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MRWC Bacteria Monitoring Program

2017 Report: Millers & Otter Rivers



Monitoring Our Rivers Health.

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

Executive Summary

In 2017 the Millers River Watershed Council (MRWC) successfully conducted its sixth bacteria monitoring season, having not sampled in 2016. A group of dedicated volunteers and two staff executed this program by monitoring a total of nine sites on the Millers and Otter rivers. Seven distinct sampling events were completed during the major recreational contact season. MRWC used a mix of sample sites to cover areas where Blue Trails exist for recreational enjoyment.

This program has been building a baseline to improve the water quality database 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 "*Is it Clean*" through a partnership with CRC (CRWC) and PVPC. The data collected was determined to be of reliable quality and consistent with all state standards for water quality monitoring.

2017 results indicate a generally healthy river system for a variety of types of recreation. Sites proved healthy for paddling recreation at all times. It was observed that rain events do elevate bacteria levels which may limit primary contact uses.

The continued success of this monitoring program illustrates the value and importance of volunteer activities to monitoring and 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 an ongoing “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 peace of mind, it is particularly important to determine if Blue Trail and other segments meet the MassDEP water quality contact standards.

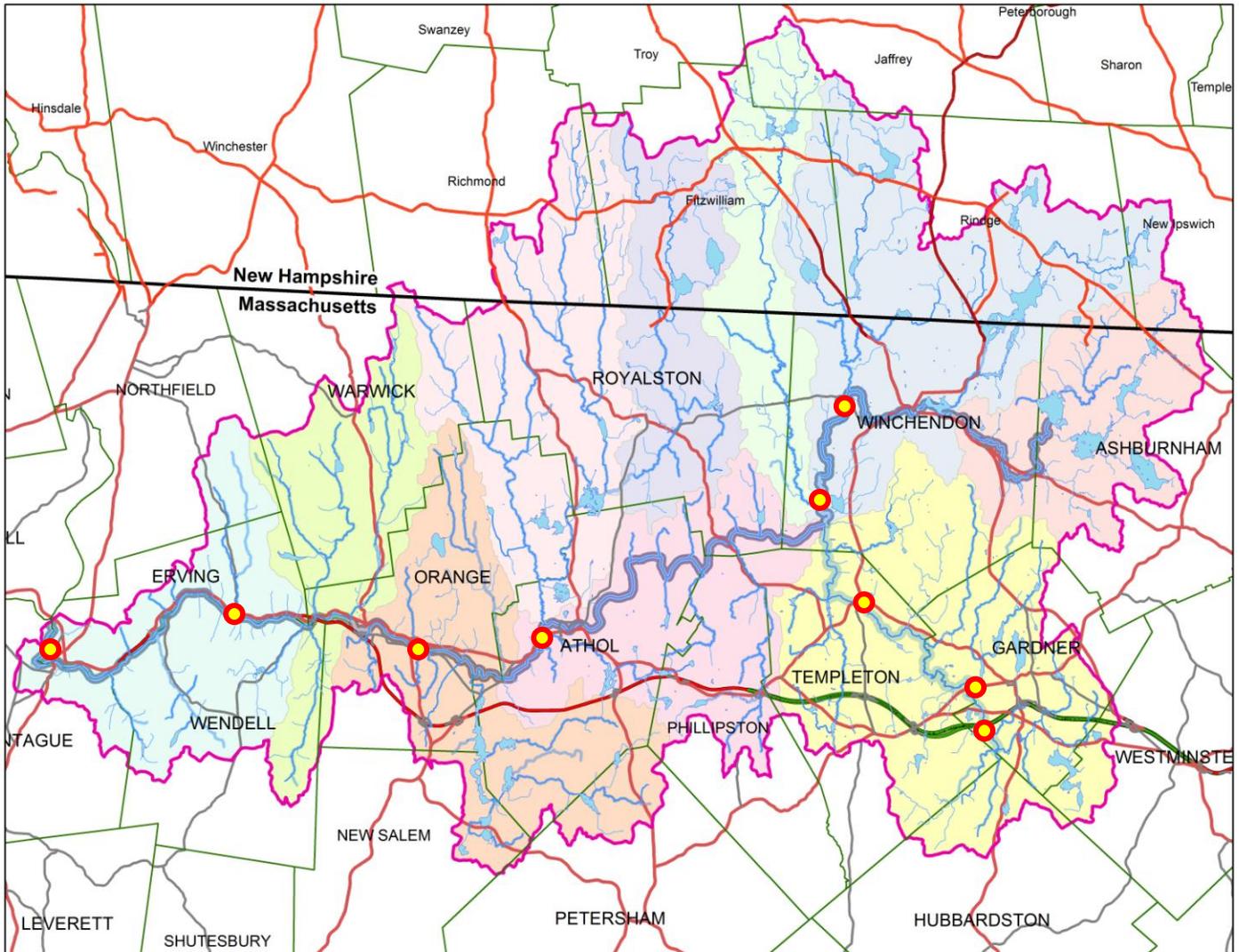
MRWC’s program is guided by a QAPP (Quality Assurance Project Plan) from which to conduct consistent operation of this effort. A QAPP is a formal monitoring plan with ample quality control that is approved by MassDEP. The data from such a program, if followed carefully, is accepted and trusted by the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

MRWC relies on fundraising to help support program costs, mainly laboratory analyses of samples and some monitoring equipment. MRWC is grateful for support from individuals/businesses who contributed to our “Adopt-A-Sample” program. MRWC used the CRC lab in Greenfield for sample analysis. Sampling kits were organized for each sample site.

Another key step was to find volunteer samplers. Outreach brought six people forward to help. All received training in proper sampling techniques, and bi-weekly sampling began on June 8, 2017 and ran through August 31st. In all we conducted seven sampling events at nine (9) sampling sites on the Millers and Otter Rivers. Volunteers noted air and water temperatures and other site conditions observed during each sampling event. Weather conditions within 48 hours of sampling events were recorded from NWS (National Weather Service) sources.

The 2017 sampling year was a strong success. Volunteer samplers did well and there were few complications. Reporting on line also worked well. This experience continues to illustrate 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.

2017 Bacteria sample sites in the Millers Basin. ●



Dark blue river = Millers River, Light Blue river = Otter River

Special thanks to our volunteers!

Diane Nassif, Sarah Trafton-Anderson, David & Monique Brule, Guy Corbosiero, Paul Goyetche

Acronyms:

CRC (Connecticut River Conservancy) formerly 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.

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 3-4 sites on the Otter River and 6-8 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.

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 CRC 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 2-3 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.

2017 Monitoring sites

In 2017 MRWC returned to sampling at key baseline data points along MRWC Blue Trails; sections within the Millers River Watershed; one set on the Millers River and one on the Otter River. Since MRWC encourages river discovery/recreation, it was deemed prudent to continue monitoring 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
MW1	Winchendon Boat launch	42°41'2.25"N	72°4'59.22"W	Below River St bridge at improved river access location
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
MORF1	Orange Riverfront Park	42°35'19.52"N	72°18'29.33"W	Sample from boat ramp
MEr1	Erving	42°35'54.72"N	72°24'9.50"W	Below bridge crossing down Arch St off Rt 2, Erving center
MCf1	Millers w/CT confluence 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 above Rt 101, 100 ft, near pipe crossing along Plant Rd
OBW1	Baldwinville	42°36'23.51"N	72° 4'30.34"W	Park behind Legion Hall, sample upstream, east bank of 202 bridge

In the table above, sites straddle sections of all 3 Millers River Blue Trails (AO, UM/LO, UO). The locations of these sites offer a good balance of data from both urban and non-urban conditions.

The Rt 2A crossing had a large beaver dam across the mouth of the culvert inlet. Samples were collected just above this as in the past. Dam created a more still pool than in previous years.

Beaver activity may also have backed up flow near the Winchendon River St site.

Results

Bacteria

The table below notes the bacteria levels for the 2017 sampling season. A discussion and interpretation of these results is presented in the Conclusions section.

2017 MRWC Bacteria Sampling Data										
Site ID#	Location - Sample Date	6/8/17	6/22/17	7/6/17	7/20/17	8/3/17	8/17/17	8/31/17	GeoMean	contact
	Millers River	count								RATING
MW1	Winchendon-River St	143.9	90.9	73.8	178.5	156.5	152.9	108.6	123.9	primary
MOSF1	New Boston Rd-	238.2	148.3	118.7	59.4	104.3	77.6	86.0	119.5	primary
MCM1	Cass Meadow	228.2	88.0	56.3	387.3	78.5	115.3	40.4	86.3	primary
MORF1	Orange-	214.2	112.6	90.6	34.1	90.8	40.4	33.6	80.4	primary
MEr1	Erving- Arch St	178.9	139.6	62.4	517.2	101.9	547.5	56.3	130.3	secondary
MCf1	Millers-	458.0	146.7	95.9	101.4	67.7	81.3	60.5	113.6	primary
	Otter River	count								
OR2A1	Rt 2A crossing	67.7	75.4	69.1	63.8	101.9	65.0	107.6	79.4	primary
OR101	Rt 101 Crossing	90.6	93.3	76.3	49.6	178.9	146.7	142.1	115.8	primary
OBW1	Baldwinville	166.4	83.6	83.6	95.9	117.8	108.1	63.7	99.0	primary
	Weather	Wet	Dry	Dry	Dry	Dry-west	Dry	Dry		
Wet = >0.1 within 24 hr OR >0.25 within 48 hr. Dry 0" precipitation within 48 hr.						Wet-East				
NA-Not Acceptable data	MCf1	sample vol low			above limit				OBW1 - NA	Bottle cracked
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										

The two high Erving readings (DRY events), though not alarmingly high, may warrant future investigation if issue persists. Sites ALL were good for paddling recreation during the 2017 season. WET events had elevated bacteria levels.

Weather

Weather was recorded from the Orange and Fitchburg Airports for the 24 & 48 hour periods prior to the sampling event. Rainfall during these time periods can produce stormwater runoff, which can impact water quality in streams. Noting the amount of rainfall and comparing it to bacteria counts can illustrate the degree of impact.

MRWC 2017 Bacteria Monitoring program Weather Data.								
Date		6/8/17	6/22/17	7/6/17	7/20/17	8/3/17	8/17/17	8/31/17
Station	Orange Airport							
precip/24 hr		0	0	0	0	0	0	0
precip/48 hr		0.91	0.03	0	0	0	0.1	0
Station	Fitchburg Airport							
precip/24 hr		0.01	0	0	0	0.64	0	0.02
precip/48 hr		0.74	0.04	0	0.09	0	0.13	0
USGS flow								
	Otter	200 cfs/high	35 cfs	20 cfs	16 cfs	12.5 cfs low	14 cfs low	8.5 cfs low
	Millers-SR				58 cfs		40 cfs	138 cfs
	Farley	2600 cfs/high	625 cfs-high	300 cfs	150 cfs	85 cfs-low	100 cfs low	85 cfs low
	Winchendon	600 cfs/high	105 cfs-up	48 cfs	20 cfs-low **	NA	NA	NA
determination		WET	DRY	DRY	DRY	DRY/WET	DRY	DRY
	WET EVENT	M/O				West/East	M/O	
	CRITERIA:							
	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.							
	* In July the Winchendon flow gage may have been off line due to a problem. Data here may be suspect.							

Most sampling was done in dry periods.

Field sheets

Volunteers performed general field “Aesthetic” observations during sampling events. These involved visual color and “nose” odor observations.

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 unusual 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: 2017 River Temperatures

<i>Water Temperatures</i>							
<i>Date</i>	6/8/17	6/22/17	7/6/17	7/20/17	8/3/17	8/17/17	8/31/17
H2O-degree F							
MILLERS							
MW1		68	65	71	68	65	61
MOSF1		68	68	73	69	65	61
MCM1		69	71		71	68	63
MORF1		68	68		69	66	60
MEr1							65
MCf1		64		74	67	67	62.5
OTTER							
OR2A1		70	73	73.5	71.5	69	62
OR101		69	71	76	69	64.5	60
OBW1			64				60

The river temperatures in mid July exceeded cold water fishery standards, which, is considered 68 degree F.

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 62 out of 63 planned bacteria samplings; 98% achieved. This met our goal of 80+%.

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 2017 deviations did not exceed 10% on the worst day. Good precision!

QC samples							
2017 field Duplicates							
field Dup	6/8/17	6/22/17	7/6/17	7/20/17	8/3/17	8/17/17	8/31/17
Count							
site	228.2	112.6	62.4	95.9	101.9	40.4	40.4
duplicate	228.2	166.4	71.2	141.4	108.1	46.5	43.5
Log 10	2.35831564	2.051538391	1.79518459	1.981819	2.0081742	1.6063814	1.606381365
Log 10 Dup	2.35831564	2.221153322	1.85247999	2.150449	2.0338257	1.667453	1.638489257
Ave dev	0	0.084807466	0.0286477	0.084315	0.0128258	0.0305358	0.016053946
RPD	0	8.4	2.8	8.4	1.3	3	1.6
Blank Grab, 8/3/17 = <1.0							
Blank Grab, 8/17/17 = <1.0							

2 blanks were 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.

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. The field dup on 9/2 was not properly labeled, this was remedied.

These results indicate that the QC objectives for 2017 were met.

Conclusions/Discussion

2017 discussion

2017 followed a dry 2016. Rain events in 2017 were more normal, yet river flows rarely remained high long and were often a bit below long term normal flows. By chance, most sample events fell on dry weather conditions (1.5 events of 7 were wet).

The data from the 2017 sampling season allows the following observations:

- All sites were suitable for recreational paddling.
- All but MEr1 met primary contact standards on average*.
- MEr1 had 2 high Dry weather readings, no identified causes.
- River Temperatures appeared a bit cooler than previous seasons.
- There were no unusual odor or color observances.
- All QC criteria were met.

*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.

2017 Conclusions

The Millers and Otter Rivers have water quality conditions well suited for recreation. Data continues to point out that immediately following a rain storm, river areas in and immediately below urban areas have elevated bacteria levels. In dry weather conditions, these rivers appear acceptable for primary and secondary contact recreation.

Communities wishing to protect acceptable 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.

Future efforts

The data from this past year of monitoring adds to the baseline of data and helps MRWC and the community broaden its understanding water quality trends. Continuing to add to this baseline when possible will be helpful. Regular monitoring enables MRWC to keep the public informed on the health of the rivers, while developing a clearer water quality history from which to determine trends and identify problems and remedial actions.

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