



## 2014 Mad River Watershed Report to LaRosa

### Summary

In 2014, Mad River Watch program volunteers drew samples on six dates at 36 sites (as planned) beginning on June 16 and continuing every two weeks through the summer ending on August 25. 15 sample sites are located on the main stem of the Mad River, 20 on tributaries, and one on Blueberry Lake.

The Friends of the Mad River lab analyzed samples from all 36 sites for *E. coli* (using the IDEXX QuantiTray method), and collected other information on each sampling date including pH, temperature and flow (data from USGS gauge in Moretown).

Through the LaRosa partnership, samples from 18 sites (4 on the main stem of the Mad River and 14 on tributaries) were analyzed for phosphorus and turbidity.

### Vermont Water Quality Standards

The Vermont Water Quality Standards (Effective October 30, 2014) set the allowable limits for *E. coli*, total Phosphorus, turbidity for the Class B (cold water fishery) waters of the Mad River and its tributaries as follows:

#### *E. coli*

Not to exceed 235 per milliliter; this is considered a “Beach Action Value” that corresponds to 8 illnesses per 1,000 swimmers and is slightly more conservative than EPA’s base recommendation of 410 *E. coli* per milliliter

#### Turbidity

Not to exceed 10 NTU (nephelometric turbidity units)

#### Total Phosphorus

Not to exceed 12 micro grams per liter

### Phosphorus

Of the total of 108 samples analyzed for total Phosphorus, 31 (28 per cent) exceeded the standard of 12 micro grams per liter. Six of those exceeding the standard were located on main stem of the river and 25 were on tributaries. Three tributaries exceeding the standard half or more of the six times sampled were Folsom Brook (5 times), High Bridge Brook (4 times), and Welder Brook (3 times).

**Table 1.** 2014 Total Phosphorus at 18 sites in the Mad River Watershed ( $\mu\text{g/l}$ )

	Site #	6/16/2014	6/30/2014	7/14/2014	7/28/2014	8/11/2014	8/25/2014
FLOW CONDITION -->		HD	LS	LR	LD	LS	LS
Mad River, Warren Falls	1	12	6.17	< 5	5.42	6.96	12
Lincoln Brook	2	12.8	7.64	8.61	5.39	< 5	6.08
Freeman Brook	4	17.2	10.2	11.4	12.1	8.58	9.85
Bradley Brook	6	11.1	9.03	11.1	12.5	7.2	8.66
Clay Brook	8	15.2	8.09	34.6	9.18	5	7.34
Folsom Brook	10	14.1	17.1	27.1	17.5	11.9	15.6
Rice Brook	11	6.34	6.7	12.7	6.73	< 5	< 5
Clay Brook, Sugarbush	12	8.24	6	36.8	6.33	5.14	6.83
Chase Brook	16	< 5	12.1	8.17	6.13	< 5	5.54
Mill Brook	18.1	10.8	7.82	11.2	5.61	< 5	5.33
Mad River, Waitsfield Covered Bridge	20	11	10	83.2	8.21	< 5	7.85
High Bridge Brook	20.1	20.8	13.4	21.6	89	10.3	10.8
Pine Brook	22	19.4	10.7	8.96	31.2	8.12	9.51
Shepard Brook	24	10.8	7.05	7.06	6.83	< 5	5.98
Dowsville Brook	25	11.7	7.7	10.6	11.5	6.3	7.83
Mad River, Moretown Village	28	8.54	11.3	16.5	11.6	5.14	7.26
Welder Brook	28.05	13.8	12.1	14.1	11.8	8.65	8.36
Mad River, Lover's Lane	31	10	13.6	12	15.2	8.36	7.4

Flow conditions seem to have a direct effect on total Phosphorus concentrations. Under the high and decreasing flows on June 16 (324 cfs down to 282 cfs at the Moretown USGS gage from midnight to noon on the day of sampling), nine locations exceeded the standard. Also, on July 14, under low and rising flow conditions (62 cfs at midnight rising to 137 cfs at noon) nine locations exceeded the standard, but only four of those were the same locations as on June 16.

Under the low and steady flow conditions of the August 11 and August 25 sampling dates (flows steady at about 57 cfs and 79 cfs, respectively), there was only one violation of the standard, Folsom Brook at 15.6 micro grams per liter.

#### Quality Control for Total Phosphorus

The average relative percent difference (RPD) of phosphorus field duplicate samples for the six sampling dates was 18.3%, which is within the estimated range of precision specified in the Quality Assurance Project Plan (QAPP) (less than or equal to 30% RPD). One field duplicate sample on July 14 when flow conditions were low and rising showed a difference of 85.86%. The large difference may have been due to sampling procedure (timing) and variation in flow regime.

#### **Turbidity**

Of the 18 sites sampled and analyzed for turbidity, only one of the 108 samples did not meet the turbidity standard of 10 NTU. That one sample was taken on July 14 on the Mad River at the Waitsfield covered bridge was 59.5 NTU. The only possible explanation is

that some disturbance occurred upstream of the sample location. This is borne out by a total phosphorus reading of 83.2 micro grams per liter on the same date at that location.

**Table 2.** 2014 Turbidity at 18 sites in the Mad River Watershed ( $\mu\text{g/l}$ )

	Site #	6/16/2014	6/30/2014	7/14/2014	7/28/2014	8/11/2014	8/25/2014
FLOW CONDITION -->		HD	LS	LR	LD	LS	LS
Mad River, Warren Falls	1	0.4	0.25	0.99	0.75	0.46	2.26
Lincoln Brook	2	0.94	0.74	1.31	1.09	0.56	0.34
Freeman Brook	4	7.33	0.97	2.67	2.25	0.46	0.58
Bradley Brook	6	1.4	1.24	2.56	4.94	1.1	1.09
Clay Brook	8	5.56	2.16	8.75	2.86	1.08	3.66
Folsom Brook	10	1.09	0.69	3.66	2.11	1.62	1.42
Rice Brook	11	< 0.2	0.16	1.73	0.78	0.2	0.23
Clay Brook, Sugarbush	12	0.21	0.37	3.31	1.17	0.68	0.73
Chase Brook	16	0.23	0.21	0.39	0.93	0.32	0.48
Mill Brook	18.1	1.22	0.97	1.75	0.9	0.65	0.62
Mad River, Waitsfield Covered Bridge	20	1.68	0.6	59.5	1.64	2.08	1.31
High Bridge Brook	20.1	3.83	2.49	4.49	9.56	1.57	0.99
Pine Brook	22	0.98	1	1.42	1.15	0.49	1.14
Shepard Brook	24	0.95	1.16	1.36	0.86	0.35	0.97
Dowsville Brook	25	2.76	1.23	2.62	3.74	0.79	1.29
Mad River, Moretown Village	28	1.62	1.16	5.32	4.34	1.05	0.79
Welder Brook	28.05	1.35	1.69	2.13	1.24	0.69	0.61
Mad River, Lover's Lane	31	2.01	1.14	3.03	6.51	1.83	1.53

### Quality Control for Turbidity

The average relative percent difference (RPD) of turbidity field duplicate samples for the six sampling dates was 32.07%, which is more than double the estimated range of precision specified in the QAPP (less than or equal to 15% RPD). This is most likely due to the very low turbidity levels which would magnify any variations in analysis.

Data completeness for the 2010 season is 100%.

### ***E.coli***

Sampling was done under four different flow conditions. On the sampling dates of June 30, August 11 and August 25 the flow of the Mad River at the Moretown gage was low and steady (LS). On June 16 the flow was high and decreasing (HD). On July 14 the flow was low and rising (LR) and on July 28 the flow was documented as low and decreasing (LD) however the flow data shows the flow decreasing from midnight (161 cfs) to 102 cfs by 0900 but then the flow began increasing to 157 cfs by 1200.

Of the 216 samples analyzed 17 (7.8 per cent) were in violation of the Vermont Water Quality Standards for *E.coli* (235 *E.coli* per 100 milliliters). Fifteen of these violations were on the sampling date of July 14 when the flow of the Mad River was low and rising.

Eleven of these violations were on the Mad River and four on tributaries (Folsom, High Bridge, Shepard and Dowsville Brooks).

The other two violations were on June 16 when the flow of the Mad River was high and decreasing, one on High Bridge Brook (Site 20.1) and one on the lower Mad River (Site 31).

It appears that one could conclude that under low and rising flow conditions, right after a rain, *E. coli* is entering the watercourses from overland or stormwater runoff.

In 2012, the Vermont Department of Health and Department of Environmental Conservation adjusted the single sample “Beach Action Value” for *E. coli* to 235 *E. coli* per 100ml. This is a slightly more conservative threshold than the current EPA base recommendation of 410 *E. coli* per 100ml and corresponds to 8 illnesses per 1,000 swimmers. It is worthy to note *E. coli* levels below the Action Value, though higher than the normal low values usually obtained during low steady low flow conditions.

On August 25 under low and steady (LS) flow conditions (79 cfs) there were no violations and no *E. coli* concentrations above 100 *E. coli* per 100ml. On August 11, again under low and steady flow conditions (57 cfs) there were only two sites above 100.

On June 30, under low and steady flow conditions there were six sites with *E. coli* levels above 100, five on the lower Mad River and one on Welder Brook (located in the lower Mad River). These high levels may be due to the fact that the day before, on June 29, flow levels were decreasing from a high of 149 cfs to 123 and then to the steady state flow of 116 cfs on the day of sampling.

A similar phenomenon seemed to occur on July 28 where flows were low and decreasing. On that sample date there were eleven samples that registered higher than 100 *E. coli* per 100ml, with seven of these on the Mad River. Again, looking at the river flow on the day before (July 27), flow rose from 59 cfs to 178 during the 24-hour day. Rising flows from land runoff could again account for the higher than the normal low-level *E. coli* concentrations.

*E. coli* concentrations for all samples from Blueberry Lake were very low, less than 10 *E. coli* per 100ml.

**Table 3. 2014 *E. coli* at 36 sites in the Mad River Watershed (*E. coli*/100ml)**

MAD RIVER WATCH RESULTS 2014 - <i>E. coli</i>		06/16/14	06/30/14	07/14/14	07/28/14	08/11/14	08/25/14	# violations per site 2014
SITE LOCATION	SITE #	HD	LS	LR	LD	LS	LS	
		<i>E. coli</i> / 100 ml	<i>E. coli</i> / 100 ml	<i>E. coli</i> / 100 ml	<i>E. coli</i> / 100 ml	<i>E. coli</i> / 100 ml	<i>E. coli</i> / 100 ml	
Warren Falls (Mad River)	1	15.8	6.3	41.9	16.2	110.0	8.6	
Bobbin Mill (Lincoln Brook)	2	6.3	5.2	125.9	43.2	7.4	5.2	
Warren Covered Bridge (Mad River)	3	13.4	7.4	160.7	25.9	8.5	5.2	
Warren Store (Freeman Brook)	4	19.9	83.6	53.0	98.9	16.0	93.3	
Brook Road above Village (Freeman Brook)	4.5	33.2	37.9	22.1	56.3	7.4	7.4	
North End Warren Village (Mad River)	5	21.3	17.5	228.2	37.9	10.9	5.2	
Bridge on West Hill Road (Bradley Brook)	6	6.3	13.5	115.3	58.3	9.8	4.1	
Seasons (Mad River)	6.5	12.1	14.8	648.8	55.6	9.7	28.8	1
Warren Riverside Park (Mad River)	7	13.1	21.6	980.4	45.9	14.8	20.1	1
Bottom of Sugarbush Access Rd (Clay Brk)	8	31.8	17.3	198.9	25.9	9.7	1.0	
Route 100 crossing (Folsom Brook)	10	18.9	52.1	488.4	127.4	8.5	8.6	1
"Dip" on East Warren Rd. (N. Folsom Brook)	10.6	155.3	18.7	49.5	48.0	6.3	21.1	
Sugarbush Health Club (Rice Brook)	11	7.4	39.3	90.6	27.5	6.3	5.2	
Inferno Road Crossing (Clay Brook)	12	1.0	2.0	35.9	6.3	4.1	13.5	
Fayston Elementary School (Slide Brk)	13.1	51.2	3.0	36.8	14.8	4.1	12.1	
German Flats, Rt 17 (Chase Brk)	16	9.8	7.4	38.9	43.2	39.3	5.2	
German Flats, Rt 17 (Mill Brk)	17	11.0	11.0	35.9	72.3	4.1	5.2	
Battleground Condos (Mill Brk)	17.1	10.9	22.8	20.1	18.7	7.4	2.0	
Mill Brook	18.1	12.0	18.3	110.6	34.5	11.0	6.3	
Lareau Swimhole (Mad River)	19	39.9	43.5	770.1	131.7	25.3	13.5	1
Couples Club (Mad River)	19.2	39.9	44.8	1203.3	105.4	27.2	12.1	1
Waitsfield Covered Bridge (Mad River)	20	27.2	41.3	816.4	101.4	24.0	20.6	1
Joslin Hill Road Culvert (High Bridge Brook)	20.1	727.0	37.9	410.6	57.3	88.0	19.9	2
Tremblay Road (Mad River)	21.5	27.5	79.8	410.6	107.1	15.6	13.4	1
North Road Covered Bridge (Pine Brook)	22	18.5	16.1	20.1	14.6	3.0	4.1	
Meadow Road Bridge (Mad River)	23	24.3	42.6	770.1	172.3	12.2	27.8	1
Route 100 Bridge (Shepard Brook)	24	16.0	55.6	387.3	30.5	15.8	16.1	1
Route 100 Bridge (Dowsville Brook)	25	14.8	21.8	27.5	39.5	1.0	19.9	
North Road near Moretown (Mad River)	26	24.6	108.1	866.4	209.8	83.6	29.9	1
Moretown Village Swim Access (Mad River)	27	28.7	101.4	613.1	160.7	80.1	28.8	1
Route 100B crossing (Doctors Brook)	27.1	114.5	29.2	214.3	43.2	20.3	15.8	
Ward Clapboard Mill (Mad River)	28	36.9	135.4	816.4	85.7	189.2	36.9	1
Near Stevens Brook Road (Welder Brook)	28.05	26.2	228.2	944.8	118.7	17.3	14.6	1
Ward Swimhole (Mad River)	29	34.5	119.8	920.8	218.7	59.8	27.2	1
Lover's Lane Bridge (Mad River)	31	35.9	107.1	218.7	285.1	26.9	34.5	1
Blueberry Lake	BBL	7.4	6.3	4.1	8.6	4.1	2.0	0
# violations by date:		1	0	15	1	0	0	17