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MRWC Bacteria Monitoring Program

2013 Report: Millers & Otter Rivers

Monitoring for healthy rivers.

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1/12/14

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A digital version of this report can be found at www.millerswatershed.org

Executive Summary

In 2013 the Millers River Watershed Council (MRWC) successfully conducted its third bacteria monitoring season. A group of dedicated volunteers and two staff executed this program by monitoring a total of ten sites on the Millers and Otter rivers. Seven distinct sampling events were completed during the major recreational contact season.

This program has been building a baseline to address a lack of water quality data on bacteria concentrations in the rivers and streams of the Millers Basin. Water-based recreational activities (and physical contact or exposure levels) are determined to be appropriate based on the concentration of bacteria in the river or water body. The Massachusetts Department of Environmental Protection (MassDEP) has developed guidelines for making such determinations.

By conducting a continuing annual program of volunteer monitoring, MRWC aims to provide watershed residents and visitors with practical information concerning the safety of using and enjoying local rivers. Results were posted regularly on www.connecticutriver.us through a partnership with CRWC and PVPC. The data collected was determined to be of reliable quality and consistent with all state standards for water quality monitoring.

Third-year results indicate a generally healthy river system for a variety of types of recreation: the one concern is with limiting primary contact after a heavy rainstorm; a typical finding in many watersheds. Often in areas located downstream of urban centers, which collect greater amounts of stormwater runoff, it is not unusual for bacterial concentrations to run high.

The continued success of this monitoring program illustrates the value and importance of volunteer activities to protecting public health. As MRWC continues its efforts to promote public recreation and enjoyment of local rivers through a series of "Blue Trails," this volunteer monitoring program should increase in importance and engage more residents to be "the eyes and ears" of the watershed. Such stewardship efforts are vital to maintaining the health and resiliency of our watershed and the many communities that call it home.

Introduction

As part of promoting a series of recreational “Blue Trails” within the watershed, MRWC determined that it would be beneficial to maintain a “complementary” bacteria monitoring program. This program serves several purposes: first, to gauge general water quality and river health; and second, to inform the public on the safety of recreational activities on/in the river. For people to enjoy our rivers with piece of mind, it is particularly important to determine if Blue Trail and other segments meet the MassDEP water quality contact standards.

MRWC’s program uses a QAPP (Quality Assurance Project Plan) from which to conduct consistent operation of this effort. A QAPP is a formal monitoring plan with ample quality control that is approved by MassDEP. The data from such a program, if followed carefully, is accepted and trusted by the state, and thus provides reliable information which can be used to foster river protection and inform the public. In the spring of 2011, MassDEP approved MRWC’s biomonitoring QAPP.

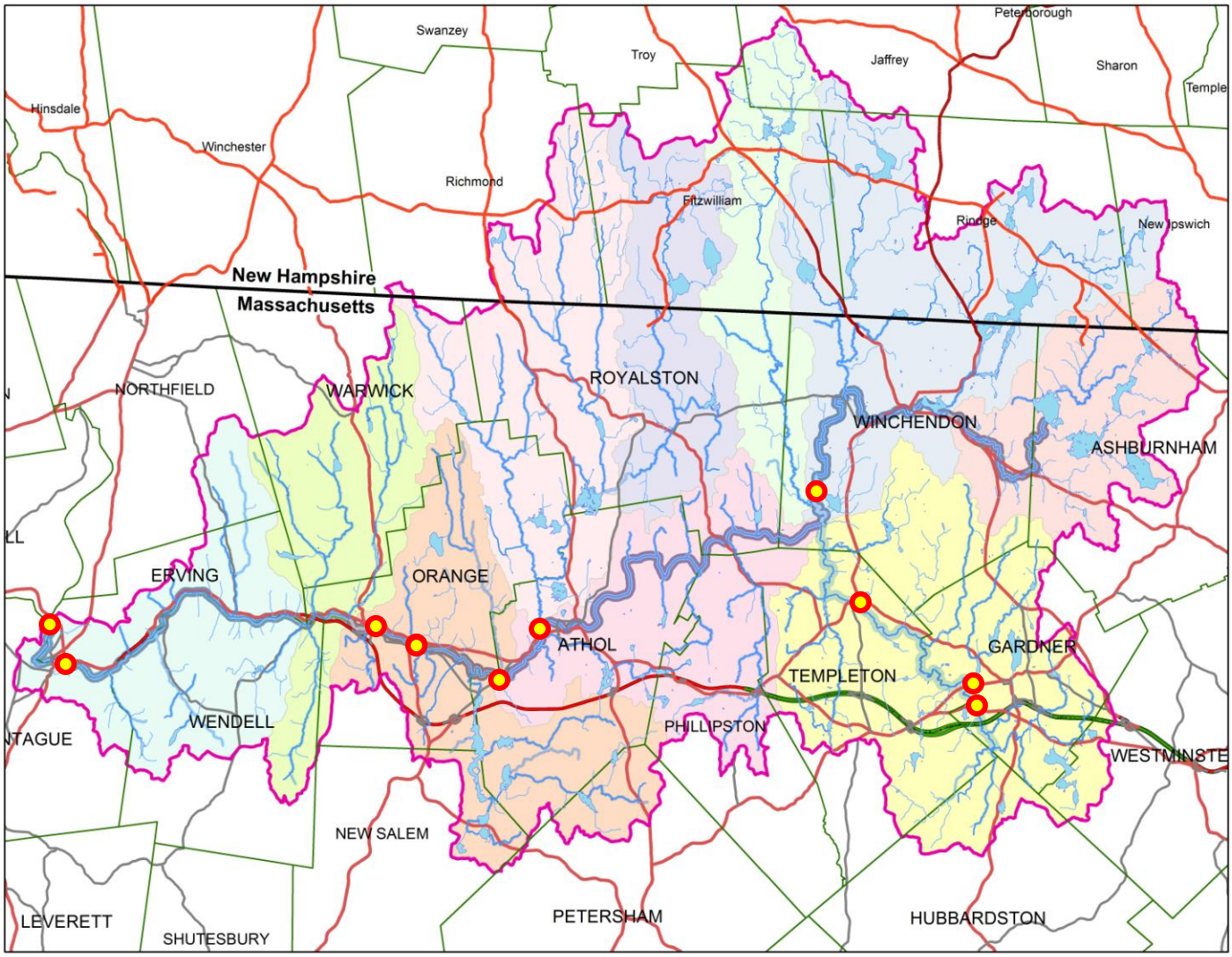
MRWC relies on fundraising to help support program costs, mainly laboratory analyses of samples and some monitoring equipment. MRWC is grateful for support from the Greater Worcester Community Foundation, the Connecticut River Watershed Council (CRWC) and the individuals/businesses who contributed to Adopt-A-Sample." MRWC used the CRWC lab in Greenfield for sample analysis. Sampling kits were organized for each sample site.

Another key step was to find volunteer samplers. Outreach brought nine people forward to help. All received training in proper sampling techniques, and bi-weekly sampling began on June 12, 2013 and ran through September 4th. In all we conducted seven sampling events at ten (10) sampling sites on the Millers and Otter Rivers. Volunteers also noted temperature and other site conditions observed during each sampling event. Weather conditions within 48 hours of sampling events were recorded.

The 2013 sampling year was a strong success. Funding limited MRWC to 10 sites, 5 fewer than 2012, but we continued with 7 sampling events. Volunteer samplers did well and there were few complications. Reporting on line also worked well. This experience illustrates MRWC commitment to monitoring and will guide any enhancements to MRWC’s monitoring program as we look continually to optimize the

choice of monitoring sites, and encourage more people to explore the Watershed and its rivers.

2013 Bacteria sample sites in the Millers Basin.



Dark blue river = Millers River

Light Blue river = Otter River

Special thanks to our volunteers!

Paul Goyetche, Diane Nassif, Bill Belco, Sean Grimley, David & Monique Brule,

Leah Berlin, Josh Lebelle, Sean Ashcraft/Peak Expeditions

Acronyms:
CRWC = Connecticut River Watershed Council
PVPC = Pioneer Valley Planning Commission
DSH = Daniel Shays Highway
MassDEP = MA Department of Environmental Protection

Project Approach

Purpose (taken from MRWC QAPP)

Quote from MassDEP's 2000 Millers River Water Quality Assessment Report:

"***There is a lack of bacteria data throughout the watershed limiting the assessment of recreational uses***."

***"Primary and Secondary Contact Recreational Summary - Rivers*:**
The majority of the river miles (92%) are currently not assessed for the *Primary* and *Secondary Contact Recreational Uses* because of the lack of current bacteria data."

The Millers River and its watershed offers many fine recreational and nature viewing opportunities. Unfortunately there is a lack of water quality data to determine if the river is meeting the state's surface water quality standards (SWQS). Many years ago, the river struggled with point source pollution, such as sewage discharges, which in time have been largely dealt with. Recreational activities are related to either primary or secondary contact standards, which are closely tied to the bacterial condition of the waters. Bacterial data for the Millers and Otter Rivers has been too limited to make a clear contact standard determination. Having adequate bacteria data to make a clear determination would inform people whether water recreation is safe and healthy.

MassDEP-Division of Watershed Management, (DWM), sampled the Millers River Watershed in 2005 as part of a five-year rotating basin schedule. DWM sampled selected sites in the Millers in 2011 and MRWC will review this data as available. Only five sites in the Millers basin have received periodic sampling on a regular basis. These are the MassDEP CERO SMART (Strategic Monitoring and Assessment for River basin Teams) sites and are typically sampled every 10 weeks.

In order to provide a more adequate data set with which to determine whether standards are being attained, having ***more sites sampled at more regular intervals*,** in season, offers the means to make a clear determination. Sampling at 4-7 sites on the Otter River and 8-12 sites on the Millers, 6-8 times at each, during the prime contact months, May through September, should offer an adequate baseline. Funding may limit the ability to cover this broad range continually, so MRWC will focus on key areas and target additional sites when possible.

An expanded data set will give a broad collection of locations and time periods, more wet/dry event information to review, and even a means to begin to consider source issues. Additional new data will help MRWC and MassDEP to make accurate water quality determinations for the Millers Basin.

Definitions: *(MassDEP)*

PRIMARY AND SECONDARY CONTACT RECREATIONAL USE (DEP)

The *Primary Contact Recreational Use* is supported when conditions are suitable (fecal coliform bacteria densities, turbidity and aesthetics meet the SWQS) for any recreational or other water related activity during which there is prolonged and intimate contact with the water and there exists a significant risk of ingestion. Activities include, but are not limited to, wading, swimming, diving, surfing and water skiing.

The *Secondary Contact Recreational Use* is supported when conditions are suitable for any recreational or other water use during which contact with the water is either incidental or accidental. These include, but are not limited to, fishing, boating and limited contact related to shoreline activities.

Stakeholders for this project include residents, visitors to, and recreational users of the Millers River Watershed; municipalities, and state, regional and federal environmental agencies. The data produced in this study will be shared with all stakeholders, to aid them in making personal decisions on safe use of the river for recreational purposes; understanding causes and effects of weather, land use and other human activities on water quality; and developing management strategies for preservation/restoration of watershed health. All data that are reported will be compared with Massachusetts surface water quality standards.

Objectives:

Since the main stem of the Millers River and one of its major tributaries, the Otter River, have not been extensively nor annually monitored by MassDEP for bacteria loading, this project is meant to complement MassDEP's limited monitoring program by conducting bacteria sampling on waters not monitored by MassDEP in order to facilitate the ability to make water quality standard attainment determinations for primary and/or secondary contact on a regular annual basis.

This monitoring program is intended to:

- Advance improvement of the water quality of rivers and streams in the Millers River Watershed that may be impaired due to bacterial contamination. Steps towards achieving this goal may entail locating sources of bacteria contamination within targeted sub-watersheds and recommending appropriate action to initiate remediation.
- Contribute to ongoing and future assessments of whether bacterial contamination impairs the river's ability to support primary and secondary contact recreation.
- Convey this information to local, state and federal agencies and to river users through 'rapid response' analysis and communication. 24 hour turnaround of sampling results enables quick public notice.

Methods

MRWC's formal QAPP document describes the various considerations, procedures, reasonings, and details of the monitoring processes. How we conducted 2012 worked out as follows.

Once adequate funding was secured, MRWC began to assemble needed equipment and select a qualified lab. Sampling kits in accordance with our bacteria SOP (MWWP R-3) were assembled for each volunteer and each site. Coolers and ice pack sets were acquired. A sampling pole, 42 inches long with a spring clamp attached to one end, was fabricated for each volunteer. This pole enabled the sampler to reach out into the current and grab a sample from a deeper point in the stream and lessen edge effects.

Each volunteer received training in sample collection, data form completion, appropriate sample care (keeping sample cold), hold time requirements, label completion, safety concerns/requirements, Quality Control (QC) requirements, and sample delivery logistics. Volunteers followed a preset sampling schedule and were reminded of sampling events 3-4 days ahead of time and regularly resupplied with sample bottles and forms if needed. Sampling was done, rain or shine, considering safety, and fortunately no events were cancelled.

Collection was done via a "grab" type sampling procedure using a sampling pole. Samples were collected in 100 ml sterile bottles prepared with thiosulfate – as a precaution against chlorine that could be present in the water sampled below a water treatment plant and which would affect sampling results. Bottles were labeled with date and time of collection and put on ice in a cooler immediately after collection. Volunteers also completed a field sheet and internal MRWC Chain of Custody (CoC). Samples were then brought to a central meeting place where a MRWC runner collected all samples into a single iced cooler and transported all samples to the lab for analysis. Once there, samples were checked in and temperature and time recorded. Samples were analyzed for bacteria using a Colilert system.

Typically only 24 hours elapsed until the lab report was issued. Data was then posted on line (www.ConnecticutRiver.us) through a partnership with CRWC and PVPC, then tabulated by event date and site.

Temperature was sampled using a conventional non-mercury stick thermometer which was placed in the flow and permitted to equilibrate for two minutes before reading. Temperatures were recorded on a field sheet with other site observations.

Meanwhile, the project coordinator had downloaded weather/rain data from NOAA/NWS for sites at both the Orange and Fitchburg airports for both the 24 and 48 hours previous to the sampling event. These airports are closest to our monitoring sites. Rainfall was recorded and tabulated for analysis. Wet weather can elevate bacteria, so viewing this data is important. River flows were also downloaded from available USGS stations in South Royalston, Erving, and Gardner.

QC samples were collected and prepared and sent to the lab: a duplicate at each sampling event and a total of three blanks (distilled pure water samples) during the sampling season. Comparing these results gives a sense of the quality of our sampling and the lab's analysis.

With all this information collected and tabulated, we are able to review the rivers' contact standards.

2013 Monitoring sites

In 2013 MRWC reduced the number of sites from 2012, but maintained key baseline data points along MRWC "Blue Trails," two river sections within the Millers River Watershed; one on the Millers River and one on the Otter River. Since MRWC encourages river discovery/recreation, it was deemed prudent to continue the investigation of how well the Blue Trail segments meet "contact standards."

Table 1: Sampling Sites (First Letter: M=Millers, O=Otter)

Site ID#	Location	Latitude	Longitude	Notes
MOSF1	New Boston Rd-ORSF	42°38'44.38"N	72° 5'55.38"W	Upstream side of bridge in Otter River State Forest
MCM1	Cass Meadow	42°35'36.71"N	72°14'20.95"W	Park at Rich Env Park, sample at boat launch, in current, not eddy
MFW1	Fielding Way	42°34'33.33"N	72°15'33.18"W	Park near cemetery, walk down old road to site. Site is upstream DSH
MORF1	Orange Riverfront Park	42°35'19.52"N	72°18'29.33"W	Sample from boat ramp
MWO1	West Orange	42°35'54.23"N	72°20'29.28"W	Park along 2A, walk under RR bridge, sample downstream side of north bank
MMF1	Millers Falls	42°34'45.16"N	72°29'27.05"W	Sample along south bank, downstream of paper mill bridge, off Newton St
MCf1	Millers confluence w/CT River	42°35'44.91"N	72°29'45.02"W	off Rt 2, sample along bank, upstream of bike bridge, Dorsey Rd
OR2A1	Rt 2A crossing	42°33'52.10"N	72° 0'42.32"W	Sample upstream side, west bank
OR101	Rt 101 Crossing	42°34'25.97"N	72° 0'58.43"W	Sample on west bank, downstream side of bridge, park in lot
OBW1	Baldwinville	42°36'23.51"N	72° 4'30.34"W	Park behind Legion Hall, sample upstream, east bank of bridge

The table above lists the 2013 sites. A number of sites straddle the "Millers River Blue Trail" and some sites are located both upstream and downstream where potential paddling trails and fishing areas are planned or exist. The Otter River sites mostly bracket the headwaters section of the Otter River where MRWC is creating a headwaters blue trail. The Baldwinville site is near the intended second phase of the Otter River Blue Trail. The Rt 2A, 101, and 202 sites all present some degree of urban runoff influence. The location of these sites offers a good balance of data from both urban and non-urban conditions.

Results

Bacteria

The table below notes the bacteria levels for the 2013 sampling season. A detailed discussion and interpretation of these results is presented in the Conclusions section.

2013 MRWC Bacteria Sampling Data											2012	2011
Site ID#	Location - Sample Date	6/12/13	6/26/13	7/10/13	7/24/13	8/7/13	8/21/13	9/4/13	GeoMean	contact	GeoMean	GeoMean
	Millers River	count								RATING		
MOSF1	New Boston Rd-OSF	461.1	172.3	129.1	NA	178.9	178.9	161.6	193.8	*2nd*	106.1	NA
MCM1	Cass Meadow	261.3	79.8	69.5	517.2	146.7	122.3	156.5	154.5	*2nd*	273.9	128.5
MFW1	Fielding Way	178.2	81.3	78.0	613.1	105.0	118.7	172.3	147.1	*2nd*	232.9	150.8
MORF1	Orange-Riverfront park	218.7	84.2	110.6	387.3	39.9	50.4	113.7	108.8	*primary*	63.7	96.9
MWO1	West Orange	114.5	62.0	67.6	178.5	54.6	172.2	107.1	97.9	*primary*	108.1	157.5
MMF1	Millers Falls	191.8	29.8	25.6	365.4	15.8	12.2	43.9	46.2	*primary*	58.0	NA
MCf1	Millers-confluence w/Ct	228.2	56.5	19.9	686.7	29.2	25.0	44.1	66.4	*primary*	103.6	NA
	Otter River	count										
OR2A1	Rt 2A crossing	118.7	44.1	37.9	261.3	88.2	63.1	75.4	80.4	*primary*	209.1	115.5
OR101	Rt 101 Crossing	93.4	140.0	65.0	980.4	85.7	155.3	103.9	141.8	*2nd*	123.0	197.7
OBW1	Baldwinville	127.4	63.8	81.3	228.2	83.9	325.5	135.4	127.8	*2nd*	188.1	219.3
	Average of event	199.3	81.4	68.5	468.7	82.8	122.4	111.4				
	Weather	*Wet*	*Dry*	*Dry*	*Wet*	*Dry*	*Dry*	*Dry*				
	State limit for primary contact = 235 cfu single date maximum (seasonal geometric mean of 126 cfu)											
	Secondary contact is acceptable up to a geometric mean of 630 cfu / 1240 cfu single date											

Most dry weather sampling events met mean primary contact standards. Secondary standards were met in all dry events. Single day results in general were good.

- 7/24/13 Samples for the 3 Otter River sites showed sign of some form of unknown precipitate (likely Iron, magnesium, or H2S) which discolored samples during analysis thus making the reliability of the results uncertain. Investigation yielded no causes.

Weather

Weather was recorded from the Orange and Fitchburg Airports for the 24 & 48 hour periods prior to the sampling event. During these time periods, streams are most greatly affected by stormwater runoff, which can illustrate runoff's impacts on water quality.

MRWC 2012 Bacteria Monitoring program Weather Data.

Date		6/12/13	6/26/13	7/10/13	7/24/13	8/7/13	8/21/13	9/4/13
Station	Orange Airport							
precip/24 hr		0.5	0	0	1.06	0	0	0.01
precip/48 hr		1.71	0.25	0	0.34	0	0	0.02
Station	Fitchburg Airport							
precip/24 hr		0.39	0	0.01	1.24	0	0	0
precip/48 hr		1.53	0.09	0	0.46	0	0	0.14
USGS flow								
	Otter	290 cfs/high	64 cfs-high	37 cfs high	41 cfs-high	28 cfs high	20 cfs ave+	14 cfs ave+
	Millers-S Royaston	1620 cfs/high	343 cfs-high	185 cfs-high	120 cfs high	97 cfs H	77 cfs-ave	138 cfs H
	Farley	3160 cfs/high	628 cfs-high	310 cfs high	600 cfs high	170 cfs	145 cfs norm	153 cfs N+
determination		***WET***	***DRY***	***Dry***	***WET***	***Dry***	***Dry***	***Dry***
	WET EVENT	M/O					M/O	
	CRITERIA:							
	if rain 2 days(48 hrs) or less prior to sampling event exceeds 0.25 inches, then sampling considered wet.							
	If rain within 24 hours is 0.10 inches or more, then wet sampling event.							
	If >0.25 inches within 3 days and stream flow has not returned to pre-rain level, wet event.							
	IF NONE OF THE ABOVE: THEN DRY EVENT.							

It was wet in the early summer as illustrated by the high river flow rates. Late summer flows began to approach normal.

Field sheets

The table below summarizes general field "Aesthetic" observations noted during sampling events. Presented below are visual color and "nose" odor observations.

2013	Color odor observations							
Date	6/12/13	6/26/13	7/10/13	7/24/13	8/7/13	8/21/13	9/4/13	*notes*
MOSF1	slight-yellow, slight rotten egg	clear none	tea none	NA	sl yellow, none	NA	lt-tea, none	
MCM1	light-tea none	light-tea none	tea none	light tea- none	lite-tea none	NA	lt-tea none	
MFW1	light-yellow none	light-tea none	brown tea- rotten egg	brown tea- none	brown tea- rotten-egg	NA	yellowish none	
MORF1	light tea, none	NA	NA	light tea none	NA	NA	tea none	
MWO1	tea none	light tea none	light tea none	light tea none	clear	NA	lt-tea none	
MMF1	brown none	tea none	tea none	brown tea, none	NA	clear none	clear/tint none	
MCf1	tea color none	tea none	tea none	brown tea, none	NA	clear none	clear/tint none	
OR2A1	slight-tea-clear- no odor	tea none	tea none	tea-none	tea, none	NA	clear-tint none	
OR101	slight-tea-clear no odor	tea none	tea none	tea-none	tea, musty	NA	clear-tint none	
OBW1	slight-tea-clear none	tea none	tea none	tea-none	tea, slight effl	NA	clear-tint none	

In general, both the Millers and Otter Rivers appear to have a tint, often described as a weak tea color. This is common in many New England rivers and relates to the presence of natural tannins from plant decay. ***It is also heartening that there were very little or NO water ODORS observed throughout the summer season.***

These general observations are useful as they can be compared from person to person, year to year and give some continuity to the monitoring. A long term record can help clarify if any changes occur.

Table: 2012 River Temperatures

Water Temperatures								
Date	6/12/13	6/26/13	7/10/13	7/24/13	8/7/13	8/21/13	9/4/13	notes
Site/temp H2O-degree F								
MILLERS								
MOSF1	64	68	72	na	64	na	62	
MCM1	66	74	75	75	67	na	67	
MFW1	64	74	75	74	69	na	69	
MORF1	58	na	na	75	na	na	70	
MWO1	60	74	75	75	68	na	70	
MMF1	60	74	75	75	na	70	68	
MCf1	60	74	75	74	na	68	65	
OTTER								
OR2A1	58	76	75	74	67	na	66	
OR101	58	75	75	73	67	na	68	
OBW1	58	74	73	72	66	na	65	

na = no data.

The river temperatures in late June and July exceeded cold water fishery standards, which, is considered 68 degree F. Most dates have consistent readings and at a glance appear similar to 2012 readings. All thermometers were QC checked.

QC Objectives (Quality Control = QC)

MRWC set a number of QC objectives for the sampling program. A review of these objectives, presented below, will determine how well the program performed this season.

Completeness:

MRWC completed 69 out of 70 planned bacteria samplings; >99% achieved. This met our goal of 80+%. We missed 2 field duplicates and 2 blank samples.

Precision:

MRWC's goal for precision was <30% deviation on duplicates when analyzing log10 of the values. Log10 smoothing of values considers the randomness of bacteria

concentrations in waters. The 2013 deviations did not exceed 15% on the worst day and was typically less that 10%. Good precision!

QC samples 2013 Field Duplicates							
Grab	6/12/13	6/26/13	7/10/13	7/24/13	8/21/13		
count/site	CM	FW	ORF	WO	MCf		
site	261.3	81.3	110.6	178.5	25.1		
duplicate	201.4	63	83.3	160.7	23.1		
Log 10	2.41713941	1.910090546	2.04375513	2.251638	1.3996737		
Log 10 Dup	2.304059466	1.799340549	1.920645	2.206016	1.363612		
Ave dev	0.056539972	0.055374998	0.06155506	0.022811	0.0180309		
RPD	5.6	5.5	6.1	2.3	1.8		
blank		<1					
Lab Dup	6/12/13	6/26/13	7/10/13	7/24/13	8/7/13	8/21/13	9/4/13
	Count						
site	261.3	79.8	69.5	517.2	146.7	122.3	156.5
duplicate	238.2	63.1	108.1	261.3	121.1	93.4	160.7
Log 10	2.41713941	1.902002891	1.8419848	2.713659	2.1664301	2.087426	2.194514342
Log 10 Dup	2.376941757	1.800029359	2.03382569	2.417139	2.0831441	1.970347	2.206015877
Ave dev	0.020098826	0.050986766	0.09592044	0.14826	0.041643	0.05854	0.005750767
RPD	2	5.1	9.6	14.8	4.2	5.8	0.6

Only 1 blank was collected using sterilized water. It was analyzed and was less than 1 cfu, the lab's lower limit. This verifies the lab's precision as well.

Thermometers were checked against a NIST certified thermometer at CRWC lab in May and December of 2013. All thermometers used in our program met our goal of +/- 1 deg C.

Representativeness:

All samples were collected in the same manner at locations within recreational areas; many sites were boat launch areas. Samples were collected in the morning and on a consistent schedule during the prime recreation season. Seven events took place to cover 3 months of the recreational season. All sites had flow.

Comparability

The comparability of the data collected by MRWC to others (e.g., MassDEP) will be good since known protocols and documenting methods were used. Sampling sites and

procedures are well documented so that future surveys can produce comparable data by following similar procedures and using same sites.

Training:

All volunteers received training in sampling, sample handling, recording, labeling, and safety procedures.

Sample Handling/Hold Times:

All samples were transported on ice packs, in coolers, and were received amply chilled. All samples were delivered to the lab within the six hour maximum hold-time limit. A few samples were delivered so soon that they had little time to chill. There were a few writing legibility issues in noting sample IDs on forms and these were successfully sorted out.

These results indicate that the QC objectives for 2013 were met.

Conclusions/Discussion

2013 discussion

The spring of 2013 was not unusually wet, but June saw rains nearly twice the norm. River levels were high throughout the summer and did not begin to approach normal flows till mid/late August. By chance, most of our sampling dates fell in periods with little or no rain. The two WET event dates did have the highest average bacteria counts of our sampling season. All sites met secondary standards, wet or dry, with half the sites having a geometric mean for the summer as primary contact attainment. The only times where a site failed the single primary sample limit of 235 cfu were on days deemed as wet weather, after a rain. This confirms the recommendation that primary contact, swimming and such, be avoided immediately after rain events.

The data from the 2013 sampling season allows the following observations:

- Dry weather events met primary contact standards at most sites and secondary contact standards for all sites.
- The poorest day for bacteria was a wet event with the most rain recorded within 24 hours. (7/24/13)
- Cass Meadow and Fielding Way sites continue to have highest geometric means. These sites are near an urban area: Athol.
- The site at New Boston Rd, ORSF, had a secondary use geomean possibly due to the higher summer flows and the nearby wetlands and animal activity.
- Other sites with a secondary rating were near urban areas.
- River Temperatures appeared similar to 2012.
- There were no unusual odor or color observances.

The state has established the use of the geometric mean to review bacteria data sets for determination of standard attainment. Use of the geometric mean is generally advised for bacteria data to attain a log normal distribution by reducing skew effects.

2013 Conclusions

Immediately following a heavy rain storm, river areas in and immediately below urban areas may not be suitable for primary contact, but secondary contact may be acceptable. In dry weather conditions, these rivers appear acceptable for primary and secondary contact recreation.

Communities wishing to meet primary contact standards should consider implementing (and maintaining) a comprehensive stormwater management program. MassDEP, the Mass Watershed Coalition, and the Mass Association of Conservation Commissions can offer information on other programs. Such programs would offer improvements in water quality that would benefit both people and river health.

2014 efforts

The data from this third year of monitoring will add to the baseline of data and help MRWC and the community, broaden its understanding water quality trends. Continuing to add to this baseline will be helpful. At a minimum, MRWC hopes to sample many of the same sites again in 2014, 6-8 times using the same procedures. Regular and consistent monitoring will enable MRWC to keep the public well-informed, while developing a clearer water quality history from which to determine trends and identify problems and remedial actions.

With possible new segments of the Blue Trail Network, MRWC will seek funding to restore sampling in Winchendon/Waterville and Erving.

MRWC may also wish to have funding resources to perform some "source" tracking if areas are discovered to have high e-coli readings. Source tracking would entail immediate follow up sampling after a high reading in and around a high reading site. This may also include "bracketing" the site by sampling areas above and below any suspected bacteria sources that could contribute to the concern. Reserve funding for up to 20 samples would be beneficial for such an effort.

Funding will determine the final scope of sampling in 2014; between grants and another "Adopt a Sample" campaign we hope to sample at least 12-13 sites.

Maintaining/Recruiting volunteers will begin in the late winter of 2014 with training slated for the late spring. MRWC will likely begin 2014 sampling in June.

MRWC sees this program as an important resource in advancing watershed protection and community engagement.

Appendix 1

2011 Bacteria data (2011 had fewer sites than 2012)

Millers & Otter Rivers: Bacteria Sampling for healthy contact.									
Site	Date:	6/14/11	6/28/11	7/12/11	7/26/11	8/9/11	8/23/11	9/6/11	geomean	geoMN dry
	e coli count: cfu									
Millers-M										
Upper Athol-MUA1		88	68	12	100	170	90	72	69.60	
Cass Meadow/Rich Env Park-MCM1		90	52	90	320	160	160	168	128.54	110.41
Fielding Way-MFW1		142	64	110	TNTC	210	140	400	150.79	124.06
Orange River Front park-MORF1		154	80	46	72	240	80	102	96.85	
West Orange-MWO1		120	108	70	420	150	100	420	157.47	106.36
Otter-O										
Whitney St - headwaters-OHWW1		114	28	40	34	150	10	NA	43.21	
Rt 2A crossing-OR2A1		34	70	76	580	290	50	180	115.48	68.55
Rt 101 Crossing-OR101		72	88	116	590	670	70	580	197.68	84.69
Baldwinville, Rt 202-OBW1		92	88	64	280	800	150	1400	219.27	93.89
Weather notes (wet/dry period)		dry/wet "	dry	dry	wet	wet	wet/dry*	wet^		
Rain - M/O- inches-48 hr		0.07/0.28	0.04/0.06	0/0	0.52/0.62	0.85/0.77	0.39/0.14	0.66/0.46		
State limit for primary contact = 235 cfu single date maximum (seasonal geometric mean of 126 cfu)										
Secondary contact is acceptable up to a geometric mean of 630 cfu / 1240 cfu single date										
TNTC > 2000 (not included in mean calculation) (geo mean dry excludes wet exceedance events)										
" dry/wet = low rain @ Orange Airport, but wet weather @ Fitchburg Airport Weather Station.										
*wet/dry = rain @ Orange Airport met wet criteria, but not @ Fitchburg Airport.										
^major rain event the week before										
high value- exceeds primary contact standard										

Primary Contact Recreation. Any recreation or other water use in which there is prolonged and intimate contact with the water with a significant risk of ingestion of water. These include, but are not limited to, wading, swimming, diving, surfing and water skiing.

Secondary Contact Recreation. Any recreation or other water use in which contact with the water is either incidental or accidental. These include but are not limited to fishing, including human consumption of fish, boating and limited contact incident to shoreline activities. Where designated, secondary contact recreation also includes

River Temperatures 2011

Date	*14-Jun*	*28-Jun*	*12-Jul*	*26-Jul*	*9-Aug*	*23-Aug*	*6-Sep*
Site/temp H2O-degree F							
MUA1	59	70	77	70	72	65	68
MCM1	59	70	76	75	76	72	70
MFW1	61	70	73	64	70	70	68
MORF1	61	70	76	76	78	70	70
MWO1	60	68	72	70	72	68	70
OHWW1	62	62	78	70	70	na	na
OR2A1	60	64	74	66	70	64	68
OR101	na	64	74	66	70	64	68
OBW1	na	64	78	70	70	64	64

2012 MRWC Bacteria Sampling Data										
Site ID#	Location - Sample Date	6/6/12	6/20/12	7/5/12	7/18/12	8/1/12	8/15/12	8/29/12	GeoMean	contact
	Millers River	count								RATING
MW1	Bridge-St, Winchendon	172.3	115.3	112.7	86.0	45.0	488.4	155.3	130.9	*2nd*
MOSF1	New Boston Rd-OSF	101.4	88.2	191.8	35.5	68.3	261.3	139.6	106.1	*primary*
MUA1	Upper Athol	81.3	86.5	60.2	64.4	25.9	387.3	69.5	78.9	*primary*
MCM1	Cass Meadow	75.4	261.3	648.8	195.6	290.9	727.0	218.7	273.9	*2nd*
MFW1	Fielding Way	115.3	90.9	307.6	129.6	137.4	1986.3	325.5	232.9	*2nd*
MORF1	Orange-Riverfront park	125.9	123.6	32.3	36.9	107.6	32.3	66.3	63.7	*primary*
MWO1	West Orange	84.2	167.0	77.6	95.9	90.6	172.6	105.4	108.1	*primary*
MEr1	Erving	165.0	77.6	105.0	90.8	72.8	1046.2	56.5	126.7	*primary*
MMF1	Millers Falls	62.0	43.5	37.3	56.5	26.5	920.8	16.0	58.0	*primary*
MCf1	Millers-confluence w/Ct	107.6	58.3	52.0	68.3	32.8	1413.6	123.6	103.6	*primary*
	Otter River	count								
OHWW1	Whitney St Templeton	43.5	24.3	52.9	16.8	10.8	290.9	5.2	28.5	*primary*
OR2A1	Rt 2A crossing	79.4	95.9	105.8	307.6	228.2	1413.6	218.7	209.1	*2nd*
OR101	Rt 101 Crossing	67.0	193.5	131.4	238.2	112.6	83.9	111.2	123.0	*primary*
OTB1	Turner/Bridge ST	93.2	98.7	88.4	103.9	76.7	98.7	57.3	86.6	*primary*
OBW1	Baldwinville	92.7	93.4	365.4	201.4	143.9	461.1	196.8	188.1	*2nd*
OCM1	Confluence w/Millers	135.4	140.1	198.9	NS	45.5	NS	172.5	124.3	*primary*
	Average of event	100.1	109.9	160.5	115.2	94.7	652.3	127.4		
	Weather	*WET*	*DRY*	*Dry/Wet*	*Dry*	*Dry*	*WET*	*Wet*		
	State limit for primary contact = 235 cfu single date maximum (seasonal geometric mean of 126 cfu)									
	Secondary contact is acceptable up to a geometric mean of 630 cfu / 1240 cfu single date									

Water Temperatures							
Date	6/6/12	6/20/12	7/5/12	7/18/12	8/1/12	8/15/12	8/29/12
Site/temp H2O-degree F							
MW1	58	67	73.5	76	68	69	67
MOSF1	59	67	75	76	70	70	68
MUA1	59	68	72	63	70	71.5	64.5
MCM1	59	66	75	63	68	71.5	68
MFW1	na	na	63	64.5	61	55	52
MORF1	59	68	75	80.5	75	71.5	70
MWO1	59	64.5	72	77	75	71.5	64.5
MEr1	60	68	77	80	75	73	70
MMF1	59	68	75	77.5	71.5	70	70
MCf1	58	66	74	78	73	70	62
OHWW1	56	66	75	78	70	70	68
OR2A1	56	66	75	76	70	70	68
OR101	58	66	75	76	70	70	70
OTB1	58	67	74	76	72	72	70
OBW1	58	68	74	78	72	72	70
OCM1	59	67	72	na	71	na	66

MRWC
Thermometer Quality Check Report
2013
Bac-T program used "T" probes

Pre-season check
Date: 5-22-13
QC used: CRWC lab NIST QC by: K Davies

Probe ID	Probe temp	Nist Temp	Probe temp2	Nist temp2	Notes
T-1	72.5	22.6/72.7	53	10.9/51.7	pass
T-3	72.5	22.6/72.7	53	10.9/51.7	pass
T-4	72.5	22.6/72.7	53	10.9/51.7	pass
T-5	22.5	22.6/72.7	11.1	10.9/51.7	pass
T-6	72.4	22.6/72.7	52	10.9/51.7	pass
T-11	72.0	22.6/72.7	52	10.9/51.7	pass
D-14052	23.0	22.6	11.5	10.9	pass
D-14056	22.5	22.6	11.2	10.9	pass
D-20480	22.7	22.6	11.5	10.9	pass
D-20473	22.7	22.6	11.4	10.9	pass
D-20448	22.5	22.6	11.2	10.9	pass

Post-season check
Date: 12/3/13
QC used: CRWC lab NIST QC by: K Davies

Probe ID	Probe temp	Nist Temp	Probe temp2	Nist temp2	Notes
T-1	67	19.6/67.3	37	3/37.4	pass
T-3	67	19.6/67.3	37	3/37.4	pass
T-4	67	19.6/67.3	37	3/37.4	pass
T-5	19.5/67	19.6/67.3	3/37	3/37.4	pass
T-6	67	19.6/67.3	37	3/37.4	pass
T-11	67	19.6/67.3	37	3/37.4	pass
D-14052	20	19.6	3.3	3	pass
D-14056	19.7	19.6	3.0	3	pass
D-20480	19.9	19.6	3.0	3	pass
D-20473	19.8	19.6	3.0	3	pass
D-20448	19.7	19.6	3.1	3	pass

All Temps C/F, T= spirit thermometers, D= digital thermometers
QC limit per QAPP = 1 deg C precision, 0.5 deg C accuracy