Ompompanoosuc River Water Quality Study
Summer 2015

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A final report Submitted to the Department of Environmental Conservation, March 7, 2016 from The White River Natural Resources Conservation District with support from the Thetford and West Fairlee Conservation Comissions and DEC

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Sample processing was made possible by an Analytical Services Partnership Grant provided by the Department of Environmental Conservation

EXECUTIVE SUMMARY

A comprehensive water quality survey of the Eastern Branch and main stem of the Ompompanoosuc River and its major tributaries was conducted on seven dates from June through September 2015. This sampling program was a follow up to sampling done in 2006 and 2007 after a number of projects were implemented to evaluate if E. coli levels have been reduced that the section of the east Branch listed as impaired might be reevaluated, and if not to help identify source areas where pollution abatement efforts should be focused.

Water sampling results from 2015 were similar to the results from 2006 and 2007, gradually increasing from the Vershire/West Fairlee town line through the Village of West Fairlee on Lake Road. In addition to this, elevated levels were identified at Schoolhouse Brook, Crossroad Brook and the Middle Brook and Beaver Brook Sites. On dates without significant rainfall the trends were nearly identical to the results from 2007, however on dates with rain the results were lower in 2015 suggesting that some of the buffer planting and other work may have reduced E. coli runoff from these events. In the areas with elevated E. coli levels there are a few very small farm operations, housing on septic systems, and the village of West Fairlee where storm water runoff may contribute to E. coli levels. As follow up, the West Fairlee and Thetford Conservation Commissions will work with the White River NRCD to evaluate farm operations and to continue buffer planting efforts, and will work with DEC to evaluate septic systems and storm water treatment options.

The sampling program also evaluated total nitrogen and total phosphorus levels at five sites. Levels were relatively low across the board, however nitrogen levels increased from Vershire through West Fairlee and Thetford, while phosphorus levels were consistent with the exception of high levels in West Fairlee on the one rain event date. This suggests a nitrogen source along the East Branch, which is a concern related to the nitrogen impairment in Long Island Sound, and rain event driven phosphorus on the West Branch.

1.0 INTRODUCTION

The Ompompanoosuc River Water Monitoring program monitored the water quality of the 18-mile Eastern Branch and one site on the West Branch of the Ompompanoosuc River over a three month period in the summer of 2015. This study was a follow-up from two years of E. coli sampling completed in 2006 and 2007 after implementation work done in response to these earlier studies and a TMDL for bacterial impaired waters that was published in 2011. Water-borne disease-causing microbes generally exist at very low levels and are difficult and expensive to detect. Therefore, indicator organisms have been used for more than a century to help identify where fecal contamination has occurred, and where there may be a risk of contracting disease-causing microbes. *E. coli*, a universal inhabitant of the intestines of warm-blooded animals, is the accepted indicator organism for freshwater.

The Ompompanoosuc River is the principle waterway for the towns of Vershire, West Fairlee, Thetford, and Norwich Vermont and is an important natural and scenic resource. The river provides numerous recreational activities for area residents and is designated by the state of Vermont as a Class B water and in some areas as a cold water fishery. Sections of the river have been classified by the state as an impaired surface water due to high levels of *E. coli* in excess of the State Standards of a geometric mean of 126 colonies per 100 ml. or more than 10% of samples above 235 colonies per 100 ml.

At each location where a water sample was collected, levels of *E. coli* were monitored. Five of

those sites included monitoring total nitrogen and phosphorus. Data generated from this project will quantify the level of river contamination and help pinpoint specific sources of pollution. Volunteers included members of the West Fairlee Conservation Commission, Thetford Conservation Commission and the Town of Vershire. Technical expertise and data management were provided by the White River Natural Resources Conservation District and the watershed coordinators with the Vermont Department of Environmental Conservation.

2.0 SAMPLE SITES

Figure 1 is a map of the sampling area. Sampling sites are identified alphabetically from the northernmost site in Vershire, VT to the Connecticut River in the south, including tributaries. The list of sites chosen for the 2015 sampling season closely mirrored those used in 2007, with additional sites for Middle Brook and Crossroad Brook, and the elimination of 3 sites below the confluence of the East and West Branches and five sites between the site I (1 mile below the landfill) and Sandy Beach where E. coli levels were consistent in 2007.

Appendix A summarizes each site's GPS coordinates, relative position to the landscape around it, and the surrounding habitat. The sampling sites were primarily in wooded and residential areas. Heavy agricultural use was not in evidence at any of the sites.

3.0 METHODOLOGY

Each site was sampled for levels of *E. coli* and 5 sites (A1, A, C1, F P1 and W1) were sampled for total phosphorus and total nitrogen. Water samples were sent to the State of Vermont La Rosa Analytical Laboratory in Burlington, Vermont where each sample was analyzed under EPA qualified analytical methods.

Samples were collected every two weeks from June 15, 2015 to September 8, 2015. The technique for acquiring samples followed a pre-defined Quality Assurance Process Procedure (QAPP). On September 8th two samples (from sites C and C1) were taken a day early and were analyzed over the hold time. The data from these two sites had to be excluded from analysis. The sampling sites were divided among the volunteers with different groups taking responsibility for a specific cluster of sites. Samples were collected and brought to the Laboratory in Burlington by Mary Childs of the White River Natural Resources Conservation District.

4.0 RESULTS AND DISCUSSION

The following sections summarize the data collected during the project. To ensure the accuracy of the results, groups utilized field blanks and laboratory duplicates. All samples were collected in accordance to methodologies described in the volunteers' QAPP and there were no detections in blank samples and all duplicates meet the RPD limits in the QAPP for each parameter. Only one of the sample dates in 2015 was taken during a high flow event or shortly after a rain as shown in Figure 2. This is important as E. coli, Phosphorus and Nitrogen often increase during rain events and so the lower frequency of rain events in 2015 vs 2006 and 2007 means that this needs to be considered when comparing data between years.

Appendix B summarizes sampling results for each site.

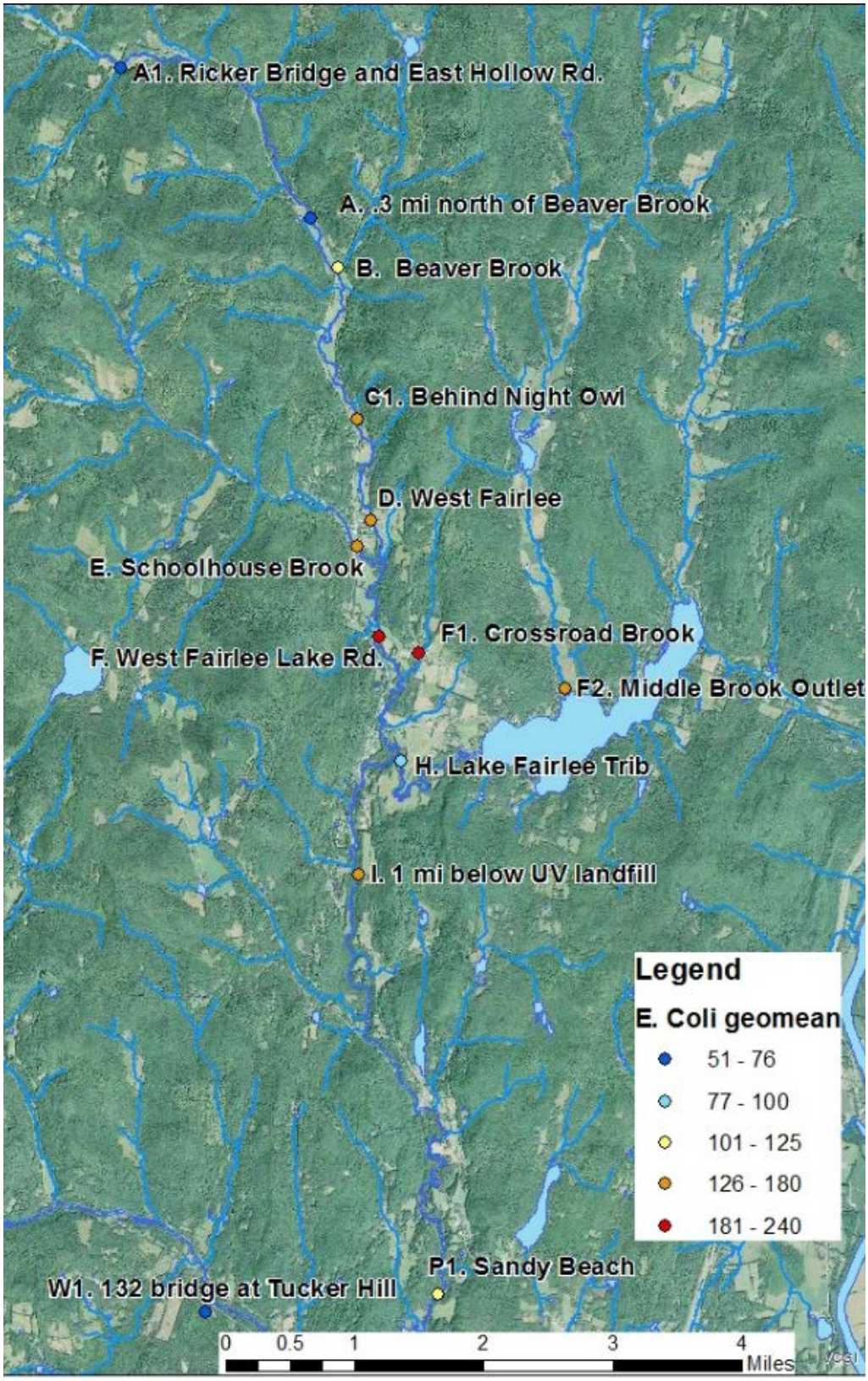


Figure 1: Locations of the water sampling sites showing the geometric mean of E. coli results over the sampling season.

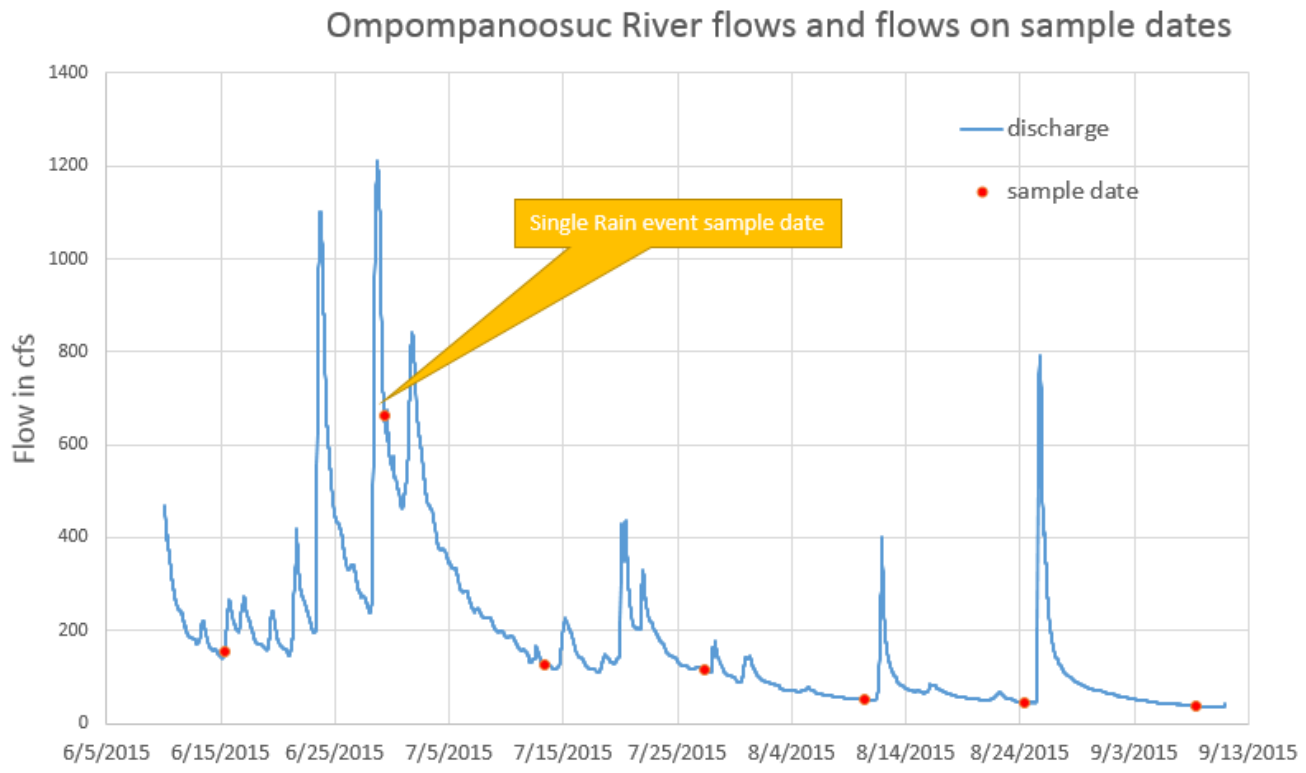


Figure 2. Discharge on the Ompompanoosuc River showing sample dates in red.

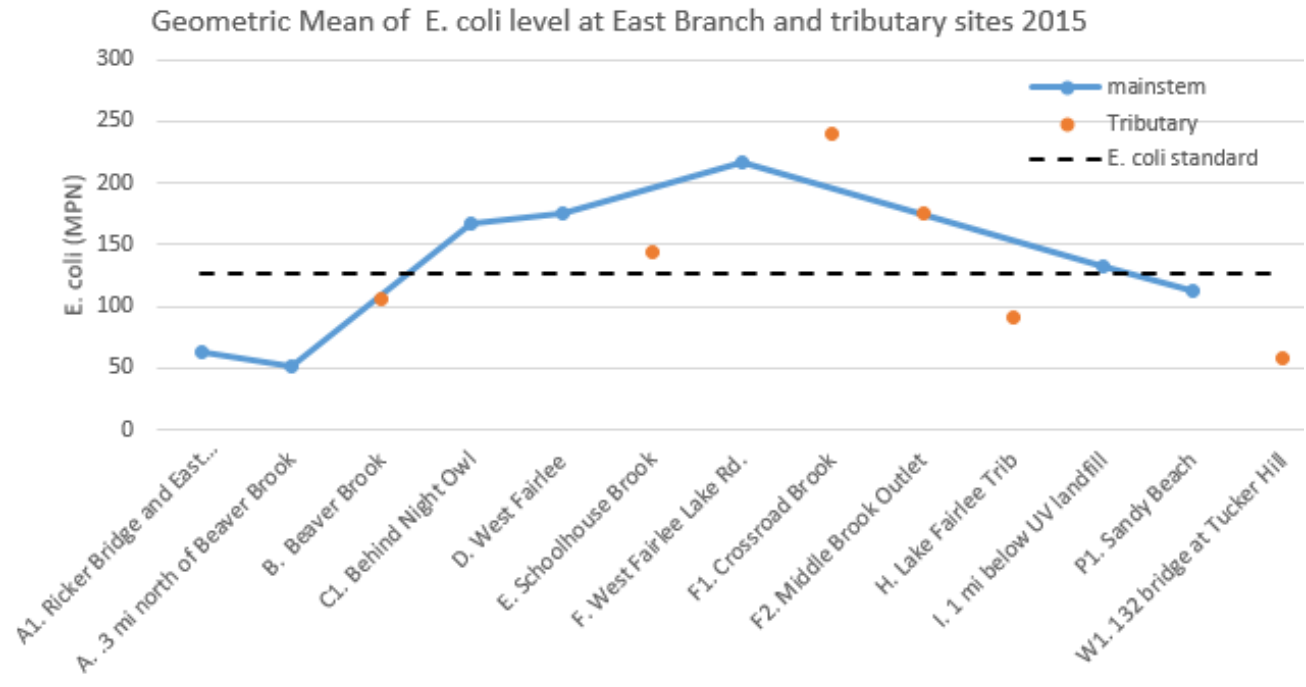


Figure 3. Geometric mean of E coli levels on the East Branch of the Ompompanoosuc River going downstream (in Blue) and for tributaires (shown as orange dots) in 2015.

4.1 E. coli results in 2015

Figure 3 shows the geometric mean of the *E. coli* levels at all of the sites monitored in 2015. The geometric mean "smoothes" the data by limiting the impact of outlying high data values and the EPA recommends using the geometric mean when analyzing E. coli data. For comparison purposes, included in this figure is Vermont's *E. coli* standard of a geometric mean of 126 colonies per 100 ml. The uppermost two sample sites on the East Branch in Vershire appear to meet water quality standards while the level of *E. coli* contamination in the Ompompanoosuc increases as the river passes through the town of West Fairlee (sites C through F in Figure 1). This trend was also seen in 2006 and 2007. This section of the Ompompanoosuc flows through a relatively dense residential area although there are a few very small agricultural operations along this stretch of the river. While the level of *E. coli* remained well above the Vermont E. coli standard of a geometric mean of 126 on all sample sites along the river, it decreased from Lake Road to Site I (1 mile below the Upper Valley Landfill) and further to the Sandy Beach at the Union Village Dam in Thetford. The *E. coli* levels in a number of tributaries were elevated including Schoolhouse Brook, Crossroad Brook and the Middle Brook. Beaver Brook increased substantially from levels in 2006. The other part of the Vermont E. coli standard is that less than 10% of samples should be above 235 colonies per 100ml. Figure 4 shows the percentage of samples above and below this level for each site. The same sites meet this component of the water quality standard as the geometric mean except Beaver Brook which had 50% of samples above this level, along with the Lake Fairlee tributary and Sandy Beach which were both above this level 14% of the time.

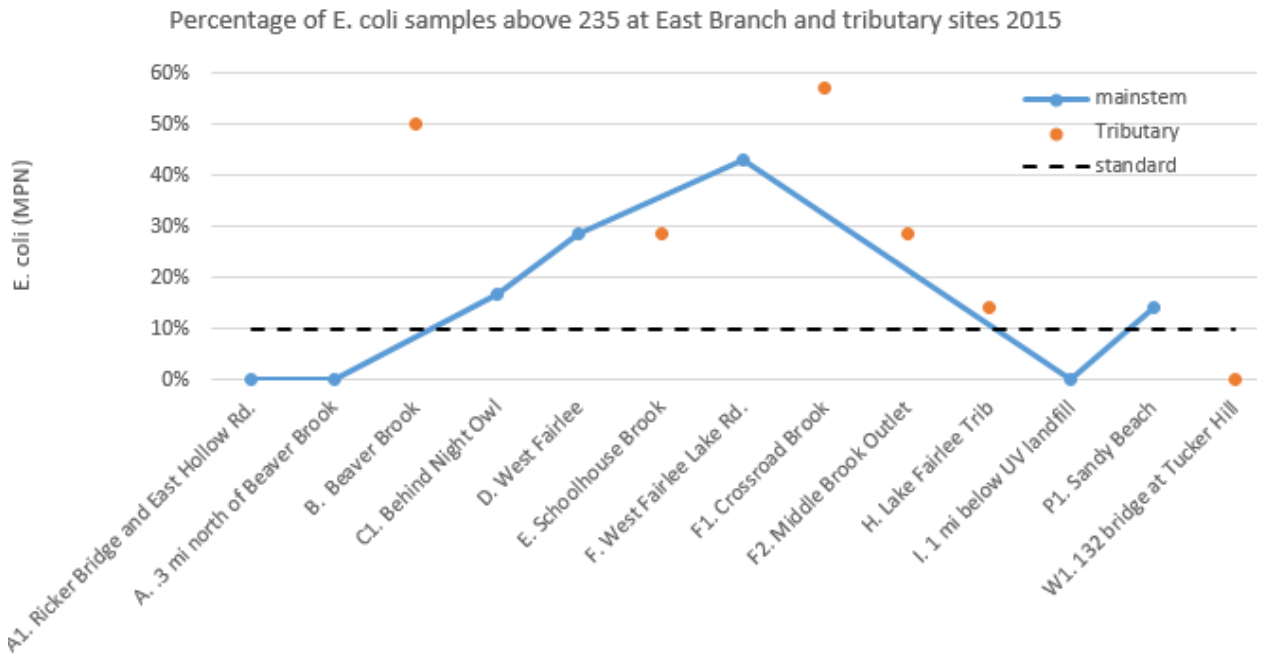


Figure 4. The percent of E. coli samples above 235 for sites on the East Branch of the Ompompanoosuc River going downstream (in Blue) and for tributaires (shown as orange dots).

4.2 Comparison with 2006 and 2007 E.coli results.

A comparison of the geometric mean of E. coli levels in 2015 to 2006 and 2007 data suggests a similar trend in E. coli levels over all years. Looking at the data across all flow conditions (figure 5) suggests that levels may have dropped slightly between 2007 and 2015. However when separating this out between rain and dry weather sampling dates it suggests that levels on dry dates have remained consistent as shown in Figure 6. E. coli levels have also increased at Beaver Brook and School House tributaries from 2006 and 2007 to 2015.

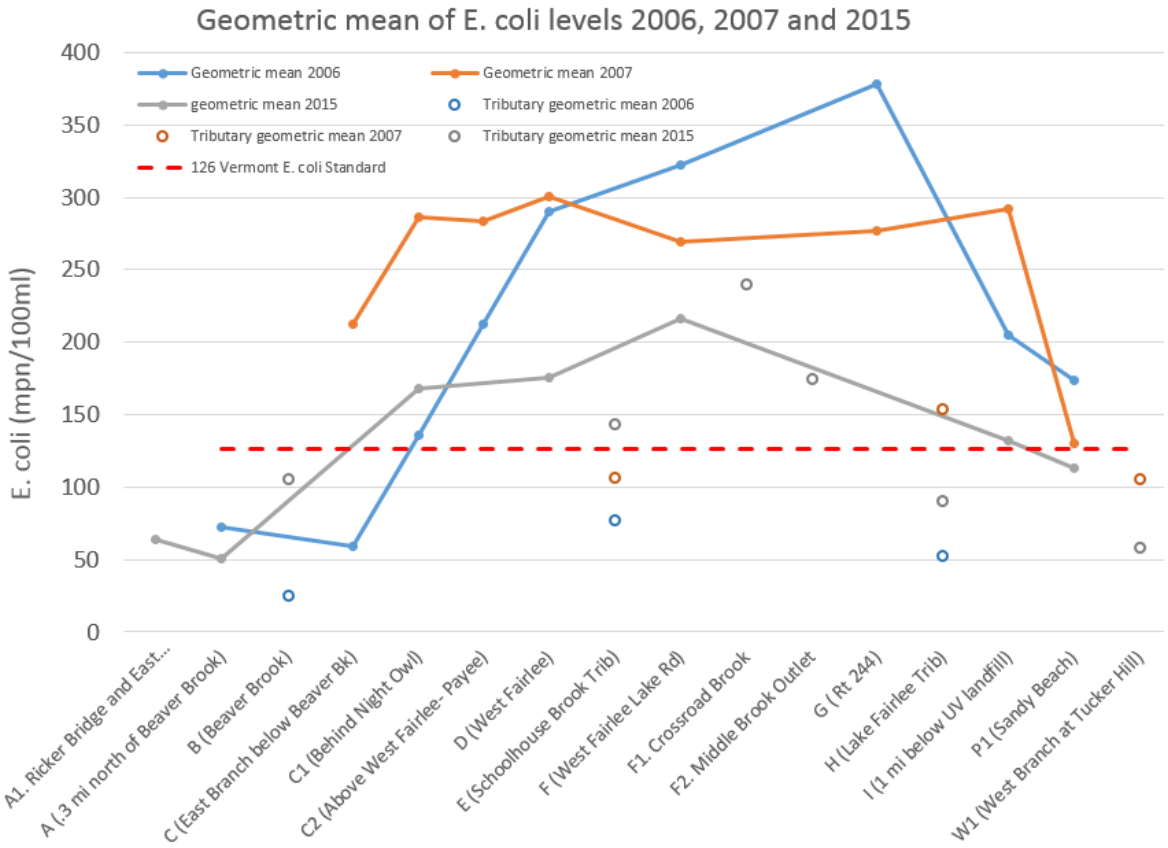


Figure 5. Geometric mean of E coli levels on the East Branch of the Ompompanoosuc River going downstream as lines (Blue 2006, Orange 2007 and Gray 2015) and dots of similar colors for tributaires.

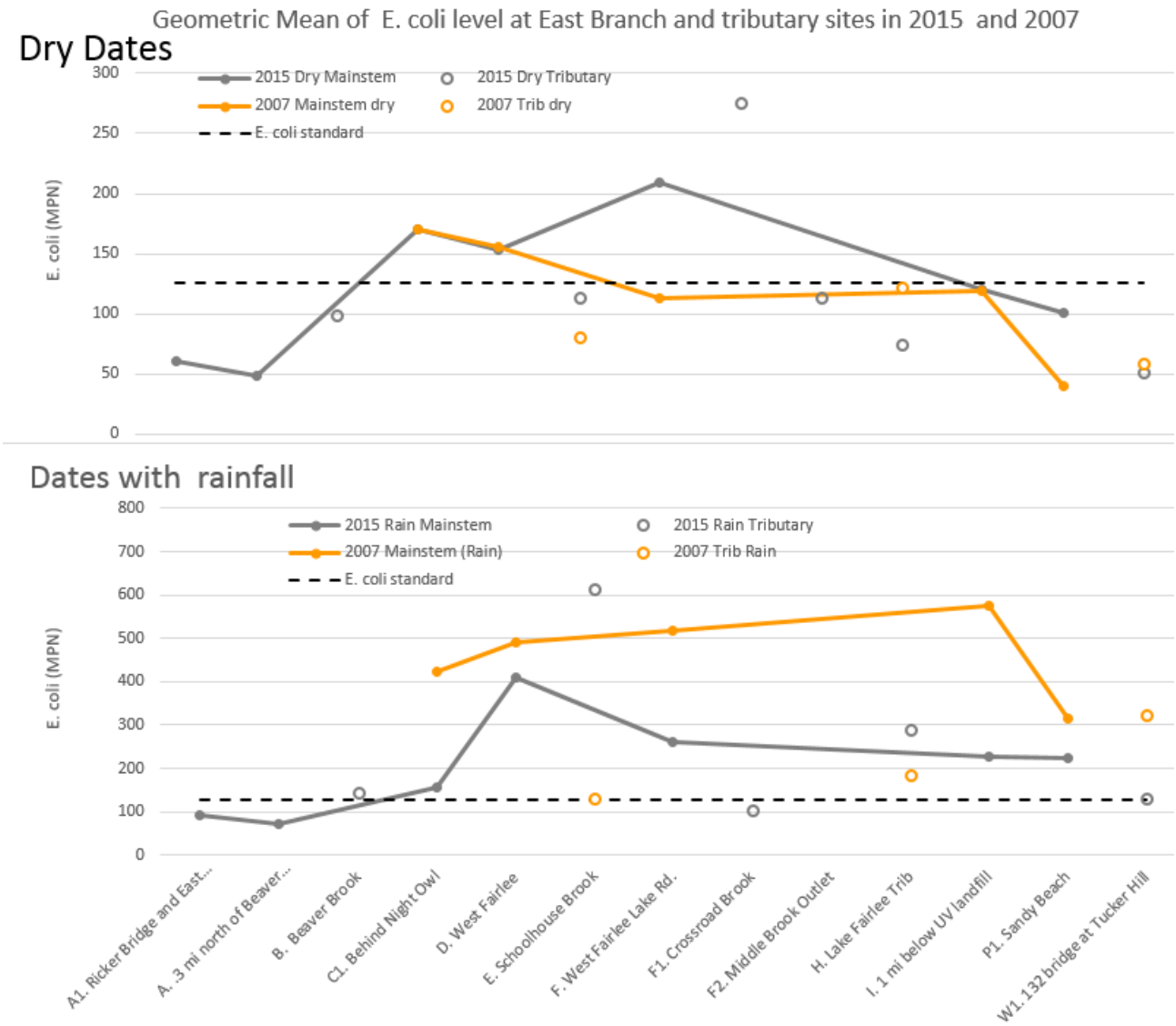
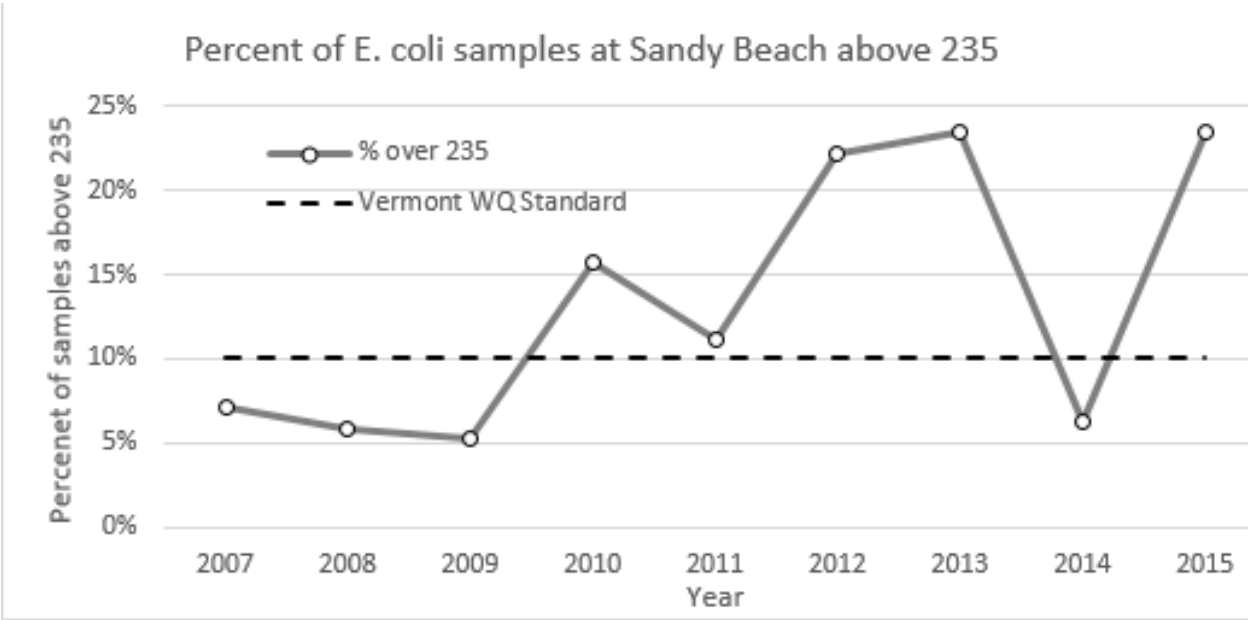


Figure 6. Geometric mean of E coli levels on the East Branch of the Ompompanoosuc River going downstream Gray 2015 - Yellow for 2007 and for tributaires (gray dots 2015 and yellow dots 2007).



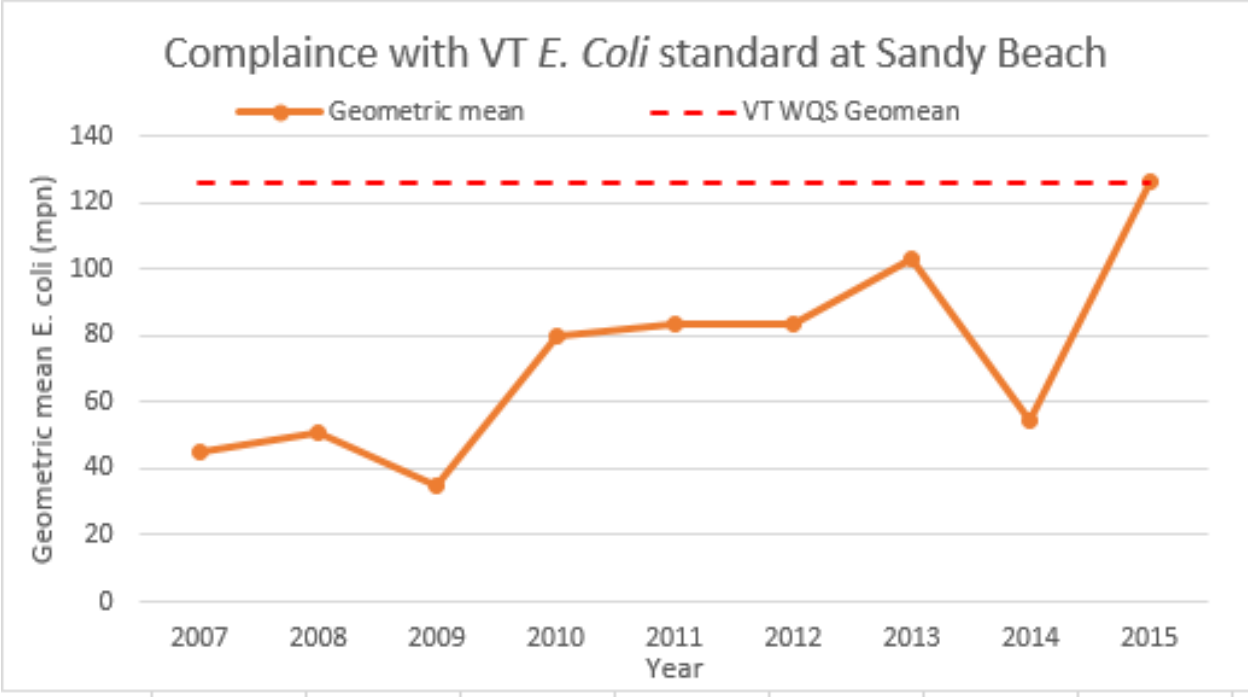


Figure 7. Geometric mean of E. coli levels at the Sandy Beach from 2007 through 2015

Water quality data collected by the US Army Corps of Engineers at the Sandy Beach site since 2007 does not indicate any decrease in recent years and in fact was the highest in 2015 as compared to earlier years. However, this included a high percentage of rainfall events which may explain the higher levels this year.

4.3 Total Phosphorus and Total Nitrogen results in 2015

The average total phosphorus and nitrogen values are shown in Figure 8 below. These levels are quite low suggesting no localized nutrient issues on this section of the Ompoanoosuc River. The results suggest stable phosphorus levels from Site A1 through the Sandy Beach. The higher levels reflected on the West Branch of the Ompompanoosuc River are caused by a single high value on the one rain event. There are large areas of streambank erosion along the West Branch which may be activated during rain events or this could be related to runoff from roads, agricultural lands or other sources in the watershed.

Nitrogen levels increased gradually from Site A1 to the Sandy Beach suggesting a source of nitrogen in this portion of the watershed. While these levels are still quite low on average they suggest a source in this area which is a concern due to the Long Island Sound nitrogen TMDL.

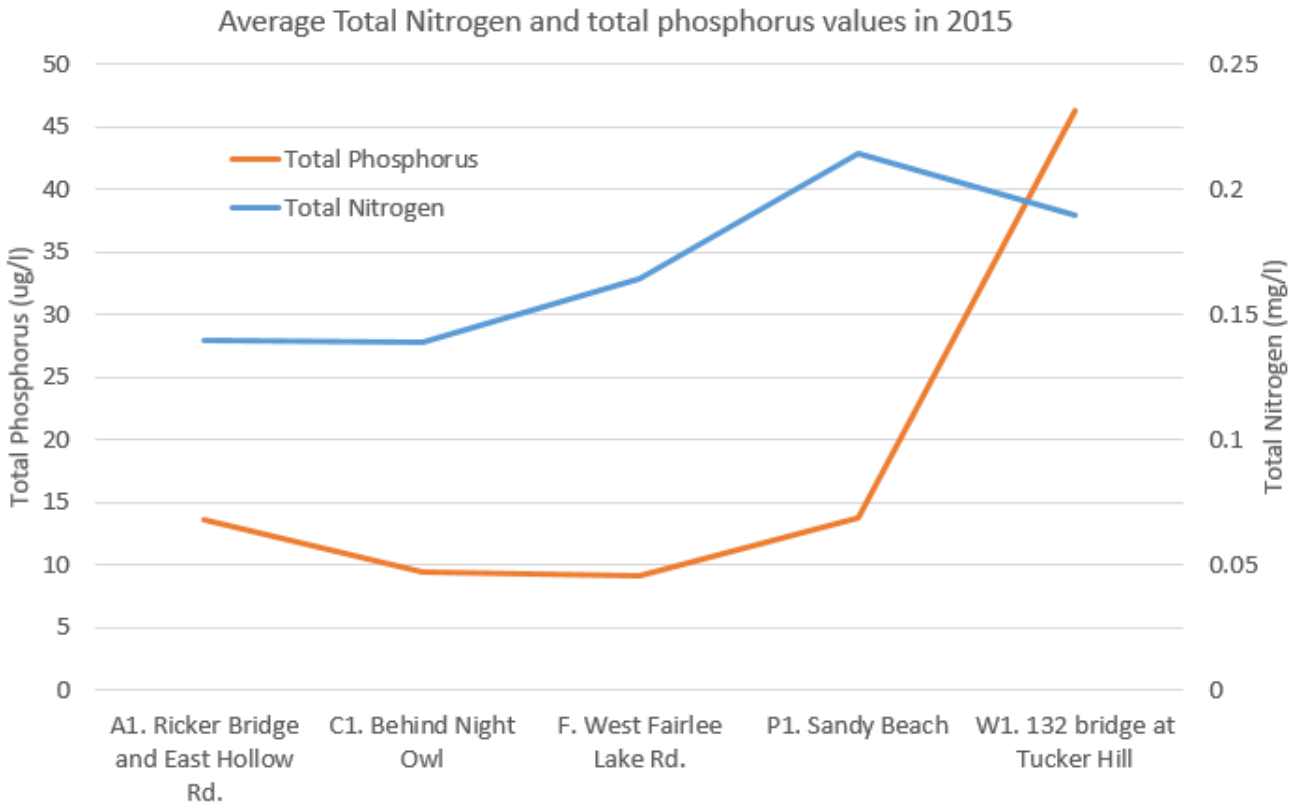


Figure 8 Average total phosphorus and nitrogen levels on the East Branch of the Ompompanoosuc River going downstream.

5.0 RECOMMENDATIONS AND CONCLUSIONS

A review of the data by the project volunteers and officials from the Department of Environmental Conservation resulted in several recommendations for action items regarding the Ompompanoosuc River. Recommendations fall into two categories: recommendations based on specific data collected in the study, and general recommendations for future work.

In response to the measured *E. coli* levels found in the Ompompanoosuc River, the recommended actions are:

- Conduct a septic survey around West Fairlee, VT.
    - Survey should be conducted door-to-door to maximize the response rate
    - Use successful models from towns with similar issues to provide education, assistance, and conduct surveys
- Conduct farm visits to identify and address any potential E. coli sources associated with small farms in West Fairlee and Thetford.
- Evaluate any possible storm water treatment opportunities in the Village of West Fairlee

Following the 2015 water moniroting season, the local Conservation Commissions, White River NRCD, and VT DEC will prioritize the above responses and recommended actions. Funding will be sought out by the watershed groups to conduct outreach, education, and project development regarding septic, agriculture, and storm water. Water monitoring will be conducted again after several years of education and practice implementation.

REFERENCES

Ompompanoosuc River Watershed Council, 2007. *Ompompanoosuc River Water Quality Study Summer 2007* Submitted to the VT DEC November 2007

White River Natural Resrouces Conservation District 2015. *Vermont General Quality Assurance Project Plan for Volunteer, Educational and Local Community Monitoring and Reporting Activities- Ompompanoosuc River Water Quality Sampling.* Submitted to the VT DEC June 2015.

FB Environmental Associates, Inc 2011. *Vermont Statewide Total Maximum Daily Load (TMDL) for Bacteria Impaired Waters.* Prepaired for State of Vermont Department of Environmental Conservation

APPENDIX A- SITE LOCATION AND DESCIRPTIONS

Site ID	Site name	GPS Coordinates	Site description	Habitat
A1.	Ricker Bridge and East Hollow Rd	43.960828, 72.299099	East Branch of the Ompompanoosuc River below Vershire Village. Ricker Bridge Rd sampled above the road culvert	Cobble bottom. Downstream Vershire Center. Field and residence upstream
A.	.3 mi north of Beaver Brook	43.94383, 72.26977	East Branch of the Ompompanoosuc River at the south downstream side of the Route 113 bridge .3 miles north of Beaver Meadow Rd.	Cobble Bottom, Small shrub buffer. Field and residence upstream
B.	Beaver Brook	43.938356, 72.265514	Tributary sampled on Beaver Meadow Rd.	Cobble bottom. Farm upstream on left bank and forested buffer on right bank.
C1.	Behind Night Owl	43.92129, 72.26260	East Branch of the Ompompanoosuc River behind the Night owl.	Sandy bottom, shallow (<2'), mostly open sandy banks, west side is Nite Owl (auto repair and towing, flat dirt parking lot), east side gentle slope mix of grass and trees
D.	West Fairlee	43.91002, 72.26050	East Branch of the Ompompanoosuc River, 150 meters north of the Mill St Bridge. Site is accessed Through Rebecca Wurdak's property down a trail to the river	Gravel/ sand bottom – Right bank open /residential, Left bank field. Small buffer both sides
E.	Schoolhouse Brook	43.90702, 72.26270	School House Brook in west Fairlee. Sample downstream of Rt 113 bridge from north side	Cobble bottom steep gradient. Narrow shrub/forest buffer. Residential upstream
F.	West Fairlee Lake Rd	43.89687, 72.25923	East Branch of the Ompompanoosuc River at Cross Road – North Side of River (Upstream)	Mixed sand cobble substrate. Open fields both sides with 25 foot buffer
F1.	Crossroad Brook	43.89500, 72.25303	Crossroad Brook on West Fairlee Rd. Sample at bridge crossing .4 miles from RT 113	Small tributary below high density residential area and adjacent to vegetable farm
F2.	Middle Brook Outlet	43.89098, 72.23055	Middlebrook outlet to Lake Fairlee on RT244, Bridge crossing next to Middle Brook Rd. Sample upstream of bridge.	Outlet of Middle brook to Lake Fairlee. Farmland and wetland complexes upstream
H.	Lake Fairlee Trib	43.88298, 72.2559	Lake Fairlee Brook just above the confluence with the East Branch of the Ompompanoosuc River. Hike in through Post Mills Natural Area along the ridge to the confluence. Sample is taken about 40 feet from the confluence to prevent any water mixing.	Predominantly hemlock trees on each side of the river with steep banks. Open field on both sides of the river upstream, with the dump on the left bank and the Airport on the Right. Sandy and Cobble Bottom.
I.	1 mi below UV landfill	43.87032, 72.26264	Ompompanoosuc River accessed from 921 Barker Road. Turn into the driveway of 921 Barker Rd and park at the second house. Hike down to the bottom of the field and there is a trail down to the river. Sample site is just below a bedrock outcrop	Mixed woodland with a predominance of evergreens. The river bottom has a lot of ledge here, with some smaller rocks, and there is a sand/silt 'beach' upstream of the site.
P1.	Sandy Beach	43.82315, 72.25054	Sandy Beach off of Buzzell Bridge Road. Sample site is at the upstream end of the site at rock outcropping.	Bedrock outcrop and sandy substrate. Heavily used recreation area and beach just downstream. Road and forest along the left bank upstream and meadow with shrub buffer on the right
W1.	132 Bridge at Tucker Hill Rd	43.82123, 72.28642	West Branch. Sample at 132 bridge crossing at Tucker Hill	River bottom, cobbles and some ledges. Banks, mixed woods, hemlocks, pines, Site is close to Rt 132, Tucker Hill Rd and Gove Hill Rd, which runs along W. bank at site

APPENDIX B – E. COLI RESULTS MPN PER 100 ML

Site	6/15/2015	6/29/2015	7/13/2015	7/27/2015	8/10/2015	8/24/2015	9/8/2015	Average	geomean
A1. Ricker Bridge and East Hollow Rd.	96	91	40	53	10	108	228	89	64
A. .3 mi north of Beaver Brook	144	71	38	39	30	26	76	60	51
B. Beaver Brook	291	144	9	291	308	43		181	106
C1. Behind Night Owl	206	155	144	326	129	115		179	168
D. West Fairlee	201	411	156	248	192	102	83	199	176
E. Schoolhouse Brook	158	613	17	150	112	121	**387**	223	144
F. West Fairlee Lake Rd.	210	261	138	215	162	261	**326**	224	216
F1. Crossroad Brook	313	105	184	102	291	261	**980**	319	240
F2. Middle Brook Outlet	172	2420	138	99	41	75	**291**	462	175
H. Lake Fairlee Trib	46	291	201	24	66	144	82	122	91
I. 1 mi below UV landfill	198	228	108	91	140	111	102	140	132
P1. Sandy Beach	93	225	86	58	70	649	51	176	113
W1. 132 bridge at Tucker Hill	133	131	75	80	33	26	27	72	59

TOTAL NITROGEN AND TOTAL PHOSPHORUS RESULTS

Nitrogen, Total – Persulfate (mg/l)	6/15/2015	6/29/2015	7/13/2015	7/27/2015	8/10/2015	8/24/2015	9/8/2015	Average
A1. Ricker Bridge and East Hollow Rd.	0.18	0.13	0.11	0.12	0.16		0.14	0.14
A. .3 mi north of Beaver Brook						0.13		0.13
C1. Behind Night Owl	0.16	0.15	0.11	0.13	0.17	0.14	0.11	0.14
F. West Fairlee Lake Rd.	0.16	0.14	0.13	0.15	0.22	0.19	0.16	0.16
P1. Sandy Beach	0.19	0.2	0.17	0.21	0.28	0.24	0.21	0.21
W1. 132 bridge at Tucker Hill	0.2	0.17	0.12	0.17	0.22	0.2	0.25	0.19
Total Phosphorus (ug/l)	**6/15/2015**	**6/29/2015**	**7/13/2015**	**7/27/2015**	**8/10/2015**	**8/24/2015**	**9/8/2015**	Average
A1. Ricker Bridge and East Hollow Rd.	30.4	26.1	6.36	6.91	6.33		5.62	13.6
A. .3 mi north of Beaver Brook						5.25		5.3
C1. Behind Night Owl	9.55	27.4	5.41	6.14	6.62	5	5.54	9.4
F. West Fairlee Lake Rd.	8.35	26	5.45	6.44	6.5	5.82	5.44	9.1
P1. Sandy Beach	10.9	38.3	8.81	10.7	9.6	8.55	9.1	13.7
W1. 132 bridge at Tucker Hill	22.4	272	6.99	5.97	6.69	5	5.14	46.3