Summary Report: 2012 Sampling Results
Addison County Riverwatch Collaborative

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Digital copy of this report available for download at:
http://www.lewiscreek.org/addison-county-riverwatch-collaborative/

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1.0 Introduction

This report provides a brief summary of the 2012 sampling results for the Addison County Riverwatch Collaborative (ACRWC). Sampling was carried out by a network of volunteers, with logistical and technical support provided by Ethan Swift of the VTDEC Monitoring, Assessment and Planning Program, Kevin Behm of the Addison County Regional Planning Commission and Kristen Underwood of South Mountain Research & Consulting. Analytical services were provided by the LaRosa Analytical Laboratory in Burlington, VT, through an analytical services partnership grant.

The reader is referred to a series of water quality reports prepared by Dr. Bill Hoadley in 2009 for an analysis of historical water quality results in each of these watersheds. This summary report is intended to be a brief synopsis of the 2012 season, with reference to these more technical reports for historical context and trend analysis.

Section 6.0 provides a one-page summary of sampling results for each of the ACRWC watersheds. These summaries are formatted to serve as a one-page handout for each watershed that can be distributed to the public in relevant towns.

2.0 Background

The ACRWC has been monitoring water quality (including sediment, phosphorus, nitrates, and E.coli) in six watersheds in Addison County (Figure 1) for two decades, with the earliest monitoring efforts beginning in 1992:

- Lemon Fair River (2003 – present)
- Lewis Creek (1992 – present)
- Little Otter Creek (1997 – present)
- Middlebury River (1993 – present)
- New Haven River (1993 – present)
- Otter Creek (1992 – present)

During a hiatus from sampling in the 2009 season, the ACRWC conducted a programmatic review of their water quality monitoring goals and objectives, and met with various state and regional groups to identify opportunities for collaboration and data sharing. With input from Dr. Bill Hoadley (2009 Draft Water Quality Reports), historical sample results and trends were analyzed to refine the overall sampling design for each of these six watersheds, in light of updated goals and objectives.

Since several years of baseline data now exist for the six ACRWC watersheds, the sampling schedule was revised, beginning with the 2010 season, to include longer-term trend monitoring at a reduced number of key sites in each watershed (sentinel sites) with a reduced number of water quality parameters. These sentinel sites are to be combined with a more focused monitoring effort in two of the six watersheds that will rotate for a period of two years on and four years off (Table 1). The focused evaluation will involve a greater number of sites (and testing parameters) than the sentinel sites, and will be conducted to meet specific data needs of relevance to the chosen watershed.

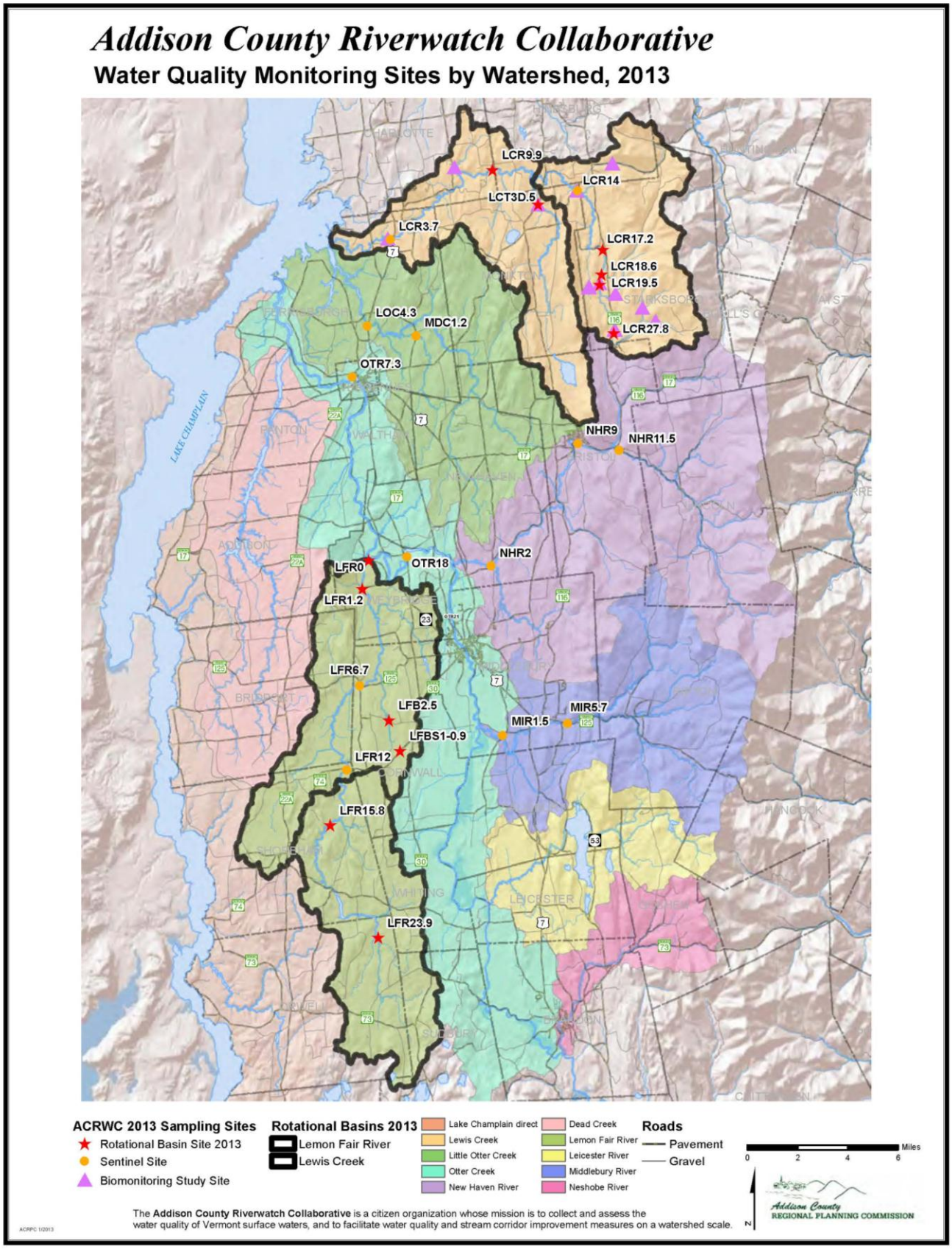
Addison County Riverwatch Collaborative
Water Quality Monitoring Sites by Watershed, 2013
LCR9.9
LCR14
LCT3D.5
LCR3.7
LCR17.2
LCR18.6
LCR19.5
LOC4.3
MDC1.2
LCR27.8
OTR7.3
NHR9
NHR11.5
NHR2
OTR18
LFR0
LFR1.2
LFR6.7
LFB2.5
MIR5.7
MIR1.5
LFBS1-0.9
LFR12
LFR15.8
LFR23.9
LAKE CHAMPLAIN
ACRWC 2013 Sampling Sites
Rotational Basin Site 2013
Sentinel Site
Biomonitoring Study Site
Rotational Basins 2013
Lemon Fair River
Lewis Creek
Lake Champlain direct
Lewis Creek
Little Otter Creek
Otter Creek
New Haven River
Dead Creek
Lemon Fair River
Leicester River
Middlebury River
Neshobe River
Roads
Pavement
Gravel
Miles
0 2 4 6
N
Addison County
REGIONAL PLANNING COMMISSION
The Addison County Riverwatch Collaborative is a citizen organization whose mission is to collect and assess the water quality of Vermont surface waters, and to facilitate water quality and stream corridor improvement measures on a watershed scale.
ACRPC 1/2013

Table 1. Rotational Schedule for Focused Monitoring

2010-2011	2012 – 2013	2014 - 2015
Little Otter Creek	Lewis Creek	Middlebury River
New Haven River	Lemon Fair	Otter Creek

Beginning with the 2012 sampling season, Lewis Creek and the Lemon Fair River were selected to be focus watersheds (Figure 1, watersheds in bold outline). Therefore, rotational sites were scheduled for sampling in addition to the sentinel sites in these two watersheds. Table 2a displays the schedule of sampling sites and parameters for the 2012 season; "R" denotes a rotational site, "S" for a sentinel site. A slightly different schedule of sampling parameters is indicated for Spring versus Summer months – i.e., *E. coli* was added to the list for Summer events.

As a result of 2009 scoping meetings with VTDEC, and consistent with updated goals and objectives for the ACRWC monitoring program, a flow study was undertaken in 2012 in the Pond Brook tributary watershed of the Lewis Creek (separate report to be delivered in May 2013). A 2012 schedule of sampling sites and parameters for the flow study is presented in Table 2b.

3.0 Methods

Water quality samples were collected by ACRWC volunteers in accordance with quality assurance procedures outlined in the EPA-approved Generic Quality Assurance Project Plan prepared by VTDEC. A Quality Assurance Summary report for the 2012 sampling data was submitted under separate cover. Samples were delivered to the LaRosa Analytical Laboratory. Due to damages sustained at the laboratory facility in the wake of Tropical Storm Irene (28-29 August 2011) operations were moved from Waterbury and temporarily located at the University of Vermont in Burlington, Vermont. The lab was housed in Jeffords Building for the spring and summer of 2012, followed by a move to Hills Building in the fall.

During 2012, ACRWC volunteers collected grab samples at 28 sites in these six watersheds during two Spring events (April and May) and four Summer events (June, July, August and September). Sampling dates were pre-determined as the first Wednesday of each month (except July to avoid the 4th of July holiday), and were not designed to capture any specific flow condition:

- April 4
- May 1 / 2
- June 6
- July 11
- August 1
- September 5

Table 2a. 2012 Schedule of Sites / Parameters – Spring and Summer

Project Name: Addison County River Watch Collaborative

Project Number: **137-01**

Sample Year: **2012**

				Spring Schedule (Apr, May)						Summer Schedule (Jun, Jul, Aug, Sep)					
				PARAMETERS						PARAMETERS					
Type	**River Name**	**Site ID**	**Site Location**	***E.coli***	**TP**	**DP**	**TN**	**Turbidity**	**TSS**	***E.coli***	**TP**	**DP**	**TN**	**Turbidity**	**TSS**
S	Lewis Creek	LCR3.7	Old Route 7 Bridge		X			X		X	X			X	
R	Lewis Creek	LCR9.9	Upper Covered Bridge, Roscoe Rd.		X			X			X			X	
S	Lewis Creek	LCR14	Tyler Bridge		X			X		X	X			X	
R	Lewis Creek	LCR17.2	Starksboro Ballfields		X			X			X			X	
R	Lewis Creek	LCR18.6	Lewis Creek Farm footbridge		X			X			X			X	
R	Lewis Creek	LCR19.5	Parsonage Road bridge		X			X			X			X	
R	Lewis Creek	LCR27.8	Hillsboro Road		X			X			X			X	
R	Pond Brook	LCT3D.5	Silver Street culvert		X	X	X	X	X	X	X	X	X	X	X
O	Pond Brook	LCT3-3.9	Mountain Road culvert		X	X	X	X	X	X	X	X	X	X	X
O	Pond Brook	LCT3-8.7	Church Road culvert		X	X	X	X	X	X	X	X	X	X	X
O	Pond Brook	LCT3-10.5	Mountain Road culvert		X	X	X	X	X	X	X	X	X	X	X
R	Lemon Fair River	LFR0	Weybridge Road bridge		X	X	X	X	X	X	X	X	X	X	X
R	Lemon Fair River	LFR1.2	Prunier Road bridge		X	X	X	X	X	X	X	X	X	X	X
S	Lemon Fair River	LFR6.7	Route 125 bridge.		X	X	X	X	X	X	X	X	X	X	X
S	Lemon Fair River	LFR12	Downstream of Route 74 bridge		X	X	X	X	X	X	X	X	X	X	X
R	Lemon Fair River	LFR15.8	Shacksboro Road bridge		X	X	X	X	X	X	X	X	X	X	X
R	Lemon Fair River	LFR23.9	Murray Road Bridge		X	X	X	X	X	X	X	X	X	X	X
R	Beaver Branch	LFB2.5	Sperry Road crossing, Beaver Branch		X	X	X	X	X	X	X	X	X	X	X
R	Trib to Beaver Branch	LFBS1-0.9	Route 125 crossing, trib to Beaver Branch		X	X	X	X	X	X	X	X	X	X	X
S	Little Otter Creek	LOC4.3	Route 7 Bridge		X	X		X	X	X	X	X		X	X
S	Mud Creek	MDC1.2	Wing Rd./Middlebrook Rd. (South)		X	X		X	X	X	X	X		X	X
S	Middlebury River	MIR1.5	Shard Villa Rd. Bridge		X			X		X	X			X	
S	Middlebury River	MIR5.7	Midd. Gorge @ Rte 125 Bridge		X			X		X	X			X	
S	New Haven River	NHR2	Muddy Branch confluence (just above)		X			X		X	X			X	
S	New Haven River	NHR9	South St. Bridge		X			X		X	X			X	
S	New Haven River	NHR11.5	Bartlett's Falls Pool							X					
S	Otter Creek	OTR21	Belden Falls		X		X	X		X	X		X	X	
S	Otter Creek	OTR7.3	Vergennes Falls/below outfall		X		X	X		X	X		X	X	

Table 2b. 2012 Schedule of Sites / Parameters – Flow Study

Project Name: Addison County River Watch Collaborative

Project Number: **137-01**

Sample Year: 2012

				Flow Study (pending storm events)						
				PARAMETERS						
Type	**River Name**	**Site ID**	**Site Location**	***E.coli***	**TP**	**DP**	**TN**	**Turbidity**	**TSS**	**Site Comments/Rationales**
S	Lewis Creek	LCR3.7	Old Route 7 Bridge							Downstream of US Rt 7; near USGS streamflow gaging station
R	Lewis Creek	LCR9.9	Upper Covered Bridge, Roscoe Rd.							Swimming site; downstream from Pond Brook confluence
S	Lewis Creek	LCR14	Tyler Bridge							Swimming and recreation site; downstream from farms, Hollow Brook
R	Lewis Creek	LCR17.2	Starksboro Ballfields							Recreation Site; upstream and downstream from agriculture
R	Lewis Creek	LCR18.6	Lewis Creek Farm footbridge							Downstream from farm
R	Lewis Creek	LCR19.5	Parsonage Road bridge							Upstream from farm; downstream from High Knob Brook
R	Lewis Creek	LCR27.8	Hillsboro Road							Transition from headwaters to agriculture in Starksboro valley.
R	Pond Brook	LCT3D.5	Silver Street culvert		X	X	X	X	X	Flow / Loading Study
O	Pond Brook	LCT3-3.9	Mountain Road culvert		X	X	X	X	X	Flow / Loading Study
O	Pond Brook	LCT3-8.7	Church Road culvert		X	X	X	X	X	Flow / Loading Study
O	Pond Brook	LCT3-10.5	Mountain Road culvert		X	X	X	X	X	Flow / Loading Study
R	Lemon Fair River	LFR0	Weybridge Road bridge							Discharge to Otter Creek
R	Lemon Fair River	LFR1.2	Prunier Road bridge							Downstream of area that is pastured into Lemon Fair
S	Lemon Fair River	LFR6.7	Route 125 bridge.							Site surrounded by pasture with very little riparian buffer.
S	Lemon Fair River	LFR12	Downstream of Route 74 bridge							Downstream of area that is pastured into Lemon Fair
R	Lemon Fair River	LFR15.8	Shacksboro Road bridge							Downstream of a farm enrolled in NRCS nutrient management program
R	Lemon Fair River	LFR23.9	Murray Road Bridge							Monitor *E.coli*, document impacts of newly established riparian buffers at a large farm.
R	Beaver Branch	LFB2.5	Sperry Road crossing, Beaver Branch							Downstream of farms.
R	Trib to Beaver Branch	LFBS1-0.9	Route 125 crossing, trib to Beaver Branch							Downstream of farms and residential development
S	Little Otter Creek	LOC4.3	Route 7 Bridge							At US Rt 7; site of USGS streamflow gaging station
S	Mud Creek	MDC1.2	Wing Rd./Middlebrook Rd. (South)							Just upstream of mouth of Mud Creek; downstream of dairy pasture
S	Middlebury River	MIR1.5	Shard Villa Rd. Bridge							Recreation Site
S	Middlebury River	MIR5.7	Midd. Gorge @ Rte 125 Bridge							Recreation Site
S	New Haven River	NHR2	Muddy Branch confluence							Bracket Muddy Branch tributary
S	New Haven River	NHR9	South St. Bridge							100 yds. below downtown Bristol's septic system
S	New Haven River	NHR11.5	Bartlett's Falls Pool							State-significant swimming and recreation site
S	Otter Creek	OTR21	Belden Falls							Accessible site downstream of Midd. Sewage Treatment Plant
S	Otter Creek	OTR7.3	Vergennes Falls/below outfall							New site: *E.coli* testing at the request of Vergennes Town Manager to monitor *E.coli* upstream and downstream of sewage treatment plant.

Site Types: R = Rotational; S = Sentinel; O = Other (special project).

In the Pond Brook watershed, the flow study was designed to rely on Spring and Summer sampling results from the ACRWC program for select stations, as well as separate samplings of storm events which occurred outside the regular ACRWC monitoring schedule. Four such events were sampled during 2012:

- April 23
- May 16 & 17
- October 20 & 22
- December 18 & 19

Four stations on the Pond Brook were sampled during flow events (LCT3D.5, LCT3-3.9, LCT3-8.7, LCT3-10.5). A fifth station (LCR14 on the Lewis Creek main stem) was added to the flow study schedule beginning with the October and December flow events, with approval from VTDEC Watershed Management Division. Grab samples were collected at each station during these events to monitor changes in concentrations of Total Phosphorus, Dissolved Phosphorus, Total Nitrogen, Turbidity and Total Suspended Solids through the storm hydrograph.

4.0 Precipitation Data

Precipitation data were compiled from existing weather stations and USGS gaging stations in vicinity of the ACRWC watersheds (Appendix B). In contrast to the previous year, calendar year 2012 was a somewhat drier-than-normal year, as recorded at regional weather stations in South Burlington (Airport), Rutland, and South Lincoln, Vermont (Table B1). Snowfall in the winter of 2011–2012 was much less than normal as recorded at these three weather stations (NOAA Online Weather Data, accessed Jan 2013). Based on USGS provisional real-time gaging records, ice-out in the lower Lewis Creek and Little Otter Creek watersheds occurred in on or about March 4, 2012; the gaging station on the lower New Haven River does not appear to have been significantly affected by ice during the winter of 2011-2012.

5.0 Hydrologic Data

Flow data were compiled from available USGS gaging stations in vicinity of the ACRWC watersheds. Four of the six watersheds sampled by the ACRWC have USGS gaging stations which record instantaneous flow at fifteen minute intervals. Gages on Lewis Creek, Little Otter Creek, and New Haven River are near the downstream end of the main stem. A nearby gage on Otter Creek (at Middlebury) is located mid-basin, at 66.5 % of this 944 square mile basin.

Flow records are available for the past 22 years at Little Otter Creek, New Haven River, and Lewis Creek gaging stations. Mean annual flows recorded at these stations over that time period are summarized in Table 5, along with data from the Otter Creek at Middlebury station. Data are summarized by water year – which begins October 1st of the previous calendar year and extends through September 30th of the indicated year. Based on 22 years of record, mean annual flows in these ACRWC watersheds for water year 2012 were below normal, related to the lower than normal rainfall and snowpack within the year.

Table 5. Mean Annual Flows, 1991 – 2012, ACRWC watersheds.

Watershed	Little Otter Creek		New Haven River		Lewis Creek		Otter Creek at Middlebury	
Drainage Area (sq mi)		73		116		81		944
Gaged Area (sq mi)		57.1		115		77.2		628
Min (1991-2012)	*2002*	27	*1995*	129	*1995*	54	*1995*	672
Max (1991-2012)	*2011*	145	*2011*	378	*2011*	214	*2011*	1912
Mean (1991-2012)		67		218		109		1167
Water Year 2012		**44.8**		**165**		**73.8**		**986**

Note: Estimates for water year 2012 are calculated from Daily Mean Flows, accessed 13 Feb 2013 online at: http://waterdata.usgs.gov/vt/nwis/rt

Figure 2 presents mean daily flows in the Little Otter Creek, New Haven River and Lewis Creek. Flows have been normalized to gaged drainage area. Generally, New Haven River tends to exhibit more flashy flows, and often has a somewhat higher flow per unit area than the Lewis Creek and Little Otter Creek.

Flows in the ACRWC watersheds were much lower than normal in 2012. In early September, the instantaneous flow in the Lewis Creek (9.7 cfs, 9/3/2012) was very near to the 99% flow duration of approximately 7.5 cfs, meaning that nearly 99% of all the DMFs recorded at this station over the 22 years of record were greater in magnitude than flows recorded on that date (USGS, 2012). Similarly, flows in the Otter Creek at Middlebury on September 4 were very close to the 99% flow duration (for 96 years of record), which itself is nearly the same as the 7Q10 flow. The "7Q10" flow is the lowest 7-day average flow that occurs on average once every 10 years. Flows in the Little Otter Creek were within 1 cfs of the 7Q10 during mid-July and late-August/early September.

Peak flows for water year 2012 occurred on May 8 in the New Haven River, May 16 in the Lewis Creek, May 17 in the Little Otter Creek, and on May 30 at the Otter Creek at Middlebury station. Peak flows were less than the estimated 2-year storm (Q2) (Olson, 2002), and less than the predicted bankfull discharge (Q1.5) (VTDEC, 2001).

Figure 3 presents a flow duration curve for the Lewis Creek watershed, annotated with the 2012 season sample dates. Spring sampling dates (April 4, May 1/2) coincided with low to moderate stages in area rivers associated with spring rains and snow melt (Table B-3 in Appendix B). Summer sampling dates (June 6, July 11, August 1 and September 5) generally coincided with low to base flow conditions (Figure 3; Table B-3 in Appendix B). The July 11 and September 5 dates corresponded with near 7Q10 flow conditions in Lewis Creek, Little Otter Creek and the Otter Creek at Middlebury.

The storm events sampled in Pond Brook of Lewis Creek (April 23, May 16 & 17, October 20 & 22, and December 18 & 19) represented discharges of 20.6% Flow Duration Interval or less (Figure 3).

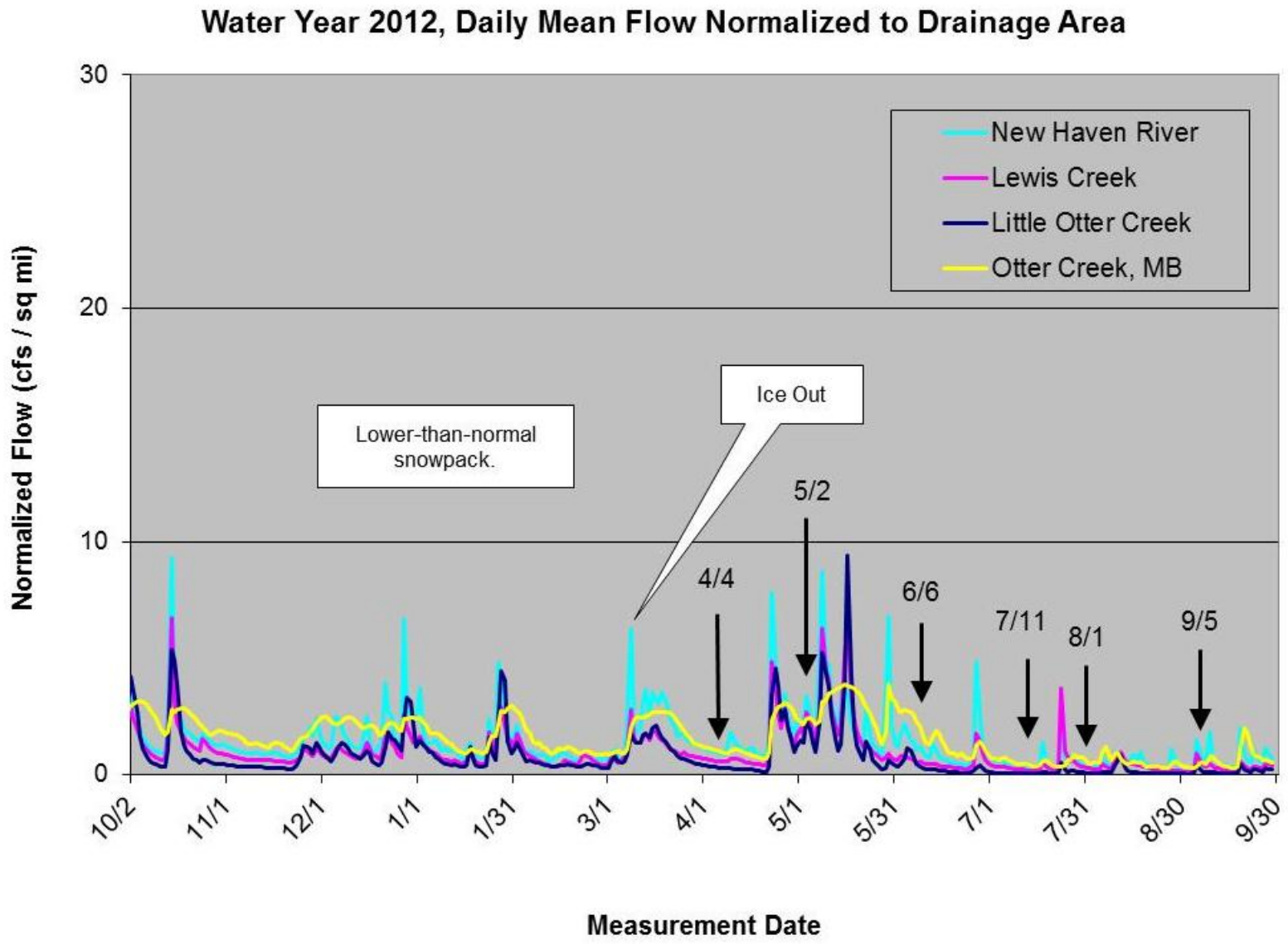

Figure 2. ACRWC Scheduled Spring and Summer Sampling Dates relative to Mean Daily Flows normalized to Gaged Drainage Area.

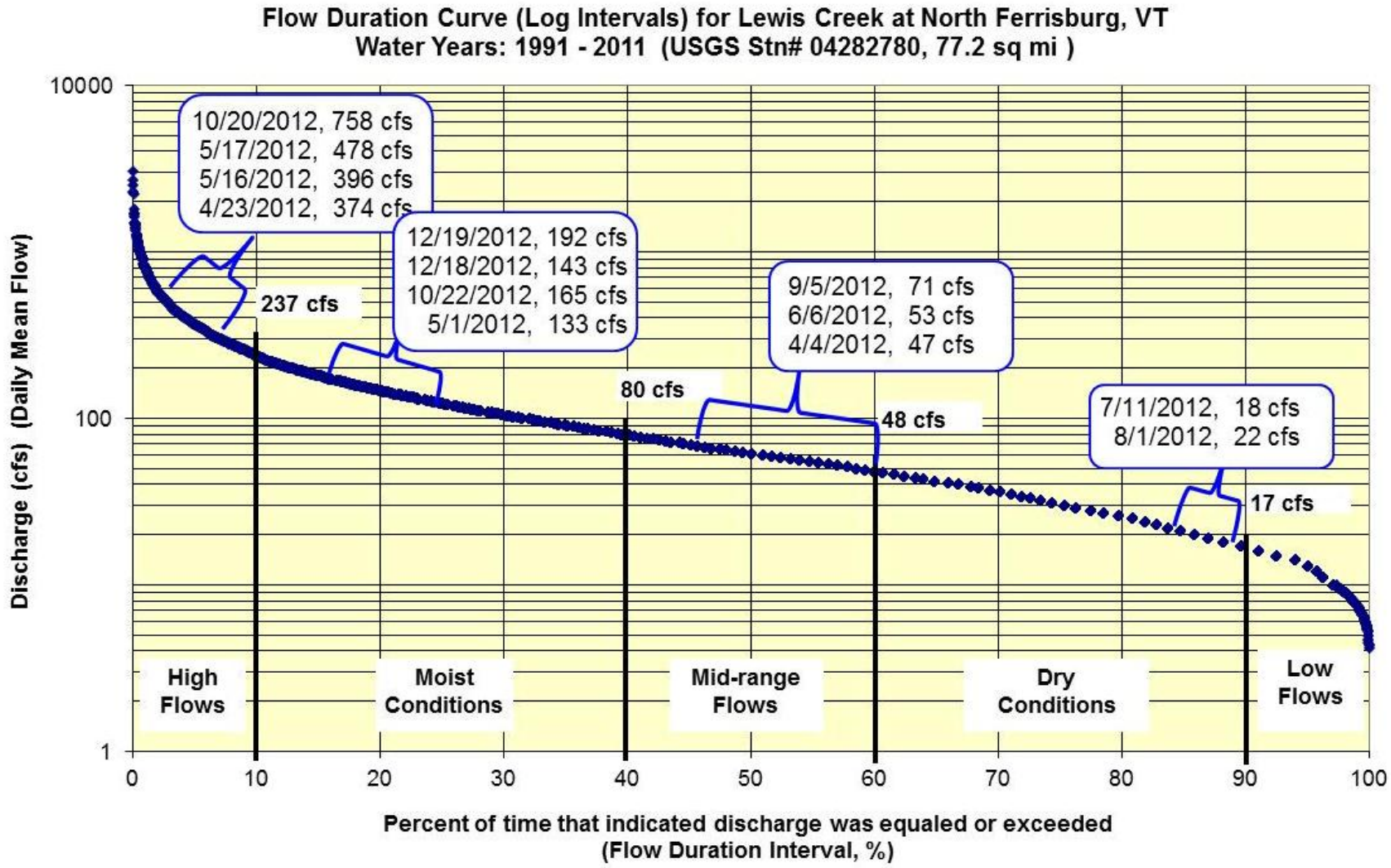

Figure 3. ACRWC Scheduled Spring and Summer Sampling Dates relative to Flow Duration Curve for the Lewis Creek watershed.

6.0 Sample Results

Appendix C contains quality-assured sample results for the 2012 season for the ACRWC watersheds. Attachments 1 through 6 summarize these results on a single page for each watershed. These attachments have been designed to serve as a handout for use in future outreach events to watershed stakeholders and relevant town boards. As discussed in Section 2.0, the Lemon Fair River and Lewis Creek were chosen as focus watersheds for 2012. Therefore, sample results are presented for sentinel as well as rotational sites in these watersheds.

In general, water quality results for 2012 were consistent with historic results and trends summarized in the 2009 Draft Water Quality Reports for each watershed (Hoadley, 2009). *E.coli* counts in each river exceeded the VT Water Quality Standard (VWQS) of 77 organisms/ 100 mL at one or more stations during one or more summer sampling dates. Generally, elevated *E.coli* detections were associated with developed land uses including nearby agriculture and livestock with direct access to the river. Wildlife sources of *E.coli* also exist in these rivers, including beaver, deer, and waterfowl. *E.coli* concentrations tended to be higher during low-flow events. *E.coli* counts were generally below the federal health-based standard (235 organisms/100 mL) at popular swimming sites, except for results of the September 5 sample at Bartlett's Falls and South Street on the New Haven River, when flow rates in area rivers were very low and near the 7Q10. A similar occurrence of elevated E. coli counts was noted in historic drought years – e.g., 1993 and 1995. The Vermont Agency of Natural Resources has published EPA-approved Total Maximum Daily Load (TMDL) plans for the Lewis Creek (and Pond Brook), Little Otter Creek, Middlebury River, and Otter Creek (VTDEC, 2011). These TMDL plans include recommendations for further assessment and mitigation of *E.coli* sources in these waters.

Turbidity concentrations in each watershed exceeded the VWQS at one or more stations during the 2012 season. In the mountainous watersheds of Lewis Creek, Middlebury River, and New Haven River (shaded yellow in Table A-1), turbidity tends to exceed the standard of 10 NTUs during high flows in the spring and early summer. Since flow conditions overall in 2012 were lower than normal, and no significant storm events were captured during the regularly-scheduled monthly sampling, turbidity exceeded the standard infrequently in these mountainous watersheds. In Lewis Creek, the standard was exceeded at all sites on September 5. While the flow condition in the river was low to moderate, samplers' notes for that event indicated that a hard rain fell the night before, resulting in turbidity. Review of area rain gages suggests that this rain event was more intense and of longer duration in northern Vermont. Of the watersheds monitored by the Collaborative, this rain event seems to have been localized to Lewis Creek. In the valley watersheds (Little Otter Creek and Lemon Fair, shaded light blue in Table A-1), the turbidity standard (10 NTUs for the designated cold-water fishery of Little Otter and 25 NTUs for the warm-water fishery of Lemon Fair) tends to be exceeded on a more frequent basis, independent of flow condition. In 2012, turbidity exceeded the VWQS during each of the sampling events, except April 4 when soils were still somewhat frozen. As noted in Table A-1 the valley watersheds have a much higher percentage of silt / clay soils derived from glacial lake sediments, which contributes to the higher turbidity in these rivers. The Otter Creek represents a mixed water with contributions from both the mountainous and valley watersheds. During 2012,

the turbidity standard at the sentinel stations on Otter Creek was exceeded only once at site OTR7.3 on September 5.

Phosphorus is monitored in the Addison County watersheds with respect to two main objectives. First, total phosphorus concentrations are compared to proposed instream nutrient criteria (VTDEC WQD, 2009) to identify potential impacts to Aquatic Life Support and Aesthetics uses of these waters. Elevated phosphorus can lead to enhanced algae production and other changes in water quality that reduce the river's capacity to support macroinvertebrates, fish and other aquatic organisms. These changes also have the potential to impact aesthetics and recreational uses of these waters. VTANR recommends that the mean of at least three low-flow phosphorus concentrations collected on non-consecutive days is compared to the proposed phosphorus criteria. Four low-flow measurements of phosphorus were available for 2012. Mean low-flow concentrations of phosphorus in the valley watersheds (Lemon Fair, Little Otter Creek) and in Otter Creek exceeded the proposed instream phosphorus criteria. On the other hand, in the mountainous watersheds, phosphorus concentrations generally do not exceed the proposed instream phosphorus criteria. One exception this year was Lewis Creek, where mean total phosphorus concentrations at six of the seven main stem site (all except the uppermost LCR27.8) and all four Pond Brook sites exceeded the proposed criterion of 44 ug/L for the warm-water medium gradient (WWMG) wadeable stream ecotype for a Class B water.

A second reason to monitor for phosphorus at the subwatershed level in Addison County watersheds is to evaluate relative contributions of phosphorus to Lake Champlain. Each of the watersheds monitored by the Collaborative contributes significant phosphorus to the lake, either directly (Lewis Creek, Little Otter Creek) or via Otter Creek (Middlebury River, New Haven River, Lemon Fair). The most substantial loading occurs during high flow events – generally occurring in the spring or fall months. In 2010 and 2011, the Collaborative carried out a flow / loading study in the Little Otter Creek. A similar study was completed in 2012 on the Pond Brook tributary of Lewis Creek. Results are reported separately. Stream flow and water quality monitoring data have been used to inform and develop priority implementation projects on a sub-watershed scale. Coarse estimates of phosphorus yields from each sub-watershed were used to communicate land use impacts on water quality and encourage landowner and municipal participation. In cooperation with local, state and federal partners, projects were prioritized and (with landowner willingness) will be developed to achieve reductions in phosphorus and sediment loading from these catchments. Identified projects have included wetland restoration & conservation, livestock exclusion, riparian buffer plantings, alternate tillage and crop rotation practices, improved forest management techniques, and improved road maintenance practices.

Nitrogen was monitored in three of the Addison County watersheds in 2012: Lemon Fair River Otter Creek and the Pond Brook tributary of Lewis Creek. None of the detected concentrations exceeded the VWQS of 5 mg/L for nitrogen as nitrate. However, the mean concentration of total nitrogen for the four available low-flow summer sample dates exceeded the proposed instream nitrogen criteria (0.75 mg/L) five of the eight Lemon Fair sites and for two out of the four Pond Brook sites.

7.0 References

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Appendix A

Physical Features of Watersheds Monitored by Addison County Riverwatch Collaborative

Table A-1 summarizes the physical characteristics of the ACRWC watersheds and nearby LaPlatte River. A majority of the drainage area for the New Haven River and Middlebury River is positioned in the mountainous terrain of the Northern Green Mountain physiographic province. Lewis Creek also has a significant percentage of its drainage area in this province. LaPlatte River, Little Otter Creek and Lemon Fair River are located further to the west in the broad, low-relief, Champlain Valley physiographic province. Thus, topographic relief and overall gradients of the New Haven River, Middlebury River and Lewis Creek are substantially higher than that of the Champlain Valley watersheds.

The Green Mountain watersheds (New Haven River, Middlebury River, and Lewis Creek; shaded yellow in Table A-1) tend to exhibit flashier flows, than the Champlain Valley watersheds due, in part, to the steeper overall gradients. The lower-gradient watersheds of the Champlain Valley (shaded blue in Table A-1) tend to be characterized by higher percentages of hydric soils derived from lacustrine and marine lake sediments, and have higher percentages of wetlands. These conditions offer temporary surface water storage and lagged flows, resulting in broader, lower-magnitude storm peaks, longer times to peak, and gradual hydrograph recessions.

In general, the Green Mountain watersheds tend to have higher percentages of forest cover, while the Champlain Valley watersheds have higher percentages of agricultural land use.

Table A-1. Physical Features of Watersheds.

Watershed	Physical Characteristics										
	Geologic Province (1)		Soils (2) (% Lake Sediments)	% Hydric Soils	% Wetlands (VSWI)	Topography		Major Land Cover/ Land Use			Stream Classification (Class B) (3)
	NGM	CV				Relief (ft)	Gradient (ft / mile)	Forest	Agric	Urban	
Middlebury River 63 sq mi	71%	29%	10%	15.2%	3.2%	1,758	111	81%	11%	3%	Cold Water Fish
New Haven River 116 sq mi	63%	37%	14%	9.8%	2.5%	2,720	106	76%	15%	4%	Cold Water Fish
Lewis Creek 81 sq mi	31%	69%	24%	18.6%	6.5%	1,676	52	60%	26%	5%	Cold Water Fish
LaPlatte River 53 sq mi	5%	95%	45%	25.3%	6.1%	960	49	38%	39%	16%	Warm Water Fish
Little Otter Creek 73 sq mi	--	100%	62%	30.3%	9.7%	416	18	35%	45%	4%	Cold Water Fish
Lemon Fair River 91 sq mi	--	91%	63%	19.3%	7.3%	256	8	25%	63%	6%	Warm Water Fish
Lower Otter Creek 498 sq mi (of 944 sq mi basin)	29%	69%	38%	20.8%	8.9%	NM	NM	67%	21%	6%	Warm Water Fish

Notes:

(1) NGM = Northern Green Mountains; CV = Champlain Valley; geologic province after Stewart & MacClintock (1969) or biophysical province after the VT Biodiversity Project.

(2) Soils of glaciolacustrine parent material, Natural Resource Conservation Service County Soil Survey Data.

(3) As per VT Water Quality Standards, effective Jan 1, 2008.

Appendix B

Precipitation and Flow Data

Table B-1. Monthly / Annual Precipitation at climate stations located in vicinity of Addison County.

	Data Source	Time Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Burlington, VT (Airport)	*1*	1971-2000	2.22	1.67	2.32	2.88	3.32	3.43	3.97	4.01	3.83	3.12	3.06	2.22	36.05
330 ft amsl	*2*	2009	1.76	1.81	1.90	1.86	5.25	5.25	4.62	2.32	3.67	2.98	2.98	3.02	37.42
20 miles N	*2*	2010	2.41	2.13	2.85	3.08	1.52	5.87	2.25	3.51	4.17	6.24	3.10	3.60	40.73
	2	2011	1.44	3.02	3.39	7.88	8.67	3.52	3.68	6.11	6.06	3.49	1.43	2.23	50.92
	2	2012	1.96	0.89	0.98	2.84	4.41	3.22	3.78	2.92	5.36	5.04	1.24	3.30	35.94
South Lincoln, VT	*1*	1971-2000	2.92	2.10	3.14	4.20	4.31	4.58	4.24	5.22	4.44	4.39	3.98	3.13	46.65
1,370 ft amsl	*2*	2009	3.05	2.91	2.14	2.55	8.71	5.52	9.07	3.03	2.25	4.52	4.76	3.80	52.31
13.6 miles SE	*2*	2010	2.88	3.69	4.65	4.17	2.21	7.50	7.18	5.61	3.36	11.56	2.13	3.08	58.02
	2	2011	1.26	2.04	4.04	1.23	3.95	1.22	2.06	10.71	1.66	1.09	2.19	2.83	34.28
	2	2012	2.19	0.83	1.90	3.64	6.29	3.12	2.88	4.77	4.94	7.02	1.38	3.92	42.88
Rutland, VT	*1*	1971-2000	2.70	1.97	2.59	2.80	3.52	3.85	4.58	4.18	3.91	3.21	3.08	2.73	39.12
620 ft amsl	*2*	2009	2.29	1.98	2.04	1.96	4.43	3.86	9.30	7.71	2.27	4.76	3.64	3.00	47.24
40 miles SSE	*2*	2010	2.22	2.83	4.69	3.04	2.87	3.00	5.35	4.14	1.95	9.76	2.28	3.66	45.79
	2	2011	2.93	3.76	3.61	5.69	4.40	4.38	4.88	11.24	4.88	3.48	1.29	2.80	53.34
	2	2012	1.69	0.69	1.12	3.32	5.26	3.66	3.62	3.42	4.58	4.57	0.71	4.08	36.72

Total precipitation in inches, including liquid equivalent of snow, sleet.
Values for 1971-2000 period reflect averages for the time period. Values for individual years are totals.

Data Sources: [1] National Climatic Data Center, 2002, Climatography of the United States No. 81 - 43 (Vermont), Monthly Station Normals of Temperature, Precipitation, and Heating and Cooling Degree Days: 1971-2000

[2] NOAA Online Weather Data, http://www.weather.gov/climate/index.php?wfo=btv

Table B-2. Monthly / Seasonal Snowfall Totals at climate stations located in vicinity of Addison County.

	Time Period	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Season
So. Burlington, VT (Airport)	1971-2000	0.0	0.0	0.0	0.3	7.2	17.1	20.9	15.3	15.4	5.8	0.0	0.0	81.9
	2009-2010	0.0	0.0	0.0	0.0	0.0	17.7	48.4	24.0	0.9	5.5	0.0	0.0	96.5
	2010-2011	0.0	0.0	0.0	0.1	0.3	27.9	26.9	43.1	29.3	0.8	0.0	0.0	128.4
	2011-2012	0.0	0.0	0.0	0.1	5.0	6.9	13.4	6.4	5.9	0.0	0.0	0.0	37.7
South Lincoln, VT	1981-2000	0.0	0.0	0.0	2.2	13.9	26.9	29.6	22.8	24.5	10.5	0.7	0.0	131.1
	2009-2010	0.0	0.0	0.0	0.1	1.1	26.0	22.5	33.0	3.2	10.0	1.0	0.0	96.9
	2010-2011	0.0	0.0	0.0	2.2	4.0	39.5	42.3	40.2	26.2	1.8	0.0	0.0	156.2
	2011-2012	0.0	0.0	0.0	2.4	4.9	24.3	18.4	12.0	11.6	0.0	0.0	0.0	73.6
Rutland, VT	1971-2000	0.0	0.0	0.0	0.3	5.6	13.5	16.7	13.9	12.4	3.6	0.0	0.0	66.0
	2009-2010	0.0	0.0	0.0	0.0	0.0	18.2	15.9	19.9	0.1	2.1	0.0	0.0	56.2
	2010-2011	0.0	0.0	0.0	0.0	0.9	21.3	26.8	37.2	14.6	0.9	0.0	0.0	101.7
	2011-2012	0.0	0.0	0.0	6.5	2.9	5.0	8.9	2.7	4.2	0.0	0.0	0.0	30.2

Total snowfall in inches. Values for 1971-2000 period reflect averages for the time period. Values for seasons are totals.
Source: http://www.weather.gov/climate/xmacis.php?wfo=btv data available as of Jan 2013

Table B-3. Flows recorded in Addison County rivers, 2012

	River	Little Otter Ck	Lewis Creek	New Haven River	Otter Ck MB
	USGS Gage #	#04282650	#04282780	#04282525	#04282500
	Drainage Area (sq mi)	57.1	77.4	115	630
Sample Dates	**4/4/2012**	20	47	112	666
(Daily Mean Flows)	4/23/2012		374		
(cfs)	**5/2/2012**	84	154	275	1,400
	5/16/2012		396		
	5/17/2012		478		
	6/6/2012	60	53	163	1,680
	7/11/2012	2.7	18	53	279
	8/1/2012	4.6	22	41	343
	9/5/2012	22	71	168	227
	10/20/2012		758		
	10/22/2012		165		
	12/18/2012		143		
	12/19/2012		192		
Peak Flows	Q2	1,120	2,280	4,410	4,270
(Olson, 2002; Table 2)	Q5	1,640	2,990	6,980	5,840
	Q10	1,990	3,420	8,870	6,970
	Q25	2,440	3,920	11,500	8,480
	Q50	2,790	4,270	13,500	9,680
	Q100	3,130	4,590	15,700	10,900
	Q500	3,950	5,290	21,200	14,200

Appendix C

Water Quality Data Tables by Watershed

Abbreviations:

TN = Total Nitrogen
TP = Total Phosphorus
DP = Dissolved Phosphorus
TSS = Total Suspended Sediments

mpn/100 mL = organisms per 100 milliliters
mg/L = milligrams per liter
ug/ L = micrograms per liter
NTU = Nephelometric Turbidity Units

-- = No Data
NS = Not Sampled
NA = Not Analyzed (insufficient sample volume)
NM = Not Measured

J = estimated value; constituent was present in an associated field blank and the concentration of constituent in the primary sample was more than 5 times the value detected in the field blank, and/or the calculated relative percent difference for an associated field duplicate pair exceeded target value.

R = rejected value; constituent was present in an associated field blank and the concentration of constituent in the primary sample was within 5 times the value detected in the field blank.

Note: QA/QC issues further detailed in separate QA Summary Report

Lemon Fair River

Location	Date	Final E. Coli. (mpn/100ml)	TN (mg-N/l)	TP (ug P/L)	DP (ug P/L)	TSS (mg/L)	Turbidity (NTU)
LFR0	4/4/2012		0.52	62.9	22.8	18.4	19.2
LFR1.2	4/4/2012		0.51	52.9	22.7	13.9	14.7
LFR6.7	4/4/2012		0.55	61.4	21.7	15.2	19.5
LFR12	4/4/2012		0.49	41.3	16.7	9.73	7.95
LFR15.8	4/4/2012		0.58	38.7	19.5	5.7	6.22
LFR23.9	4/4/2012		0.24	19.7	9.16	5.6	7.9
LFB2.5	4/4/2012		0.29	22.5	10.1	6.8	7.51
LFBS1-0.9	4/4/2012		0.24	22.5	15.9	2.9	2.59
LFR0	5/2/2012		0.89	84.2	35.4	28.8	34.6
LFR1.2	5/2/2012		0.83	75.3	33.8	22.4	28.2
LFR6.7	5/2/2012		0.87	83.2	30.4	29.4	44.5
LFR12	5/2/2012		0.95	81.5	35.3	36.4	49
LFR15.8	5/2/2012		1	70.2	34.7	17.6	27.9
LFR23.9	5/2/2012		0.43	41.3	16.1	15.9	24.8
LFB2.5	5/2/2012		0.39	28.9	16.7	7.3	10.6
LFBS1-0.9	5/2/2012		0.31	25.6	20.2	1.8	1.86
LFR0	6/6/2012	313	0.88	246	118	48	92.5
LFR1.2	6/6/2012	326	0.96	238	112	42	90.5
LFR6.7	6/6/2012	248	0.77	212	120	35.2	90.4
LFR12	6/6/2012	1986	0.95	312	113	139	279
LFR15.8	6/6/2012	1986	1.02	370	NA	140	360
LFR23.9	6/6/2012	345	0.65	68.8	35.2	18	25.2
LFB2.5	6/6/2012	613	0.56	63.2	33.8	19.9	23.8
LFBS1-0.9	6/6/2012	122	NA	48.9	38.8	1.4	3.93
LFR0	7/11/2012	40	0.75	70	15.1	26.4	16.6
LFR1.2	7/11/2012	50	0.9	183	52.9	118	146
LFR6.7	7/11/2012	921	2.21	510	28.3	321	357
LFR12	7/11/2012	40	1.62	294	15.2	173	219
LFR15.8	7/11/2012	43	0.95	44.6	29.7	7.73	13
LFR23.9	7/11/2012	55	0.54	42.5	20.1	18.2	22.4
LFB2.5	7/11/2012	50	0.32	48.2	15.3	17.2	12.8
LFBS1-0.9	7/11/2012	> 2419.6	0.87	114	39.9	57.2	59.6
LFR0	8/1/2012	26	0.52	151	81.5	25	47.3
LFR1.2	8/1/2012	29	0.78	228	70.2	110	144
LFR6.7	8/1/2012	435	0.9	197	77.2	95.2	136
LFR12	8/1/2012	54	0.32	224	58	130	189
LFR15.8	8/1/2012	96	0.56	53.2	42.1	5.9	9.82
LFR23.9	8/1/2012	91	0.62	58.7	28.3	10.5	9.8
LFB2.5	8/1/2012	86	0.29	53.8	30.1	20.4	15.2
LFBS1-0.9	8/1/2012	435	0.74	122	53.4	24.8	48.9
LFR0	9/5/2012	687	0.66	88.4	30.2	29.2	38.2
LFR1.2	9/5/2012	172	0.84	175	44.3	90	249
LFR6.7	9/5/2012	1553	1	226	79.2	112	298
LFR12	9/5/2012	1203	0.61	220	70.2	106	307
LFR15.8	9/5/2012	1986	0.56	44.9	35.3	5.73	8.37
LFR23.9	9/5/2012	411	0.71	62.1	33.3	4.67	5.52
LFB2.5	9/5/2012	816	0.29	50.2	31.1	18.2	16.2
LFBS1-0.9	9/5/2012	> 2419.6	0.85	172	108	24.6	26.8

Shaded cells represent values that exceed the relevant VT Water Quality Standard:
E.coli = 77 MPN/100 mL; Turbidity (warm water Class B) = 25 NTUs

Lewis Creek

Location	Date	Final E. Coli. (mpn/100ml)	TN (mg-N/l)	TP (ug P/L)	DP (ug P/L)	TSS (mg/L)	Turbidity (NTU)
LCR3.7	4/4/2012			21.1			3.45
LCR9.9	4/4/2012			17.8			4.2
LCR14	4/4/2012			12.7			3.38
LCR17.2	4/4/2012			7.49			0.78
LCR18.6	4/4/2012			6.36			0.46
LCR19.5	4/4/2012			5.88			0.53
LCR27.8	4/4/2012			< 5			0.55
LCT3D.5	4/4/2012		0.44	46.2	16.8	5.07	3.08
LCT3-3.9	4/4/2012		0.38	44.9	21.5	4.13	1.89
LCT3-8.7	4/4/2012		0.56	34.2	15.2	6.67	3.31
LCT3-10.5	4/4/2012		0.55	27.8	9.65	6.13	2.6
LCR3.7	5/1/2012			39.8			8.37
LCR9.9	5/1/2012			56.3			13.4
LCR14	5/1/2012			107			13.2
LCR17.2	5/1/2012			31.9			6.35
LCR18.6	5/1/2012			21.9			3.25
LCR19.5	5/1/2012			25.7			2.11
LCR27.8	5/1/2012			8.76			0.59
LCT3D.5	5/1/2012		0.47	44	22.2	7.73	4.64
LCT3-3.9	5/1/2012		0.45	42.5	21.9	3.6	1.73
LCT3-8.7	5/1/2012		0.61	45.2	20	9.6	5.99
LCT3-10.5	5/1/2012		0.5	23.4	8.83	3.47	2.01
LCR3.7	6/6/2012	46		24.4			4.77
LCR9.9	6/6/2012			28.8			5.09
LCR14	6/6/2012	148		10.2			1.46
LCR17.2	6/6/2012			11.9			0.75
LCR18.6	6/6/2012			9.28			0.45
LCR19.5	6/6/2012			10.8			0.48
LCR27.8	6/6/2012			5.9			0.58
LCT3D.5	6/6/2012	81	0.43	78.9	60	6.67	5.24
LCT3-3.9	6/6/2012	166	0.38	73.2	57.4	1.87	1.18
LCT3-8.7	6/6/2012	517	0.66	49.9	26.3	8.43	5.55
LCT3-10.5	6/6/2012	99	0.57	34.6	16.6	3.6	2.58

Shaded cells represent values that exceed the relevant VT Water Quality Standard:
E.coli = 77 MPN/100 mL; Turbidity (cold water Class B) = 10 NTUs

Lewis Creek (continued)

Location	Date	Final E. Coli. (mpn/100ml)	TN (mg-N/l)	TP (ug P/L)	DP (ug P/L)	TSS (mg/L)	Turbidity (NTU)
LCR3.7	7/11/2012	35		28.1			6.19
LCR9.9	7/11/2012			38.9			7.04
LCR14	7/11/2012	517		20.7			4.76
LCR17.2	7/11/2012			9.01			0.59
LCR18.6	7/11/2012			7.3			0.38
LCR19.5	7/11/2012			6.88			< 0.2
LCR27.8	7/11/2012			5.28			< 0.2
LCT3D.5	7/11/2012	43	0.64	109	80.9	3.6	3.65
LCT3-3.9	7/11/2012	45	0.64	106	86.9	1.6	1.17
LCT3-8.7	7/11/2012	613	0.84	51.3	36.9	5.6	3.26
LCT3-10.5	7/11/2012	313	0.81	39.7	28.8	4.6	2.4
LCR3.7	8/1/2012	111		29.9			7.08
LCR9.9	8/1/2012			48			8.21
LCR14	8/1/2012	866		21.4			4.82
LCR17.2	8/1/2012			9.26			0.43
LCR18.6	8/1/2012			8.52			< 0.2
LCR19.5	8/1/2012			8.46			< 0.2
LCR27.8	8/1/2012			5.05			< 0.2
LCT3D.5	8/1/2012	1046	0.72	143	103	7.73	6.3
LCT3-3.9	8/1/2012	166	0.59	162	112	2.67	2.08
LCT3-8.7	8/1/2012	517	1.03	63.4	48.4	6.6	4.91
LCT3-10.5	8/1/2012	488	0.9	50.1	31.6	11.6	5.08
LCR3.7	9/5/2012	> 2419.6		153			47.6
LCR9.9	9/5/2012			130			61.4
LCR14	9/5/2012	> 2419.6		169			18.5
LCR17.2	9/5/2012			282			33.7
LCR18.6	9/5/2012			169			29.9
LCR19.5	9/5/2012			165			22.3
LCR27.8	9/5/2012			65.9			14.2
LCT3D.5	9/5/2012	> 2419.6	0.78	148	66.4	35.4	18.7
LCT3-3.9	9/5/2012	> 2419.6	0.92	168	79.6	6.8	6.06
LCT3-8.7	9/5/2012	411	0.91	140	81.5	6	3.01
LCT3-10.5	9/5/2012	> 2419.6	1.02	85.2	54.5	11.2	6.17

Shaded cells represent values that exceed the relevant VT Water Quality Standard:
E.coli = 77 MPN/100 mL; Turbidity (cold water Class B) = 10 NTUs

Lewis Creek (continued) – Flow Study

Location	Date	Final E. Coli. (mpn/100ml)	TN (mg-N/l)	TP (ug P/L)	DP (ug P/L)	TSS (mg/L)	Turbidity (NTU)
LCT3D.5	4/23/2012		0.65	85.6	49.2	24.2	12.6
LCT3-3.9	4/23/2012		0.53	66.6	39.8	12.4	4.08
LCT3-8.7	4/23/2012		1.25	101	37	25.4	14.8
LCT3-10.5	4/23/2012		0.49	28.5	10.1	3.87	2.47
LCT3D.5	5/16/2012		1.33	499	74.3	464	225
LCT3-3.9	5/16/2012		0.62	84.9	47.1	12.6	10.3
LCT3-8.7	5/16/2012		3.58	1330	186	1030	1320
LCT3-10.5	5/16/2012		0.61	35.4	13.6	11.2	2.13
LCT3D.5	5/17/2012		0.5	69.6	41.6	17.7	9.93
LCT3-3.9	5/17/2012		0.42	66.5	46.2	5.33	3.59
LCT3-8.7	5/17/2012		0.72	115	59.8	14.2	19.3
LCT3-10.5	5/17/2012		0.58	33.9	NA	4.2	2.09
LCR14	10/20/2012		0.53	106	14.9	81.2	31
LCT3D.5	10/20/2012		0.57	81.1	47.1	13	6.74
LCT3-3.9	10/20/2012		0.54	60.9	36.3	5.6	3.44
LCT3-8.7	10/20/2012		1.37	320	146	34	90
LCT3-10.5	10/20/2012		0.71	34.9	12.6	6.4	2.19
LCR14	10/22/2012		0.46	19.2	9.4	8	3.67
LCT3D.5	10/22/2012		0.57	53.6	35	7.2	6.38
LCT3-3.9	10/22/2012		0.56	42.9	31.5	4	3.03
LCT3-8.7	10/22/2012		0.72	109	77.8	3.25	4.77
LCT3-10.5	10/22/2012		0.65	22.5	11.2	3	1.18
LCR14	12/18/2012		0.63	34.6	12.1	17.2	8.77
LCT3D.5	12/18/2012		0.56	48.1	23.5	12.4	11.6
LCT3-3.9	12/18/2012		0.56	33.3	19.2	4	4.82
LCT3-8.7	12/18/2012		1.21	109	55.3	7.2	8.97
LCT3-10.5	12/18/2012		0.71	22.2	7.33	2.8	2.16
LCR14	12/19/2012		0.51	20.1	8.76	9	5.01
LCT3D.5	12/19/2012		0.49	36.2	21.3	6.4	7.72
LCT3-3.9	12/19/2012		0.53	31.9	18.8	5.6	4.2
LCT3-8.7	12/19/2012		1.14	78.7	43.3	6	12.9
LCT3-10.5	12/19/2012		0.71	23.6	8.39	3	2.78

Shaded cells represent values that exceed the relevant VT Water Quality Standard:
E.coli = 77 MPN/100 mL; Turbidity (cold water Class B) = 10 NTUs

Little Otter Creek

Location	Date	Final E. Coli. (mpn/100ml)	TN (mg-N/l)	TP (ug P/L)	DP (ug P/L)	TSS (mg/L)	Turbidity (NTU)
LOC4.3	4/4/2012			28.5	13.9	4.8	6.24
MDC1.2	4/4/2012			35.6	29.7	4.93	4.85
LOC4.3	5/2/2012			72.6	31.4	27	31.7
MDC1.2	5/2/2012			49.3	38.2	5.2	7.13
LOC4.3	6/6/2012	248		175	136	42.6	46.4
MDC1.2	6/6/2012	54		143	104	9.8	10.2
LOC4.3	7/11/2012	24		63.5	55.8	5.2	8.25
MDC1.2	7/11/2012	308		104	59.3	10.4	13.4
LOC4.3	8/1/2012	2420		76.6	57.8	8	13.9
MDC1.2	8/1/2012	81		170	84.1	8.6	8.65
LOC4.3	9/5/2012	> 2419.6		210	54.6	104	117
MDC1.2	9/5/2012	> 2419.6		957	820	16.8	21.1

Shaded cells represent values that exceed the relevant VT Water Quality Standard:
E.coli = 77 MPN/100 mL; Turbidity (warm water Class B) = 25 NTUs

Middlebury River

Location	Date	Final E. Coli. (mpn/100ml)	TN (mg-N/l)	TP (ug P/L)	DP (ug P/L)	TSS (mg/L)	Turbidity (NTU)
MIR1.5	4/4/2012			12			2.42
MIR5.7	4/4/2012			12			1.27
MIR1.5	5/2/2012			16.7			2.99
MIR5.7	5/2/2012			7.68			1.01
MIR1.5	6/6/2012	205		31600			11.7
MIR5.7	6/6/2012	7		8.98			0.43
MIR1.5	7/11/2012	488		19.4			3.32
MIR5.7	7/11/2012	2		6.85			< 0.2
MIR1.5	8/1/2012	345		26.4			5.07
MIR5.7	8/1/2012	1		7.79			< 0.2
MIR1.5	9/5/2012	1300		44.7			9.26
MIR5.7	9/5/2012	192		13.7			2.12

Shaded cells represent values that exceed the relevant VT Water Quality Standard:
E.coli = 77 MPN/100 mL; Turbidity (cold water Class B) = 10 NTUs

New Haven River

Location	Date	Final E. Coli. (mpn/100ml)	TN (mg-N/l)	TP (ug P/L)	DP (ug P/L)	TSS (mg/L)	Turbidity (NTU)
NHR2	4/4/2012			8.04			1.07
NHR9	4/4/2012			5.69			0.52
NHR2	5/2/2012			16.4			3.33
NHR9	5/2/2012			8.25			0.75
NHR2	6/6/2012	52		18.6			4.4
NHR9	6/6/2012	38		7.4			0.66
NHR11.5	6/6/2012	15					
NHR2	7/11/2012	93		15.6			3.25
NHR9	7/11/2012	27		8.03			0.72
NHR11.5	7/11/2012	16					
NHR2	8/1/2012	77		17.1			4.07
NHR9	8/1/2012	45		6.58			< 0.2
NHR11.5	8/1/2012	17					
NHR2	9/5/2012	687		25.6			6.15
NHR9	9/5/2012	1733		103			24.8
NHR11.5	9/5/2012	1986					

Shaded cells represent values that exceed the relevant VT Water Quality Standard:
E.coli = 77 MPN/100 mL; Turbidity (cold water Class B) = 10 NTUs

Otter Creek (Lower)

Location	Date	Final E. Coli. (mpn/100ml)	TN (mg-N/l)	TP (ug P/L)	DP (ug P/L)	TSS (mg/L)	Turbidity (NTU)
OTR21	4/4/2012		0.54	18.3			2.33
OTR7.3	4/4/2012		0.56	19			3.36
OTR21	5/2/2012		0.54	32.6			3.27
OTR7.3	5/2/2012		0.48	28.3			6.42
OTR21	6/6/2012	249	0.58	61.4			16.1
OTR7.3	6/6/2012	172	0.62	92.7			24.4
OTR21	7/11/2012	47	0.64	36.8			5.32
OTR7.3	7/11/2012	54	0.45	28.8			11
OTR21	8/1/2012	54	0.6	30.6			4.31
OTR7.3	8/1/2012	58	0.47	29.9			6.5
OTR21	9/5/2012	38	0.55	24.3			3.44
OTR7.3	9/5/2012	2420	0.5	343			31.6

Shaded cells represent values that exceed the relevant VT Water Quality Standard:
E.coli = 77 MPN/100 mL; Turbidity (warm water Class B) = 25 NTUs.

Attachments

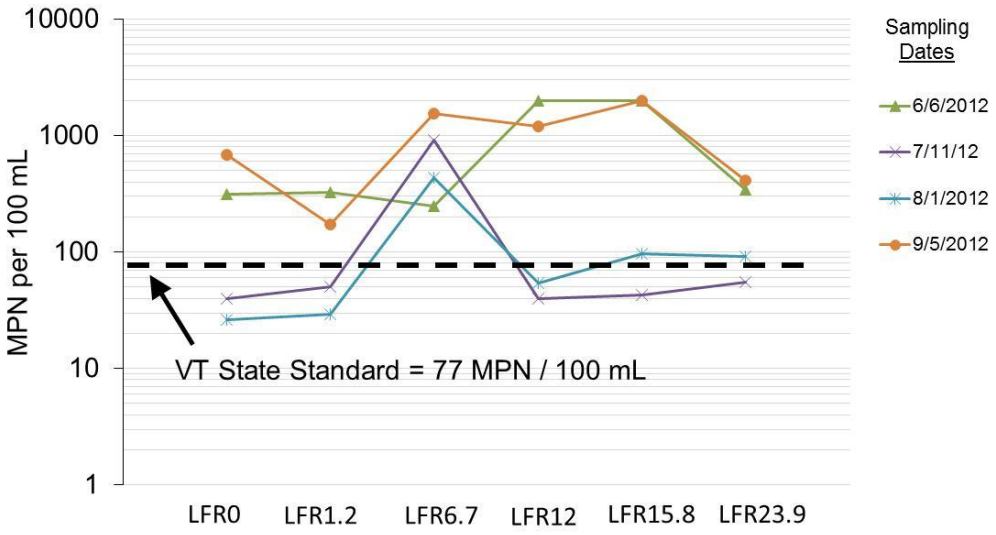
1 Lemon Fair River – 2012 Water Quality Summary
2 Lewis Creek – 2012 Water Quality Summary
3 Little Otter Creek – 2012 Water Quality Summary
4 Middlebury River – 2012 Water Quality Summary
5 New Haven River – 2012 Water Quality Summary
6 Otter Creek (Lower) – 2012 Water Quality Summary

2012 – 2013
Focus Watershed

Addison County Riverwatch Collaborative
Lemon Fair River - 2012 Water Quality Summary

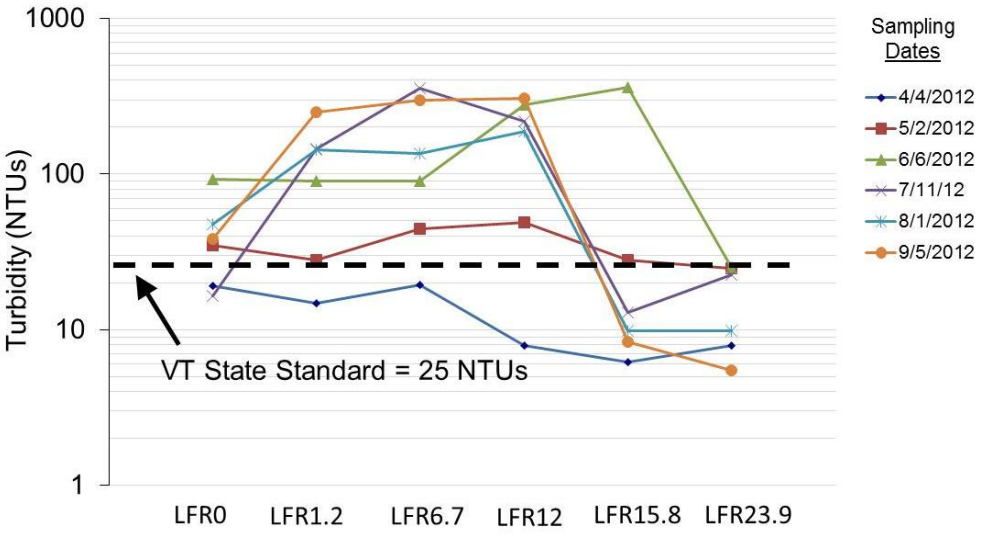
The Addison County Riverwatch Collaborative has been monitoring water quality in the Lemon Fair River since 2003. For the 2012 and 2013 seasons, the Lemon Fair River is the subject of a more intensive monitoring focus, where rotational as well as sentinel stations are monitored and additional parameters are tested. Six sites are located on the main stem, and two stations are located on the Beaver Branch tributary in the lower watershed (see table at right). During 2012, sampling occurred on two spring dates (April 4 and May 2) and four summer dates (June 6, July 11, August 1, and September 5). Samples were tested for phosphorus and turbidity; E.coli was tested only on the Summer dates. Flow in the river during all summer dates and the April spring date represented low to baseflow conditions (based on streamflow gages in area rivers). Flows on the May date were moderate due to spring rains. In general, flows in 2012 were below normal, due to the lower than normal rainfall and snowpack within the year.

Site	Location	Town
LFR0	Weybridge Road bridge	Weybridge
LFR1.2	Prunier Road bridge	Weybridge
LFR6.7	Route 125 bridge.	Cornwall
LFR12	Downstream of Route 74 bridge	Shoreham
LFR15.8	Shacksboro Road bridge	Shoreham
LFR23.9	Murray Road Bridge	Orwell
LFB2.5	Sperry Road crossing, Beaver Branch	Cornwall
LFBS1-0.9	Route 125 crossing, trib to Beaver Branch	Cornwall

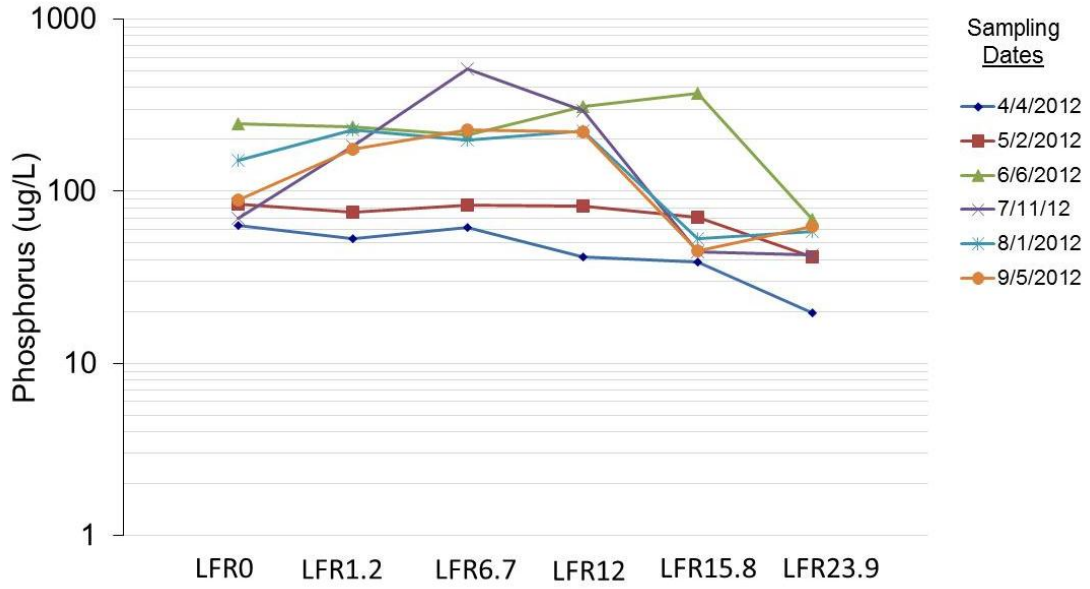


E.coli counts at most sites on the Lemon Fair River often exceeded the state standard of 77 organisms/ 100 mL on the four Summer sampling dates: June 6, July 11, August 1, and Sept 5. Detected E.coli counts were relatively consistent with historic monitoring results. The graph at the left shows results for the stations located on the Lemon Fair main stem from upstream (right) to downstream (left). During the low-flow conditions on July and August sample dates, a possible local contribution of E.coli is evidenced by the jump in readings between stations LFR12 and LFR6.7.

Turbidity levels in the Lemon Fair at the sampled stations ranged from 1.9 to 360 NTUs, with an average level of 76 NTUs for the six sample dates. Concentrations exceeded the Vermont state standard of 25 NTUs (for Class B warm-water fisheries) at a majority of stations (except Beaver Brook site LFB2.5) on all sample dates except April 4. The graph at the right shows results for the stations located on the Lemon Fair main stem from upstream (right) to downstream (left). During these low-flow conditions, an increase in Turbidity is evident between LFR15.8 and LFR12 on a number of five out of the six sample dates.



Phosphorus was detected at moderate levels during the six Spring and Summer sampling dates. Concentrations ranged from 19.7 to 510 ug/L, with an average of 121 ug/L. The mean of the four, low-flow, summer sample results at each station (including the two Beaver Branch sites) exceeded the recently proposed instream phosphorus criterion of 44 ug/L for warm-water medium gradient (WWMG) wadeable stream ecotype in Class B waters. It is possible that Lemon Fair River would instead be classified as a slow-winder stream ecotype (not yet determined for the reaches sampled); there is no proposed instream phosphorus criterion to date for the slow-winder ecotype. The graph below shows results for the stations located on the Lemon Fair main stem from upstream (right) to downstream (left). During the low-flow conditions sampled in 2012, a slight increasing trend in phosphorus is suggested by the results for April 4, May 2, and August 1. Of particular note is the sharp increase in phosphorus concentration between stations LFR15.8 and LFR12 during baseflow conditions on July 11, August 1 and September 5 – consistent with the previously indicated rise in turbidity for the same dates. Dissolved phosphorus results for these dates (not shown) indicate that this rise is predominantly associated with the particulate fraction of total phosphorus.



Nitrogen concentrations were generally low (ranging from 0.24 to 2.2 mg/L) and well below the state standard for nitrogen as nitrate (5 mg/L). The mean of the four, low-flow, summer sample results at sites LFR15.8, LFR12, LFR6.7, LFR1.2 and Beaver Branch station LFBS1-0.9 exceeded the recently proposed instream nitrogen criteria of 0.75 mg/L for WWMG wadeable stream ecotype in Class B waters.

2013: A more intensive monitoring focus continues for a second year in the Lemon Fair River for the 2013 season, where rotational as well as sentinel stations will be monitored. The Addison County Riverwatch Collaborative will sample for total and dissolved phosphorus, total nitrogen, total dissolved solids, turbidity, and E.coli.

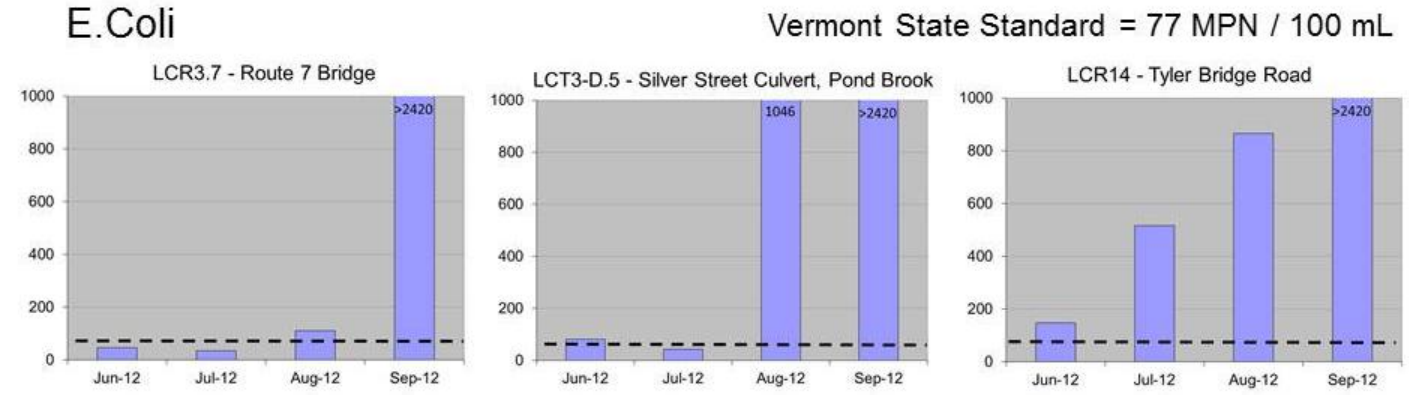
For more information, contact the Lemon Fair sampling coordinator:
Kathy Morse, 545-2859, kmorse@middlebury.edu
http://acrpc.org/addison-county-river-watch-collaborative/contact

2012 – 2013
Focus Watershed

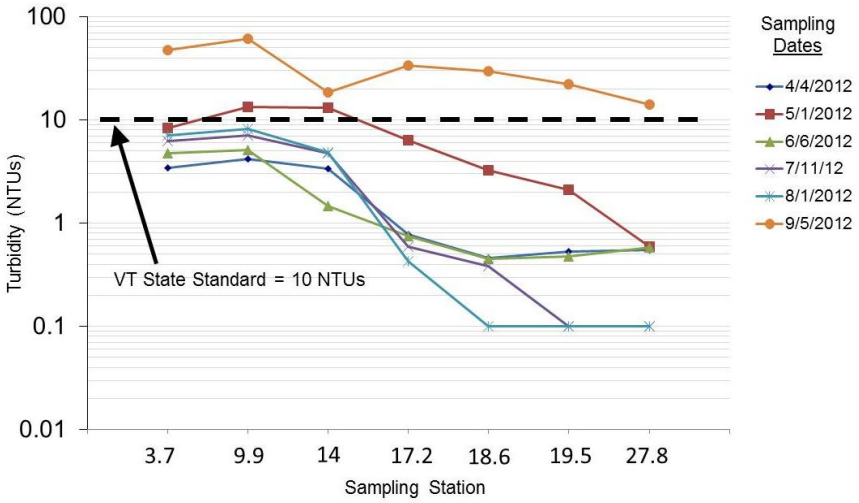
Addison County Riverwatch Collaborative
Lewis Creek - 2012 Water Quality Summary

The Addison County Riverwatch Collaborative has been monitoring water quality in the Lewis Creek since 1992. For the 2012 and 2013 seasons, Lewis Creek is the subject of a more intensive monitoring focus, where rotational as well as sentinel stations are monitored and additional parameters are tested. During 2012, sampling occurred on two spring dates (April 4 and May 1) and four summer dates (June 6, July 11, August 1, and September 5). Samples were tested for phosphorus and turbidity. E.coli was tested at select stations (LCR3.7, LCT3D.5, and LCR14) only on the Summer dates. Flow in the river during all summer dates and the April spring date represented low to baseflow conditions (based on the USGS streamflow gage at the Route 7 crossing). Flows on the May date were moderate due to spring rains. In general, flows in 2012 were below normal, due to the lower than normal rainfall and snowpack within the year.

Site	Location	Town
LCR3.7	Old Route 7 Bridge	Ferrisburgh
LCR9.9	Upper Covered Bridge, Roscoe Rd.	Charlotte
LCR14	Tyler Bridge	Monkton
LCR17.2	Starksboro Ballfields	Starksboro
LCR18.6	Lewis Creek Farm footbridge	Starksboro
LCR19.5	Parsonage Road bridge	Starksboro
LCR27.8	Hillsboro Road	Starksboro
LCT3D.5	Silver Street culvert	Monkton

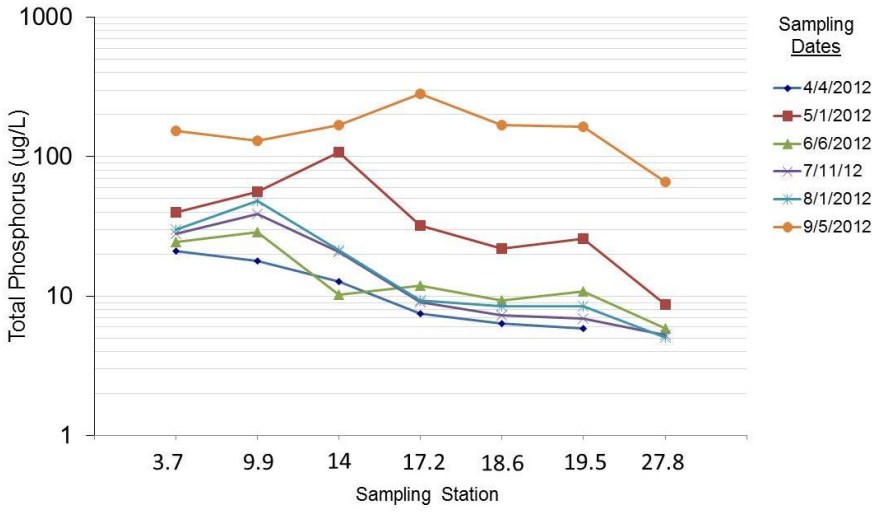


E.coli counts in the Lewis Creek at the three select sites exceeded the state standard of 77 organisms/100 mL on the August 1 and September 5 sample dates. The standard was exceeded on June 6 at the Pond Brook station (LCT3D.5) and Tyler Bridge Road (LCR14) and on July 11 at LCR14. E.coli results exceeded the federal health standard of 235 MPN/100 mL at all three stations on September 5, at LCT3D.5 and LCR14 on August 1, and on July 11 at LCR14. Detected E.coli counts at these sites in the 2012 season were largely consistent with historic results. E.coli counts can become elevated particularly during low flow conditions in the warmer summer months. A similar occurrence of elevated E. coli counts was noted in historic drought years – e.g., 1993 and 1995.

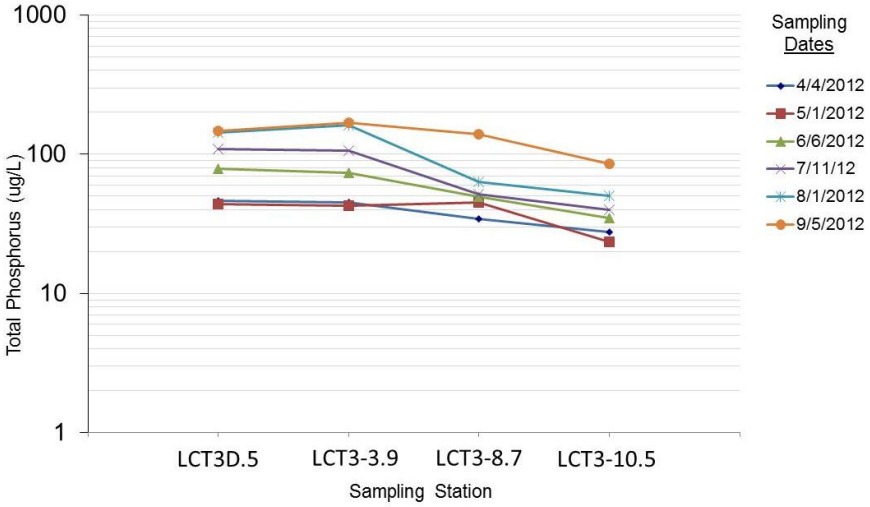


Turbidity levels in the Lewis Creek at the sampled stations ranged from <0.2 to 61.4 NTUs, with a mean level of 8.0 NTUs for the six sample dates. Turbidity levels exceeded the Vermont state standard of 10 NTUs (for Class B cold-water fisheries) at stations LCR9.9 and LCR14 on May 1; flows were moderate due to spring rains. All sites exceeded the standard during low flow conditions on September 5. The graph at left shows turbidity levels from upstream (right) to downstream (left) for the stations along the main stem of the Lewis Creek. During the generally low flow conditions of the 2012 season, a slight increasing trend in turbidity was evident with distance downstream.

Phosphorus was detected at low to moderate concentrations during the six Spring and Summer sampling dates, ranging from 5 to 282 ug/L, with an average of 51 ug/L. The mean concentration of Total Phosphorus for the four available low-flow Summer sample dates (June 6, July 11, August 1, and September 5) at six of the seven Lewis Creek main stem sites (all except LCR27.8) exceeded the proposed criteria of 44 ug/L for the warm-water medium gradient (WWMG) wadeable stream ecotype in Class B waters. Mean values were particularly influenced by the elevated concentrations detected on September 5. The graph at right shows total phosphorus levels from upstream (right) to downstream (left) for the stations along the main stem of the Lewis Creek. During the generally low flow conditions of the 2012 season, an increasing trend in phosphorus concentration was evident with distance downstream.



Pond Brook study: In 2012, a flow monitoring study was carried out in the Pond Brook tributary (LCT3) of Lewis Creek to support restoration and conservation project identification and prioritization. Pond Brook has been identified as a major sediment and phosphorus loader to the Lewis Creek watershed based on Spring / Summer water quality monitoring from 2004 to present (Hoadley, 2011; available at: http://lewiscreek.org/lewis-creek-water-quality). Total Phosphorus concentrations have consistently been above levels which would suggest nutrient enrichment, and have been above the proposed instream nutrient criteria (44 ug/L) for Class B "warm-water medium-gradient" wadeable streams (VTDEC WQD, 2009). The study involved storm event sampling during spring and fall months. Full results will be reported separately in the spring of 2013.



As part of this study, three additional water quality stations were established in the Pond Brook subwatershed to complement the existing rotational site (LCT3D.5) located at the Silver Street crossing of Pond Brook. These stations were sampled on the same dates as the main stem sites. The graph at left shows total phosphorus levels from upstream (right) to downstream (left) for the stations along the Pond Brook. During the generally low flow conditions of the 2012 season, Pond Brook TP concentrations (at LCT3D.5) were greater than the main stem concentrations (at LCR14) on April 4, June 6, July 11, and August 1 and may have accounted in part for the increase in TP concentrations on the main stem between LCR14 and LCR9.9.

2013: A more intensive monitoring focus continues in the Lewis Creek for the 2013 season, where rotational as well as sentinel stations will be monitored and additional parameters tested. Six new stations in the headwaters of the Lewis Creek watershed have been established to evaluate baseline water quality conditions in the upper main stem and the Hillsboro Brook, High Knob Brook, Hogback Brook, Hollow Brook and Pringle Brook tributaries in support of biomonitoring studies to be funded in a subsequent year. At these new sites, along with five existing sites which will double as biomonitoring sites, the Addison County Riverwatch Collaborative will sample for Alkalinity, Total Phosphorus, Total Nitrogen, and Turbidity as well as field parameters including temperature and conductivity.

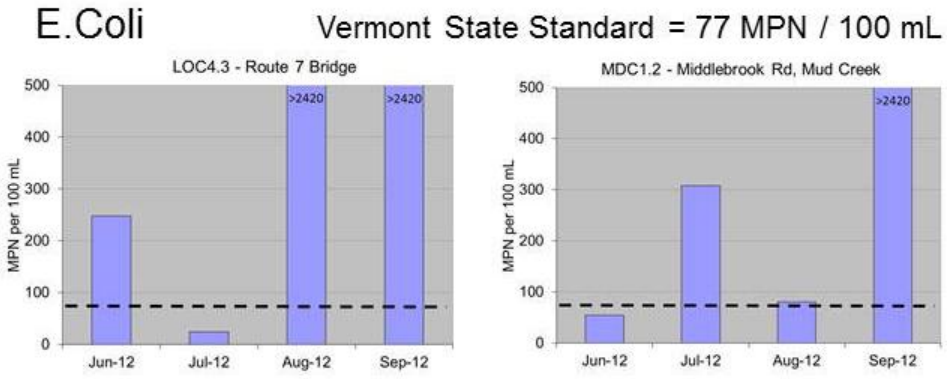
For more information, contact the Lewis Creek sampling coordinator:
Louis DuPont, 453-5538, ldupont@gmavt.net
http://acrpc.org/addison-county-river-watch-collaborative/contact

Addison County Riverwatch Collaborative
Little Otter Creek - 2012 Water Quality Summary

Site	Location	Town
LOC4.3	Route 7 Bridge	Ferrisburgh
MDC1.2	Wing Rd./Middlebrook Rd. (South)	Ferrisburgh

The Addison County Riverwatch Collaborative has been monitoring water quality in the Little Otter Creek since 1997. For years 2012 through 2015, the number of sampling locations in this watershed has been reduced to two sentinel stations, LOC4.3 and MDC1.2. During 2012, sampling occurred on two spring dates (April 4 and May 2) and four summer dates (June 6, July 11, August 1, and September 5). Samples were tested for phosphorus (total and dissolved), total suspended solids, and turbidity; E.coli was tested only on the Summer dates. Flow in the river during all summer dates and the April spring date represented low to baseflow conditions, based on records from the USGS streamflow gages located at the Route 7 crossing. Flows on the May date were moderate due to spring rains. In general, flows in 2012 were below normal, due to the lower than normal rainfall and snowpack within the year.

E.coli counts at the Little Otter Creek watershed stations were well above the state standard of 77 MPN/100 mL and above the federal health-based standard of 235 MPN/100 mL for a one-time detection on most of the four summer sample dates. E.coli concentrations detected at these stations during 2012 are relatively consistent with historic monitoring results. Mud Creek station (MDC1.2) has traditionally had elevated E.coli as it is located directly downstream of a dairy pasture where livestock have direct access to the stream. Very low flow rates on September 5 probably contributed to the high E.coli counts per 100 mL.



Turbidity levels in the Little Otter Creek at the two sentinel stations were moderate and often exceeded the Vermont standard of 10 NTUs (for Class B cold-water fisheries). Values ranged from 4.9 to 117 NTUs, with a mean level of 24 NTUs for the six sample dates. Highest turbidity concentrations in 2012 at each station were detected during very low flow conditions on September 5. Turbidity results for 2012 at these two stations were largely consistent with historic trends. Based on past years' sampling results, turbidity can increase well above the state standard at times of high flow – during a Summer thunderstorm, or during Spring runoff conditions.

Phosphorus levels were detected at low to moderate concentrations during the six Spring and Summer sampling dates. Concentrations ranged from 28.5 to 957 ug/L, with an average of 174 ug/L. Maximum concentrations for the season were detected during very low flow conditions on September 5. Total Phosphorus concentrations detected in 2012 were generally consistent with historic data. Vermont recently proposed in-stream phosphorus criteria for aquatic life and aesthetics uses in wadeable streams (VTDEC, 2009). The mean concentration of Total Phosphorus for four, low-flow Summer sample dates at both sentinel stations exceeded the proposed criteria of 44 ug/L for the warm-water medium gradient (WWMG) wadeable stream ecotype in Class B waters.

2013: The Addison County Riverwatch Collaborative will continue to monitor for E.coli, phosphorus (total and dissolved), total suspended sediments, and turbidity at these two sentinel sites in 2013. An increased number of parameters and additional monitoring sites will be evaluated when a more intensive monitoring focus rotates back to the Little Otter Creek for a two-year period beginning in the year 2016.

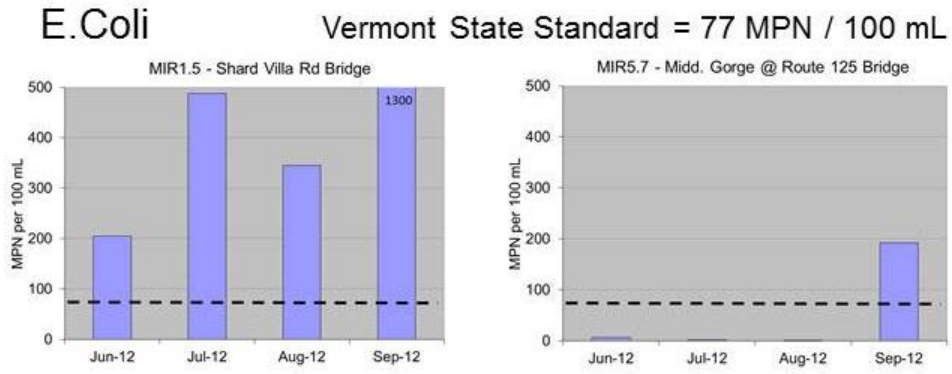
For more information, contact the Little Otter Creek sampling coordinator:
Matt Witten, 434-3236, mwitten@gmavt.net
http://acrpc.org/addison-county-river-watch-collaborative/

Addison County Riverwatch Collaborative
Middlebury River - 2012 Water Quality Summary

Site	Location	Town
MIR1.5	Shard Villa Rd. Bridge	Middlebury
MIR5.7	Midd. Gorge @ Rte 125 Bridge	Middlebury

The Addison County Riverwatch Collaborative has been monitoring water quality in the Middlebury River since 1993. For years 2010 through 2013, the number of sampling locations in this watershed has been reduced to two sentinel stations, MIR1.5 and MIR5.7. During 2012, sampling occurred on two spring dates (April 4 and May 2) and four summer dates (June 6, July 11, August 1, and September 5). Samples were tested for phosphorus and turbidity; E.coli was tested only on the Summer dates. Flow in the river during all summer dates and the April spring date represented low to baseflow conditions (based on streamflow gages in area rivers). Flows on the May date were moderate due to spring rains. In general, flows in 2012 were below normal, due to the lower than normal rainfall and snowpack within the year.

E.coli counts at the Middlebury Gorge near the Route 125 bridge (MIR5.7) were well below the state standard of 77 organisms/100 mL on three sample dates: June 6, July 11, and August 1, but were detected above the standard during very low flow conditions on September 5. E.coli counts at the downstream station at Shard Villa Road bridge (MIR1.5) were well above the state standard on all four summer sampling dates. These results are generally consistent with historic Summer sampling results, which have shown an increase in E.coli levels in the Middlebury River downstream of the Route 7 bridge.



Turbidity levels in the Middlebury River were generally low and below the Vermont state standard of 10 NTUs (for Class B cold-water fisheries). Values ranged from 0.43 to 11.7 NTUs, with an average level of 4 NTUs for all six sample dates. The one value detected slightly above the standard (11.7 NTUs) occurred on June 6 at the Shard Villa Rd sampling station (MIR1.5) during low to moderate flow conditions. Based on past years' sampling results, Turbidity can increase well above the state standard at times of high flow – during a Summer thunderstorm, or during Spring runoff conditions – particularly in the lower section of the river below the Route 7 bridge.

Phosphorus levels were detected at relatively low concentrations during the six Spring and Summer sampling dates, with one exception. A total phosphorus concentration of 36,000 ug/L was reported for the June 6 sample collected at Shard Villa Rd, station MIR1.5. No lab or field quality assurance issues related to this sample were reported. This concentration represents by far the highest concentration of phosphorus that has ever been reported in 20 years of sampling by the Collaborative. Moderately high concentrations of Total Phosphorus have been recorded in past years at times of high flow and runoff in the lower reaches of the Middlebury River – but never at such a high concentration. Samplers are not aware of any changes in land use or other conditions that may be responsible for this one-time detection. For the remainder of the sample results, phosphorus concentrations ranged from 6.9 to 44.7 ug/L, with an average of 16 ug/L. If the outlier result is removed, the mean concentration of Total Phosphorus for the four low-flow Summer sample dates at either site did not exceed the proposed criterion of 44 ug/L for the warm-water medium gradient (WWMG) wadeable stream ecotype in Class B waters.

2013: The Addison County Riverwatch Collaborative will continue to monitor for E.coli, phosphorus and turbidity at these two sentinel sites in 2013. An increased number of parameters and additional monitoring sites will be evaluated when a more intensive monitoring focus rotates back to the Middlebury River for a two-year period beginning in the year 2014.

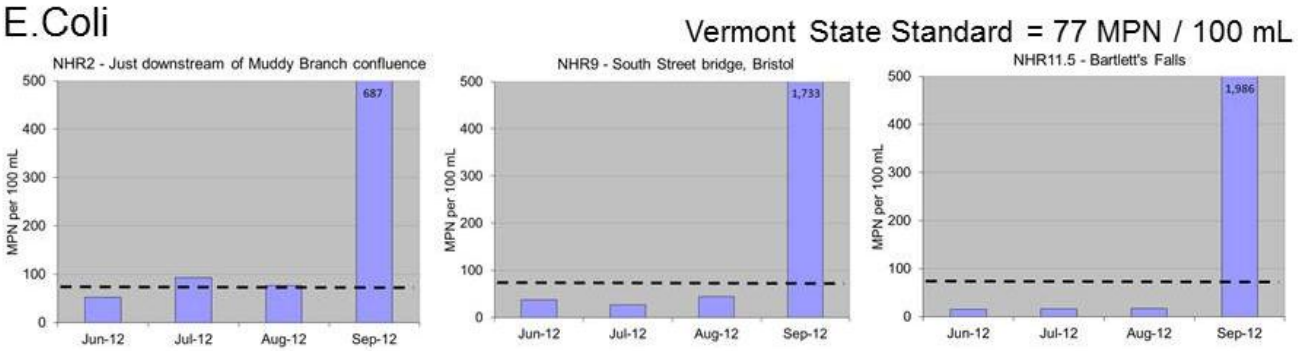
For more information, contact the Middlebury River sampling coordinator:
Heidi Willis, 352-4327, redsprings@nbnworks.net
http://acrpc.org/addison-county-river-watch-collaborative/

Addison County Riverwatch Collaborative
New Haven River - 2012 Water Quality Summary

Site	Location	Town
NHR2	Muddy Branch confluence	New Haven
NHR9	South St. Bridge	Bristol
NHR11.5	Bartlett's Falls Pool	Bristol

The Addison County Riverwatch Collaborative has been monitoring water quality in the New Haven River since 1993. For years, 2012 through 2015, the number of sampling locations in this watershed has been reduced to two sentinel stations, NHR2 and NHR9, and a third recreational site monitored only for E.coli (NHR11.5). During 2012, sampling occurred on two spring dates (April 4 and May 2) and four summer dates (June 6, July 11, August 1, and September 5). The sentinel stations were tested for phosphorus and turbidity. E.coli was tested at these sites and NHR11.5 on the four Summer dates. Flow in the river during all summer dates and the April spring date represented low to baseflow conditions, based on records from the USGS gage on the New Haven River at Brooksville. Flows on the May date were moderate due to spring rains. In general, flows in 2012 were below normal, due to the lower than normal rainfall and snowpack within the year.

E.coli counts at popular recreational sites (South St. Bridge, NHR9; Bartlett's Falls, NHR11.5) were below the state standard of 77 organisms/100 mL on three Summer dates, June 6, July 11, and August 1. On September 5, during a period of very low flows, E.coli concentrations were well above the state standard and the federal health-based standard of 235 MPN/100 mL for a one-time detection. A similar occurrence of elevated E. coli counts was noted in historic drought years – e.g., 1993 and 1995. A slight increasing trend in E.coli levels is evident from this year's results with distance downstream from station NHR11.5 to NHR2, consistent with historic trends. In contrast, the elevated concentrations at very-low flow conditions on September 5 seem to indicate a decreasing trend with downstream distance.



Turbidity levels on the New Haven River at the two sampled stations ranged from <0.2 to 24.8 NTUs, with a mean level of 4.2 NTUs for the six sample dates. Turbidity levels exceeded the Vermont state standard of 10 NTUs (for Class B cold-water fisheries) at site NHR9 during the very low flow condition sampled on September 5. Results from 2012 are largely consistent with historic trends. Based on past years' sampling results, turbidity can increase well above the standard at times of increased flow – during a Summer thunderstorm, or during Spring runoff conditions – especially in the lower reaches of the river below the Bristol Flats. A slight increasing trend in turbidity with distance downstream is generally observed during all flow conditions.

Phosphorus was detected at relatively low concentrations on the New Haven River during the Spring and Summer sampling dates. Concentrations ranged from 5.7 to 103 ug/L, with an average of 20 ug/L. Results were consistent with historic trends, which indicate an increase in concentrations with distance downstream. At all stations, moderately high concentrations of Total Phosphorus have been detected in past years at times of high flow and runoff. In 2012, the mean concentration of Total Phosphorus for the four available low-flow Summer sample dates (June 6, July 11, August 1, September 5) at each of the New Haven River sites did not exceed the proposed criterion of 44 ug/L for the warm-water medium gradient (WWMG) wadeable stream ecotype in Class B waters.

2013: The Addison County Riverwatch Collaborative will continue to monitor for E.coli, phosphorus and turbidity at these sentinel sites in 2013. An increased number of parameters and additional monitoring sites will be evaluated when a more intensive monitoring focus rotates back to the New Haven River for a two-year period beginning in the year 2016.

For more information, contact the New Haven River sampling coordinator:
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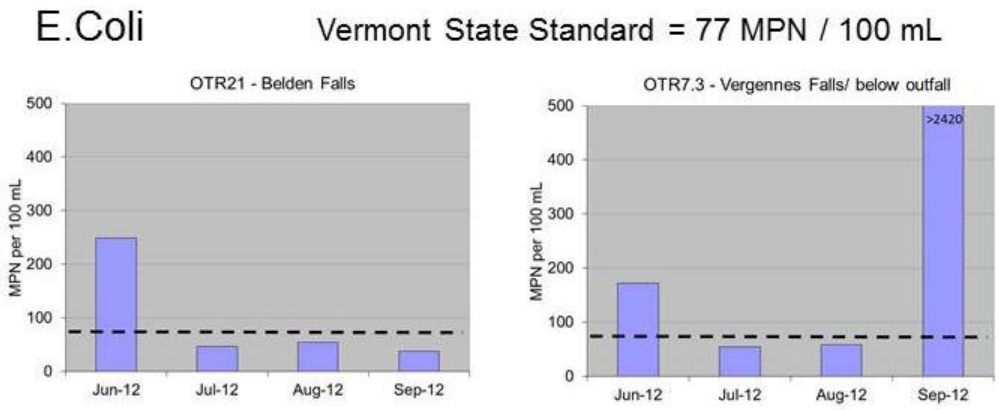
Addison County Riverwatch Collaborative
Otter Creek - 2012 Water Quality Summary

Site	Location	Town
OTR21	Belden Falls	New Haven
OTR7.3	Vergennes Falls/below outfall	Vergennes

The Addison County Riverwatch Collaborative has been monitoring water quality in the lower Otter Creek since 1992. For years 2010 through 2013, the number of sampling locations in this watershed has been reduced to two sentinel stations, OTR21 and OTR7.3. During 2012, sampling occurred on two spring dates (April 4 and May 2) and four summer dates (June 6, July 11, August 1, and September 5). Samples were tested for phosphorus and turbidity; E.coli was tested only on the Summer dates. Flow in the river during all summer dates and the April spring date represented low to baseflow conditions (based on streamflow gages in area rivers). Flows on the May date were moderate due to spring rains. In general, flows in 2012 were below normal, due to the lower than normal rainfall and snowpack within the year.

E.coli concentration in the Otter Creek at the Belden Falls site (OTR21) on June 6 was above the state standard of 77 MPN/100 mL and slightly above the federal health-based standard of 235 MPN/100 mL for a one-time detection. At the downstream Vergennes Falls station (OTR7.3) E.coli counts were above the state standard on June 6 and well above the state and federal standards on September 5. E.coli concentrations detected at these sentinel stations during 2012 are relatively consistent with historic results.



Turbidity levels in the Otter Creek at the two sentinel stations were generally low and below the Vermont state standard of 25 NTUs (for Class B warm-water fisheries), except for the September 5 sample at OTR7.3 where a value of 31.6 NTUs was reported. Values ranged from 2.3 to 31.6 NTUs, with a mean value of 9.8 NTUs for the six sample dates. Results are consistent with historic data, which indicate that median turbidity values are generally less than 10 NTUs.

Phosphorus levels were detected at relatively low concentrations during the six Spring and Summer sampling dates. Concentrations ranged from 18 to 343 ug/L, with an average of 62 ug/L. Moderately high concentrations of Total Phosphorus have been recorded in past years at times of high flow and runoff. In 2012, the mean concentration of Total Phosphorus at site OTR7.3 for the four low-flow Summer sample dates (June 6, July 11, August 1, and September 5) was 124 ug/L. This value is higher than the proposed criterion of 44 ug/L for the warm-water medium gradient (WWMG) wadeable stream ecotype in Class B waters. The Otter Creek might instead be classified as a Slow Winder stream, but criteria have not yet been developed for this ecotype.

Nitrogen levels were detected at very low concentrations during the six Spring and Summer sampling dates, well below the state standard for nitrogen as nitrate (5 mg/L). Concentrations ranged from 0.45 to 0.64 mg/L, with an average of 0.5 mg/L. The mean values of the Summer, low-flow, sample results at sites OTR21 and OTR7.3 (0.59 and 0.51 mg/L, respectively) were below the recently proposed instream nitrogen criteria of 0.75 mg/L for WWMG wadeable stream ecotype in Class B waters.

2013: The Addison County Riverwatch Collaborative will continue to monitor for E.coli, phosphorus, nitrogen and turbidity at two sentinel sites in 2013. Station OTR18 (Twin Bridges Picnic Area) will be substituted for OTR21, due to site access concerns at OTR21. An increased number of parameters and additional monitoring sites along the Otter Creek will be evaluated when a more intensive monitoring focus rotates back to the watershed for a two-year period beginning in the year 2014.

For more information, the Otter Creek sampling coordinator:
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