



2015 Mad River Watershed Report to LaRosa

Summary

In 2015, Mad River Watch program volunteers drew samples on six dates at 36 sites (as planned) beginning on June 15 and continuing every two weeks through the summer ending on August 24. 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, 36 (33 per cent) exceeded the standard of 12 micro grams per liter. Twelve of those exceeding the standard were located on main stem of the river and 24 were on tributaries. Two tributaries exceeded the standard five of the six times sampled were Folsom Brook and High Bridge Brook. Welder Brook exceeded the standard two times and Clay Brook exceeded the standard

two times at each of two sites. This year the lowest sample site on the Mad River exceeded the standard 5 times under differing flow conditions.

Table 1. 2015 Total Phosphorus at 18 sites in the Mad River Watershed ($\mu\text{g/l}$)

		6/15/2015	6/29/2015	7/13/2015	7/27/2015	8/10/2015	8/24/2015
FLOW CONDITION -->		LR	HD	LS	HD	LS	LS
FLOW CATEGORY/LEVEL --> (Generalized Across Sites)		MF	MF	LB	MF	LB	LB
Mad River, Warren Falls	1	14.9	11.9	< 5	54	14.4	< 5
Lincoln Brook	2	12.3	7.68	5.4	7.3	18.8	< 5
Freeman Brook	4	56	11.7	6.24	8.91	8.24	6.33
Bradley Brook	6	19.1	9.89	8.18	8.69	8.39	7.77
Clay Brook	8	117	16.5	5.25	7.17	7.99	6.74
Folsom Brook	10	30.4	14.3	12	16.6	17.7	16.2
Rice Brook	11	6.68	< 5	< 5	5.15	6.53	6.14
Clay Brook, Sugarbush	12	30	10.4	< 5	6.26	6.26	5.57
Chase Brook	16	11.1	6.65	5.92	13.2	6.24	5.54
Mill Brook	18.1	error	7.281	< 5	9.34	6.17	< 5
Mad River, Waitsfield Covered Bridge	20	14.1	9.39	5.28	173	6.94	6.76
High Bridge Brook	20.1	103	24.2	9.79	50.2	12.2	23.1
Pine Brook	22	34.4	9.97	7.27	9.3	10.9	8.11
Shepard Brook	24	30	7.99	< 5	7.05	10.7	6.25
Dowsville Brook	25	67.6	14.2	7.19	8.16	9.35	11
Mad River, Moretown Village	28	81.2	25.5	6.23	377.6	9.34	8.39
Welder Brook	28.05	56.9	14	9.59	11.8	11	9.63
Mad River, Lover's Lane	31	20.2	16.8	6.65	46.1	14.6	13.1

Samples taken on June 16 when the river flow was low and rising/medium flow (305 cfs at midnight rising to a peak of 774 at noon) all but three sites exceeded the standard. In contrast, on July 13 when the river flow was low and steady/base flow at about 100 cfs, there were no violations. Yet at even lower steady/base flows on August 10 and 24 (53 cfs and 47 cfs, respectively) there were violations on both dates at the headwaters (Warren Falls) and near the mouth of the Mad River and on Folsom and High Bridge Brooks.

Quality Control for Total Phosphorus

The average relative percent difference (RPD) of phosphorus field duplicate samples for the six sampling dates was 15.46%, 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 June 15 when flow conditions were low and rising showed a difference of 80.32%. The large difference may have been due to sampling procedure (timing) and variation in flow regime.

Data completeness for the 2015 season is 94%.

Turbidity

Of the 18 sites sampled and analyzed for turbidity, 10 of the 108 samples did not meet the turbidity standard of 10 NTU. Most of the violations (7) occurred on June 15 when low and rising/medium flow conditions and the rest of the violations (3) occurred on July 27 under high and decreasing/medium flow conditions.

Table 2. 2015 Turbidity at 18 sites in the Mad River Watershed ($\mu\text{g/l}$)

		6/15/2015	6/29/2015	7/13/2015	7/27/2015	8/10/2015	8/24/2015
FLOW CONDITION -->		LR	HD	LS	HD	LS	LS
FLOW CATEGORY/LEVEL --> (Generalized Across Sites)		MF	MF	LB	MF	LB	LB
Mad River, Warren Falls	1	11.8	3.38	0.63	44.1	0.65	0.94
Lincoln Brook	2	4.73	1.1	0.41	0.8	0.78	0.33
Freeman Brook	4	19.5	1.89	0.5	1.3	0.48	0.41
Bradley Brook	6	7.95	2.42	0.9	0.89	0.76	0.52
Clay Brook	8	85.6	5.55	0.52	1.43	0.9	0.64
Folsom Brook	10	6.28	1.21	0.48	0.76	0.62	0.47
Rice Brook	11	0.81	0.54	0.21	0.6	0.4	0.71
Clay Brook, Sugarbush	12	5.34	10.1	0.53	0.64	0.74	0.73
Chase Brook	16	1.89	0.52	0.32	1.42	< 0.2	0.22
Mill Brook	18.1	8.55	1.57	0.4	1.6	0.23	0.36
Mad River, Waitsfield Covered Bridge	20	5.3	2.22	0.44	173.8	0.36	1.06
High Bridge Brook	20.1	69.3	8.54	1.58	1.54	0.96	1.96
Pine Brook	22	12.9	1.32	0.49	1.21	0.33	0.28
Shepard Brook	24	8.18	0.92	0.3	0.54	< 0.2	0.48
Dowsville Brook	25	40	5.2	1.21	1.65	1.22	1.49
Mad River, Moretown Village	28	25.9	3.05	0.72	472	0.82	0.65
Welder Brook	28.05	16.1	1.3	0.85	1.21	0.78	0.55
Mad River, Lover's Lane	31	7.02	3.97	0.85	15.6	1.69	1.81

Quality Control for Turbidity

The average relative percent difference (RPD) of turbidity field duplicate samples for the six sampling dates was 12.04%, which is within the estimated range of precision specified in the QAPP (less than or equal to 15% RPD).

Data completeness for the 2015 season is 100%.

E.coli

Sampling was done under three different flow conditions. On the sampling dates of July 13, August 10, and August 24 the flow of the Mad River at the Moretown gage was low and steady (LS) or low base (LB) flow. On June 15 the flow was low and rising (LR) and medium flow (MF). On June 29 and July 27 the flow was high and decreasing (HD) and medium flow (MF).

Of the 216 samples analyzed 14 (6.5 per cent) were in violation of the Vermont Water Quality Standards for *E.coli* (235 *E.coli* per 100 milliliters). Ten of these violations were

on the sampling date of June 15 when the flow of the Mad River was high and decreasing. Two of these violations were on the Mad River (in Moretown) and 8 on six different tributaries (Freeman, Folsom, High Bridge, Pine and Doctor Brooks).

The other four other violations were on July 27, again when flow conditions high and decreasing, one on Doctor's Brook (Site 27) and three on the Mad River.

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

E. coli concentrations for all samples from Blueberry Lake were low and very low, ranging from 69.7 to 3.1 *E. coli* per 100ml.

Table 3. 2015 *E. coli* at 36 sites in the Mad River Watershed (*E. coli*/100ml)

		06/15/15	06/29/15	07/13/15	07/27/15	08/10/15	08/24/15	# violations per site 2015
Flow Condition -->		LR	HD	LS	HD	LS	LS	
FLOW Category/Level -->		MF	MF	LB	MF	LB	LB	
(Generalized Across Sites)								
SITE LOCATION	SITE #	E.coli/100 ml						
Blueberry Lake	BBL	69.7	20.1	22.8	5.2	8.6	3.1	0.0
Warren Falls (Mad River)	1	44.1	12.1	10.6	53.0	9.8	11.0	0.0
Bobbin Mill (Lincoln Brook)	2	22.8	22.8	9.7	40.4	5.2	55.6	0.0
Warren Covered Bridge (Mad River)	3	54.5	20.3	4.1	93.4	4.1	15.6	0.0
Warren Store (Freeman Brook)	4	461.1	66.3	13.4	63.8	1.0	26.9	1.0
Brook Road above Village (Freeman Brook)	4.5	1046.2	45.5	5.2	44.1	4.1	3.1	1.0
North End Warren Village (Mad River)	5	166.4	24.3	50.4	90.6	35.5	14.6	0.0
Bridge on West Hill Road (Bradley Brook)	6	31.3	12.2	6.3	8.5	6.3	49.6	0.0
Seasons (Mad River)	6.5	34.1	30.1	6.3	195.6	25.6	17.3	0.0
Warren Riverside Park (Mad River)	7	53.7	36.8	16.0	209.8	11.0	18.7	0.0
Bottom of Sugarbush Access Rd (Clay Brk)	8	52.1	81.6	5.2	22.6	21.6	17.3	0.0
Route 100 crossing (Folsom Brook)	10	1986.3	83.3	5.2	9.8	17.5	19.9	1.0
"Dip" on East Warren Rd. (N. Folsom Brook)	10.6	920.8	111.9	8.5	11.0	14.5	21.3	1.0
Sugarbush Health Club (Rice Brook)	11	20.9	12.1	3.1	3.1	6.3	6.3	0.0
Inferno Road Crossing (Clay Brook)	12	143.9	4.1	3.0	9.8	4.1	9.8	0.0
Fayston Elementary School (Slide Brk)	13.1	20.3	4.1	8.6	28.8	8.6	10.9	0.0
German Flats, Rt 17 (Chase Brk)	16	61.3	22.8	8.6	26.9	5.2	17.6	0.0
German Flats, Rt 17 (Mill Brk)	17	43.5	24.9	3.1	70.0	8.6	16.0	0.0
Battleground Condos (Mill Brk)	17.1	47.5	20.1	3.1	11.0	4.1	23.3	0.0
Mill Brook	18.1	95.9	38.9	29.2	55.6	10.9	20.1	0.0
Lareau Swimhole (Mad River)	19	79.4	42.0	14.8	126.8	17.5	10.9	0.0
Couples Club Field (Mad River)	19.2	198.9	18.3	24.3	123.0	14.6	33.1	0.0
Waitsfield Covered Bridge (Mad River)	20	166.4	21.1	12.0	547.5	21.3	18.5	1.0
Joslin Hill Road Culvert (High Bridge Brook)	20.1	1553.1	88.0	9.8	45.7	36.8	25.6	1.0
Tremblay Road (Mad River)	21.5	209.8	58.3	23.1	41.0	129.6	29.1	0.0
North Road Covered Bridge (Pine Brook)	22	547.5	86.0	21.1	2.0	21.3	12.2	1.0
Meadow Road Bridge (Mad River)	23	198.9	51.9	35.0	67.1	185.0	35.9	0.0
Route 100 Bridge (Shepard Brook)	24	146.7	71.7	11.0	10.9	39.9	16.1	0.0
Route 100 Bridge (Dowsville Brook)	25	204.6	23.0	13.4	19.7	10.7	16.9	0.0
North Road near Moretown (Mad River)	26	344.8	72.3	71.2	92.1	115.3	178.5	1.0
Moretown Village Swim Access (Mad River)	27	224.7	62.7	44.8	1413.6	95.9	61.3	1.0
Route 100B crossing (Doctors Brook)	27.1	920.8	111.9	14.8	26.0	21.6	46.4	1.0
Ward Clapboard Mill (Mad River)	28	727.0	95.9	48.7	1046.2	53.7	56.5	2.0
Near Stevens Brook Road (Welder Brook)	28.05	1299.7	107.6	17.3	29.2	10.7	24.6	1.0
Ward Swimhole (Mad River)	29	184.2	46.0	78.9	50.0	58.6	108.1	0.0
Lover's Lane Bridge (Mad River)	31	124.6	26.6	101.4	770.0	22.8	27.9	1.0
# violations by date:		10.0	0.0	0.0	4.0	0.0	0.0	14.0

DEC Flow and Level

In 2015, the Vermont DEC formalized a new protocol to capture flow data. While we generalized results across each site for consideration alongside Friends of the Mad River's historical Flow Condition parameter, Table 4 shows Flow Condition and Level for each site on each sample day.

Table 4. DEC Flow Category and Level

	Site #	6/15/2015	6/29/2015	7/13/2015	7/27/2015	8/10/2015	8/24/2015
Blueberry Lake	BBL	M-	HF	LB	LB	LB	LB
Warren Falls (Mad River)	1	H-	HF	LB	HF	LB	LB
Bobbin Mill (Lincoln Brook)	2	H-	HF	LB	MF	LB	LB
Warren Covered Bridge (Mad River)	3	H-	HF	LB	HF	LB	LB
Warren Store (Freeman Brook)	4	H-	HF	LB	MB	LB	LB
Brook Road above Village (Freeman Brook)	4.5	H-	HF	LB	MB	LB	LB
North End Warren Village (Mad River)	5	H-	HF	LB	HF	LB	LB
Bridge on West Hill Road (Bradley Brook)	6	H-	HF	LB	HF	LB	LB
Seasons (Mad River)	7	MF	MF	LB	LF	LB	LB
Warren Riverside Park (Mad River)	7	MF	MF	LB	LF	LB	LB
Bottom of Sugarbush Access Rd (Clay Brk)	8	MF	MF	LB	LF	LB	LB
Route 100 crossing (Folsom Brook)	10	MF	MF	LB	LF	LB	LB
"Dip" on East Warren Rd. (N. Folsom Brook)	10.6	HF	MF	LB	LF	LB	LB
Sugarbush Health Club (Rice Brook)	11	H-	HF	MB	MB	LB	MB
Inferno Road Crossing (Clay Brook)	12	H-	HF	MB	MB	MB	MB
Fayston Elementary School (Slide Brk)	13.1	H-	HF	MB	MB	MB	MB
German Flats, Rt 17 (Chase Brk)	16	H-	HF	MB	MB	MB	MB
German Flats, Rt 17 (Mill Brk)	17	H-	HF	MB	MB	MB	MB
Battleground Condos (Mill Brk)	17.1	H-	MF	MB	MB	MB	LB
Mill Brook	18.1	H-	MF	MB	MB	MB	LB
Lareau Swimhole (Mad River)	19	M-	HF	MB	HF	LB	LB
Couples Club Field (Mad River)	19.2	M-	HF	MB	HF	LB	LB
Waitsfield Covered Bridge (Mad River)	20	M-	HF	MB	HF	LB	LB
Joslin Hill Road Culvert (High Bridge Brook)	20.1	H-	HF	LB	NONE	LB	LB
Tremblay Road (Mad River)	21.5	H-	HF	MB	HF	LB	LB
North Road Covered Bridge (Pine Brook)	22	H-	HF	LB	MB	LB	LB
Meadow Road Bridge (Mad River)	23	M-	HF	MB	HF	LB	LB
Route 100 Bridge (Shepard Brook)	24	H-	HF	MB	MB	LB	LB
Route 100 Bridge (Dowsville Brook)	25	H-	HF	MB	MB	LB	LB
North Road near Moretown (Mad River)	26	HF	HF	LB	HF	MB	MB
Moretown Village Swim Access (Mad River)	27	HF	HF	MB	HF	MB	LB
Route 100B crossing (Doctors Brook)	27.1	HF	HF	LB	MB	MB	LB
Ward Clapboard Mill (Mad River)	28	HF	HF	LB	HF	MB	LB
Near Stevens Brook Road (Welder Brook)	28.05	HF	HF	MB	MB	MB	LB
Ward Swimhole (Mad River)	29	HF	HF	MB	MB	LB	LB
Lover's Lane Bridge (Mad River)	31	HF	HF	MB	HF	MB	LB