ten Mile River Watershed. Nonetheless, the other community metrics generally corroborate the designation of SM00 as the site to which the remaining sampling sites are to be compared for the purpose of carrying out the RBP. Attempts to define the least or minimally impaired reference condition, through such measures as the application of a human disturbance index or the establishment of ecoregional reference sites, were beyond the scope of this investigation, but should be considered in the future.

Results of the RBP III analyses of sites in the Ten Mile River Watershed were “slightly impaired” at stations TM01, TM06 and TM14 on the Ten Mile River, and “moderately impaired” at stations TM06A and BG02A on the Ten Mile and Bungay rivers, respectively. Since habitat characteristics did not appear to limit the biological potential at any of these sites, adverse impacts on the macroinvertebrate community at TM06A and BG02A can be attributed primarily to water quality conditions. The macroinvertebrate communities present at all of the test sites exhibited reductions in the numbers of total and EPT taxa, higher Biotic Index values and much lower Scraper/Filterer ratios when compared to the reference community at SM00. These metrics all point to a macroinvertebrate community structured in response to organic enrichment. A shift in the distribution of macroinvertebrate organisms among functional feeding groups (FFG) in the main stem Ten Mile and Bungay rivers was noteworthy (Table 3). All of the functional feeding groups were represented in the macroinvertebrate samples collected from the Sevenmile River (SM00) and headwater station on the Ten Mile River (TM01), and no single FFG made up more than 40% of the sample. In contrast, the macroinvertebrate community at downstream stations on the Ten Mile River and at the Bungay River site was characterized by a preponderance of Filtering Collectors. These “suspension feeders” filter Fine Particulate Organic Matter (FPOM) directly from the water column and their presence in abundance is indicative of a plentiful supply of algal cells, detritus and decomposing organic matter typically associated with the enrichment of low-gradient, heavily impounded streams, such as the Ten Mile River.

Five of the sites investigated in 2007 were included in previous bioassessments performed by the MassDEP/DWM (Table 1). Four indicative community metrics from the RBP III analyses and the overall impairment status assessments resulting from those analyses were compared from year to year to determine whether the biological condition had changed at those sites (Table 4). While a determination of true statistical trends is not possible using screening-level techniques such as the RBP, the overall assessment of all of the sites remained relatively consistent throughout the ten-year duration represented by these surveys. Three of the four main stem Ten Mile River sites ranged from non- to slightly impaired over this time period, though there were no discernible trends in their condition from the earlier to later surveys. One main stem station, TM06A, was found to be moderately impaired on each of the three investigations.



Table 2. Summary of habitat analysis (i.e. comparability to the reference habitat condition) and RBP III analysis of macroinvertebrate communities sampled in the Ten Mile River Watershed during 19 – 20 September 2007. Shown are the calculated metric values, metric scores (in italics) based on comparability to the reference station (SM00), and the corresponding assessment designation for each biomonitoring station. Complete habitat evaluations are presented in Appendix 1. Refer to Table 1 for a listing and description of sampling stations.

SAMPLING STATION	SM00		TM01		TM06		TM06A		TM14		BG02A	
STREAM	Sevenmile River		Ten Mile River		Ten Mile River		Ten Mile River		Ten Mile River		Bungay River	
HABITAT SCORE	162		148		143		142		140		129	
HABITAT % REFERENCE	--		91%		88%		88%		86%		80%	
HABITAT COMPARABILITY	--		Comparable		Supporting		Supporting		Supporting		Supporting	
TAXA RICHNESS	26	6	14	2	14	2	13	2	13	2	9	0
BIOTIC INDEX	4.87	6	5.85	4	5.25	6	5.39	6	5.50	6	4.90	6
EPT INDEX	6	6	3	0	5	4	3	0	5	4	5	4
EPT/CHIRONOMIDAE	1.50	6	2.50	6	41.0	6	33.5	6	89.0	6	88.0	6
SCRAPER/FILTERER	1.55	6	1.00	6	0.15	0	0.48	2	0.05	0	0.20	0
REFERENCE AFFINITY	100%	6	73%	6	44%	2	63%	4	43%	2	40%	2
% DOMINANT TAXON	21%	4	23%	4	37%	2	44%	0	31%	2	63%	0
TOTAL METRIC SCORE	40		28		22		20		22		18	
% COMPARABILITY TO REFERENCE	--		70%		55%		50%		55%		45%	
BIOLOGICAL CONDITION -DEGREE IMPACTED	REFERENCE		SLIGHTLY IMPAIRED		SLIGHTLY IMPAIRED		MODERATELY IMPAIRED		SLIGHTLY IMPAIRED		MODERATELY IMPAIRED	

Table 3. The distribution of macroinvertebrate organisms among five functional feeding groups (FFG) at each of the sites sampled in the Ten Mile River Watershed during 19 – 20 September 2007. FFG designations are presented for each taxon in Appendix 2.

Functional Feeding Group (FFG)	Sampling Station					
	SM00	TM01	TM06	TM06A	TM14	BG02A
Shredders (SH)	9%	1%	1%	1%	2%	1%
Scrapers (SC)	41%	31%	11%	25%	5%	16%
Gathering Collectors (GC)	19%	30%	15%	21%	2%	3%
Filtering Collectors (FC)	26%	31%	71%	52%	91%	79%
Predators (PR)	5%	7%	2%	1%	0%	1%



Table 4. Selected macroinvertebrate RBPIII community metrics and impairment status for five sampling locations in the Ten Mile River Watershed sampled by MassDEP/DWM in 1997, 2002 and 2007. See text for a description of the metrics.

Water Body	Year	Community Metrics				Impairment Status
		Total Richness	EPT Richness	Biotic Index	% Dominant Taxon	
Sevenmile River, near Draper Ave., North Attleborough, MA	1997	29	5	6.99	23	Reference
	2002	27	5	5.71	16	Reference
	2007	26	6	4.87	21	Reference
Ten Mile River, near Fuller Street, Plainville, MA	1997	21	3	6.14	13	Slight
	2002	19	5	5.28	14	Non-impaired
	2007	14	3	5.85	23	Slight
Ten Mile River, at Cedar Street, North Attleborough, MA	1997	18	5	5.86	17	Non-Slight
	2002	20	6	5.32	23	Non-impaired
	2007	14	5	5.25	37	Slight
Ten Mile River, near Rte. I-295, Attleboro, MA	1997	15	2	7.35	47	Moderate
	2002	11	1	7.05	25	Moderate
	2007	13	3	5.39	44	Moderate
Ten Mile River, near Central Ave., Pawtucket, RI	1997	15	8	5.90	31	Slight
	2002	19	5	4.69	30	Non-impaired
	2007	13	5	5.50	31	Slight

SUMMARY

Sampling of the benthic macroinvertebrate community was carried out in September, 2007 at six sites in the Ten Mile River Watershed to evaluate the biological health of selected streams and to determine their status with respect to the support of the *Aquatic Life* use, as designated in Massachusetts' Surface Water Quality Standards. Results of these assessments form the basis for reporting and listing waters under sections 305(b) and 303(d) of the Clean Water Act. Field and laboratory methods and data analysis were based on the USEPA's Rapid Biomonitoring Protocols. Station SM00 on the Sevenmile River in North Attleborough served as the reference site. The macroinvertebrate community structure at three sampling stations on the Ten Mile River ranged between "non-impaired" and "slightly impaired." At one site each on the Ten Mile and Bungay rivers the benthic macroinvertebrate community was found to be "moderately impaired". Nonetheless, the low EPT richness and high Biotic Index scores at all of the sites on the Ten Mile and Bungay rivers are characteristic of invertebrate communities structured in response to organic enrichment. Five of the sites investigated in 2007 were the subjects of previous bioassessments performed by the MassDEP/DWM. RBP III community metrics and impairment levels were compared from year to year to determine whether the biological condition had changed at these sites. The overall assessment of all of the sites remained fairly constant throughout the time represented by the surveys. The Ten Mile River in Attleboro consistently exhibits the worst biological condition.

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Appendix 1. Habitat assessment summary for biomonitoring stations sampled during the 2007 Ten Mile River Watershed survey. For within-reach parameters, scores ranging from 16-20 = optimal; 11-15 = suboptimal; 6-10 = marginal; 0-5 = poor. For riparian parameters, scores ranging from 9-10 = optimal; 6-8 = suboptimal; 3-5 = marginal; 0-2 = poor. Maximum habitat score for any site = 200. Refer to Table 1 for a listing and description of sampling stations.

STATION	SM00	TM01	TM06	TM06A	TM14	BG02A
PRIMARY PARAMETERS (range is 0-20)	SCORE					
INSTREAM COVER	15	8	13	15	15	9
EPIFAUNAL SUBSTRATE	17	17	14	15	18	17
EMBEDDEDNESS	19	18	18	18	17	11
CHANNEL ALTERATION	19	17	14	17	12	16
SEDIMENT DEPOSITION	18	12	14	8	13	8
VELOCITY-DEPTH COMBINATIONS	10	8	14	13	15	12
CHANNEL FLOW STATUS	9	15	14	15	9	10
SECONDARY PARAMETERS (range is 0-10 for each bank)	SCORE					
BANK VEGETATIVE PROTECTIONleft right	10 10	10 10	9 7	9 8	5 8	9 8
BANK STABILITYleft right	8 8	9 9	9 5	6 6	4 7	8 8
RIPARIAN VEGETATIVE ZONE WIDTHleft right	10 9	5 10	8 4	10 2	8 9	10 3
TOTAL SCORE	162	148	143	142	140	129



Appendix 2. Species-level taxa list and counts, functional feeding groups (FG), and tolerance values (TV) for macroinvertebrates collected from stream sites during the 2007 Ten Mile River Watershed survey from 19 to 20 September 2007. Refer to Table 1 for a listing and description of sampling stations.

Taxon	FFG ¹	TV ²	Sampling Stations					
			SM00 ³	TM01	TM06	TM06A	TM14	BG02A
Hydrobiidae	SC	8				1		
Physidae	GC	8	1			5		
Planorbidae	SC	6				3		
Pisidiidae	FC	6	6				3	
<i>Nais communis/variabilis</i>	GC	8	1					
<i>Pristinella osborni</i>	GC	10	1					
Lumbriculidae	GC	7			4	1		1
Hirudinea	PR	7			1			
<i>Caecidotea</i> sp.	GC	8						1
<i>Caecidotea communis</i>	GC	8		6		4		
<i>Gammarus</i> sp.	GC	6			1			
<i>Hyalella azteca</i>	GC	8		24				
<i>Lebertia</i> sp.	PR	6	1			1		
<i>Baetis flavistriga</i>	GC	4			8	11		
<i>Eurylophella</i> sp.	GC	2	2					
<i>Maccaffertium</i> sp.	SC	3					2	
<i>Paraleptophlebia</i> sp.	GC	1	1					
Coenagrionidae	PR	9	1					
<i>Micrasema</i> sp.	SH	2	2					
Hydropsychidae	FC	4			1			1
<i>Cheumatopsyche</i> sp.	FC	5	5		38	48	19	68
<i>Hydropsyche betteni</i>	FC	7	3	13	21	8	34	1
<i>Hydropsyche sparna</i>	FC	6					9	
Hydroptilidae	GC	4						1
Leptoceridae	PR	4			1			1
<i>Psilotreta labida</i>	SC	0		1				
<i>Chimarra aterrima</i>	FC	4	14					
<i>Chimarra obscura</i>	FC	4		6	13		25	16
Elmidae	SC	4	7	2				
<i>Macronychus glabratus</i>	SH	5					1	
<i>Microcyloepus pusillus</i>	GC	3			2		1	
<i>Optioservus</i> sp.	SC	4		2				
<i>Oulimnius latiusculus</i>	SC	4	13	18	1			
<i>Stenelmis</i> sp.	SC	5		10			3	17
<i>Stenelmis crenata</i>	SC	5	23		10	23		
<i>Ectopria nervosa</i>	SC	5	2					
Ceratopogonidae	PR	6	1					
<i>Polypedilum</i> sp.	SH	6	1					
<i>Polypedilum flavum</i>	SH	6						1
<i>Micropsectra/Tanytarsus</i> sp.	FC	7	1					
<i>Rheotanytarsus exiguus</i> gr.	FC	6			1			
<i>Rheotanytarsus pellucidus</i>	FC	5					1	
<i>Diamesa</i> sp.	GC	5	1	1				
Orthoclaadiinae	GC	5			1			
<i>Corynoneura</i> sp.	GC	4				1		
<i>Cricotopus/Orthocladus</i> sp.	GC	7		1				
<i>Paracricotopus</i> sp.	GC	4	2					
<i>Parametriochnemus</i> sp.	GC	5	5					



Appendix 2. Species-level taxa list and counts, functional feeding groups (FG), and tolerance values (TV) for macroinvertebrates collected from stream sites during the 2007 Ten Mile River Watershed survey from 19 to 20 September 2007. Refer to Table 1 for a listing and description of sampling stations.

Taxon	FFG ¹	TV ²	Sampling Stations					
			SM00 ³	TM01	TM06	TM06A	TM14	BG02A
<i>Rheocricotopus</i> sp.	GC	6	4					
<i>Thienemanniella</i> sp.	GC	6				1		
<i>Tvetenia paucunca</i>	GC	5	3					
<i>Thienemannimyia</i> gr.	PR	6	1	6				
<i>Hemerodromia</i> sp.	PR	6	1	1				
Psychodidae	GC	10					1	
<i>Simulium</i> sp.	FC	5		14			10	
Tipulidae	SH	5	7		1			
<i>Pseudolimnophila</i> sp.	SH	3		1				
<i>Tipula</i> sp.	SH	6				1	1	
Total			110	106	104	108	110	108

¹Functional Feeding Group (FFG) lists the primary feeding habit of each species and follows the abbreviations: SH-Shredder; GC-Gathering Collector; FC-Filtering Collector; SC-Scraper; PR-Predator.

²Tolerance 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.

³Reference station

