

Middlebury River – 2014 and 2015 Water Quality Summary

Addison County River Watch Collaborative

River Name	Site	Location	Town
Middlebury River	MIR0	Mouth of Middlebury River	Middlebury
Middlebury River	MIR1.5	Shard Villa Rd. Bridge	Middlebury
Middlebury River	MIR2	Blake Roy Rd. Bridge	Salisbury
Middlebury River	MIR3	Route 7 Access	Middlebury
Middlebury River	MIR5.7	Midd. Gorge @ Rte 125 Bridge	Middlebury
North Branch MR	MRNB1.7	Dugway Road Bridge	Ripton
North Branch MR	MRNB3.5	Norton Farm Rd Bridge	Ripton
MR (Middle Branch)	MIR10.6	Natural Turnpike Road	Ripton
MR (Middle Branch)	MIR13	Wagon Wheel Rd Bridge	Ripton
South Branch MR	MRSB1	Goshen Road Bridge	Ripton
South Branch MR	MRSB4.2	Brook Road Bridge	Ripton
Halnon Brook MR	MRHT0.1	Upstream of Route 7 crossing	Salisbury

The Addison County River Watch Collaborative has been monitoring water quality in the Middlebury River since 1993. For the 2014 and 2015 seasons, the Middlebury River has been the subject of a more intensive monitoring focus, where rotational as well as sentinel stations were monitored and additional parameters were tested. Seven new water quality monitoring stations were established on tributaries in the Middlebury River watershed during years 2014 and 2015. Two new stations (MIR10.6 and MIR13) are located on the Middle Branch of the Middlebury River which is essentially an extension of the main stem of the river. Two new stations (MRSB1 and MRSB4.2) were established on the South Branch tributary coincident with biomonitoring stations maintained by the VTDEC. The South Branch joins the main stem of the Middlebury River in Ripton village downstream of station MIR10.6 (Natural Turnpike crossing) and well upstream of station MIR5.7 at the East Middlebury Gorge. Two stations (MRNB1.7 and MRNB3.5) were located on the North Branch, which also joins the main stem between sites MIR10.6 and MIR5.7, although well below the village of Ripton along Rt 125. One additional site on a small tributary to Halnon Brook was established to assess the potential influence of a fish hatchery. This site is located east of Route 7 along the road leading to Lake Dunmore. Below this station, the brook crosses Route 7 to join Halnon Brook, which itself meanders through agricultural lands and wetlands to join the Middlebury River main stem immediately upstream of the Blake Roy Rd bridge (site MIR2). These seven tributary stations were monitored along with five rotational and sentinel stations distributed along the main stem downstream from the Gorge to the confluence with Otter Creek.

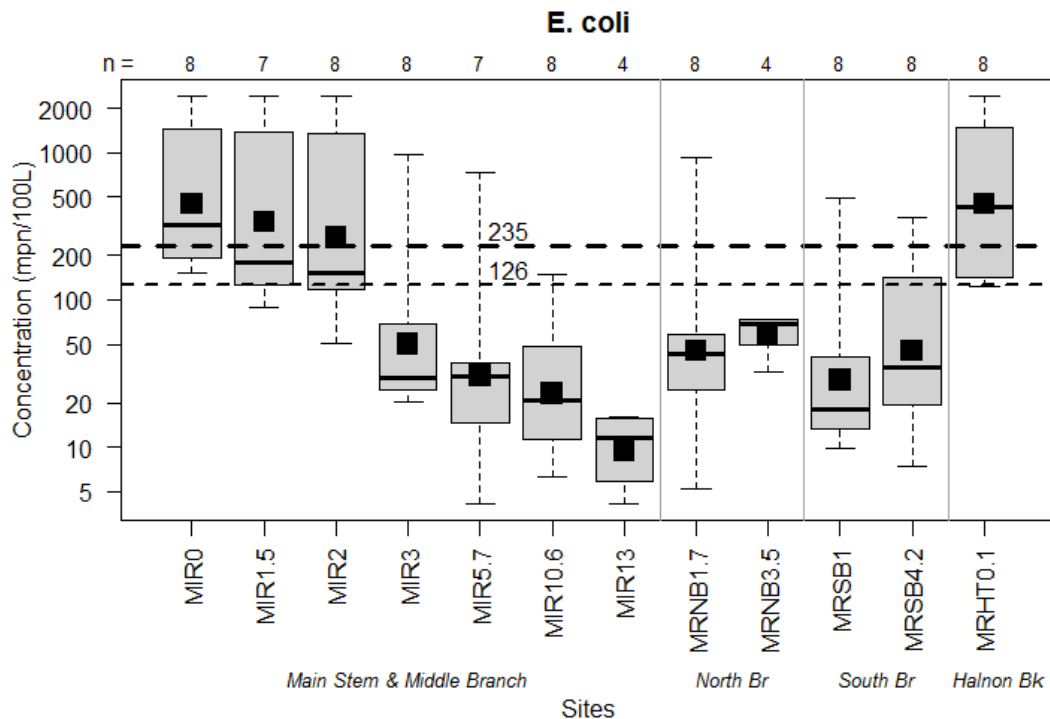
Table 1 (next page) summarizes the flow conditions captured during scheduled sample dates in 2014 and 2015, based on streamflow gaging records from nearby gages on the New Haven River and Lewis Creek. Generally, April events captured high flows coincident with snowmelt each year. Three baseflow events were sampled: one in 2014 on July 2, and two in 2015 on May 6 and September 2. The remaining events occurred during moderate to high flow conditions resulting from higher-than-normal rainfall in the spring and early summer months and isolated storm events. On an average annual basis, flows in both 2014 and 2015 were near normal in the Addison County watersheds monitored by the Collaborative.

Table 1. Streamflow conditions during sampling events, 2014-2015. (per VTDEC Guidance on Streamflow Observations at time of Water Quality Sampling of Rivers and Streams)

Year	Sample Date	Flow Condition	Flow Category
2014	April 9	High	Freshet Flow/ Snowmelt
	May 7	High	Freshet Flow
	June 4	Moderate	Freshet Flow
	July 2	Moderate	Baseflow
	August 6	High	Freshet Flow
	September 3	Moderate	Freshet Flow
2015	April 8	High	Freshet Flow/ Snowmelt
	May 6	Moderate	Baseflow
	June 3	High	Freshet Flow
	July 1	High	Freshet Flow
	August 5	Moderate	Freshet Flow
	September 2	Low	Baseflow

Samples were tested for E.coli, total phosphorus, total nitrogen and turbidity; E.coli was tested only on the summer dates. As part of the baseline water quality study, alkalinity was tested at the newly-established tributary sites during the summer months only.

Figure 1. Summary of E.coli Results for Middlebury River sites, 2014-2015.



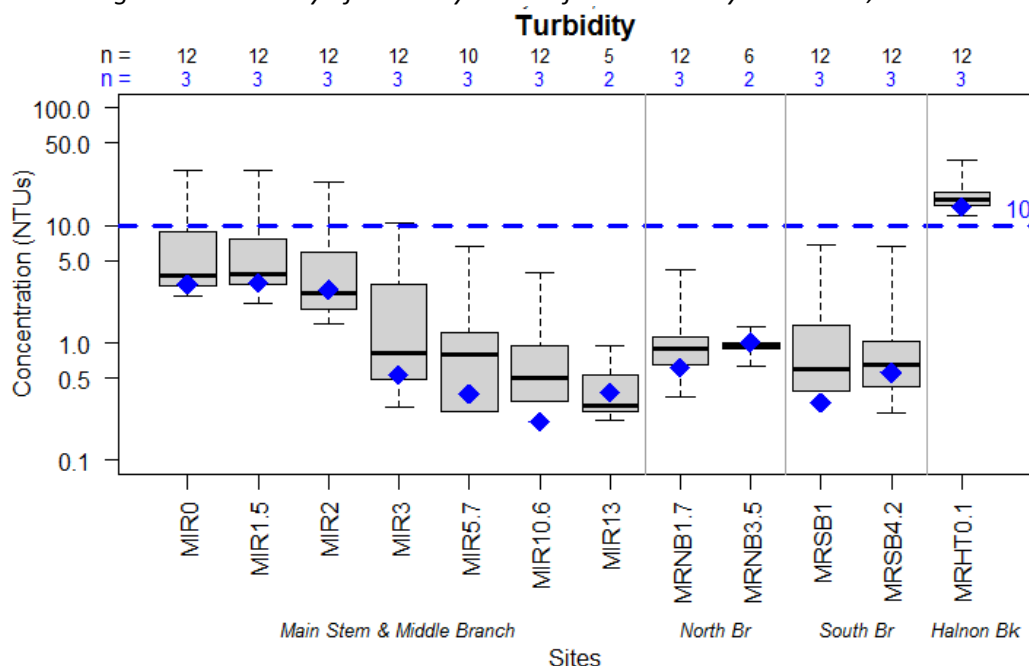
E.coli counts at sites on the Middlebury River main stem and tributaries ranged from 4.1 to >2,420 organisms/ 100 mL during 2014 and 2015. The box-and-whisker chart in Figure 1 summarizes E. coli concentrations detected at all Middlebury River main stem and tributary stations in 2014 and 2015. The whiskers extend to the maximum and minimum values detected in those two years, while the gray-shaded

box represents the interquartile range of values. The median value is marked by the dark horizontal line. The geometric mean of all available samples for each station is displayed as the black square symbol. The number of samples (n) represented by each box-and-whisker is displayed across the top of the chart. Since the Wagon Wheel station on the Middle Branch (MIR13) and the Norton Farm Bridge station on the North Branch (MRNB3.5) were sampled in 2015 and not in 2014, there are only 4 sample results reported for each of these stations. A valid box-and-whisker plot should be based on at least 5 samples, so the reader should focus simply on the median value for these two stations represented by the dark horizontal line. The black dashed lines in the figure above represent the health-based standards for E.coli. Vermont Water Quality Criteria (October 2014) state that E.coli is not to exceed a geometric mean of 126 organisms /100ml obtained over a representative period of 60 days, and no more than 10% of samples should be above 235 organisms/100 ml. One or more samples from all stations except the Middle Branch sites and the Norton Farm Rd bridge site on North Branch exceeded the 235 mpn/100 L on one or more dates. The geometric mean of the Halnon Brook site and the lowest three stations on the main stem exceeded the geometric mean standard of 126 org/100 mL.

Along the main stem, E.coli counts showed an increasing trend with distance downstream from the Middlebury Gorge, consistent with historic results. Agricultural land uses dominate the river corridor in this lower end of the Middlebury River. A majority of the E.coli results for the Halnon Brook site over both years also exceeded the health-based standard. At the popular swimming site, MIR5.7 at the East Middlebury gorge, E.coli values were generally below the health-based standard except during very low flow conditions on September 3 in 2014.

Turbidity levels in the Middlebury River during 2014 and 2015 were relatively low, ranging from <0.2 to 36 NTUs, with an average level of 4.6 NTUs for all samples collected. The box-and-whisker plot below shows the full distribution of Turbidity results for samples collected over the two seasons. The blue diamond marks the mean of that subset of samples collected during baseflow conditions, with the corresponding number of samples (n) indicated in blue along the top of the chart.

Figure 2. Summary of Turbidity Results for Middlebury River sites, 2014-2015.

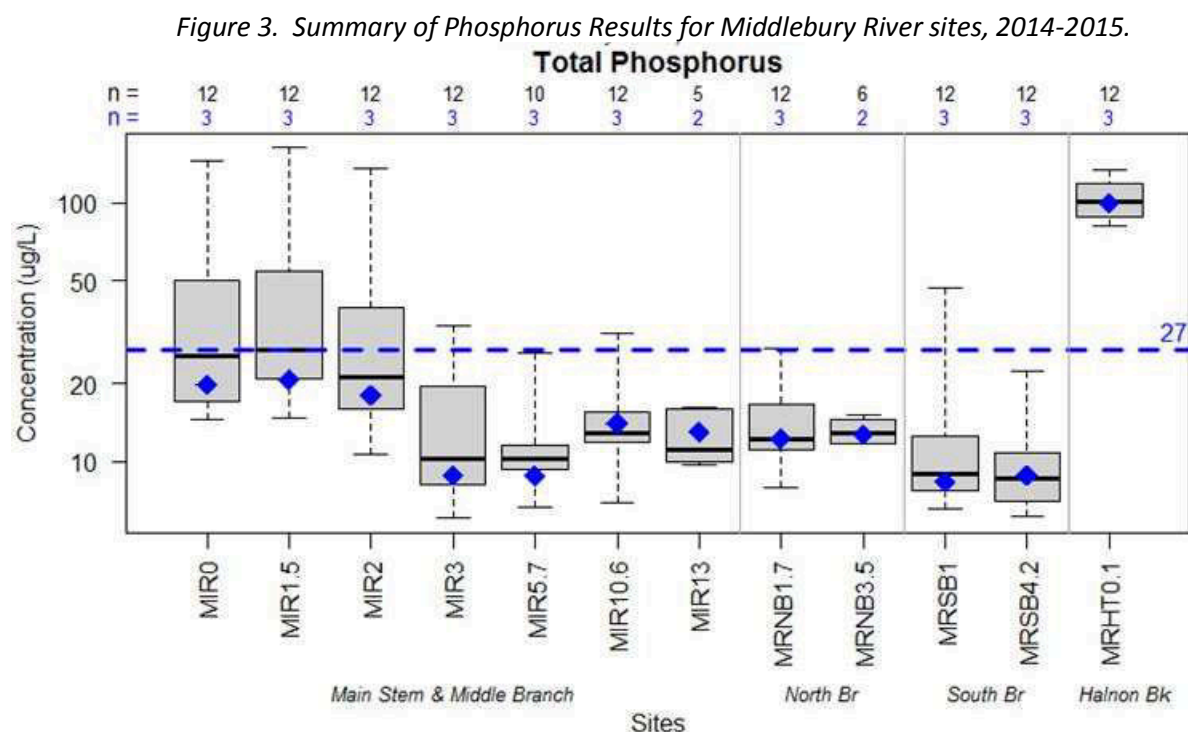


The Vermont state standard of 10 NTUs (for Class B cold-water fisheries) is applicable during baseflow conditions. The mean turbidity value for (up to 3) baseflow sampling events conducted over both seasons did not exceed this turbidity standard, except at the newly-established Halnon Brook station, MRHT0.1. This station is located downstream from a fish hatchery.

Main stem results (left-half of the chart) are largely consistent with historic trends. Based on past years' sampling results, turbidity can become elevated at times of increased flow – during a summer thunderstorm, or during spring runoff conditions – especially in the lower reaches of the river below the Route 7 bridge. A slight increasing trend in turbidity with distance downstream is generally observed during all flow conditions. Turbidity can occur as a result of high suspended sediments in the water (during moderate to high flows) and as a result of algae during low flow conditions.

Nitrogen levels were detected at very low concentrations over the two years of spring and summer sampling dates. Concentrations ranged from 0.2 to 0.9 mg/L, with an average of 0.4 mg/L. A past standard for nitrogen as nitrate (5 mg/L) was eliminated during the 2014 update of the Vermont Water Quality Standards.

Phosphorus levels were detected at low to moderate concentrations during 2014 and 2015, ranging from 6.2 to 164 ug/L, with a mean of 29 ug/L. The distribution of Phosphorus results is displayed in the box-and-whisker plot below. The blue diamond marks the mean of that subset of samples collected during baseflow conditions, with the corresponding number of samples (n) indicated in blue along the top of the chart.



For each station except Halnon Brook, the mean concentration of Total Phosphorus for the three available baseflow events (July 2014; May and September 2015) was below the approved instream nutrient standard of 27 ug/L for the warm-water medium gradient (WWMG) Wadeable Stream Ecotype in Class B waters.

Along the main stem (left-half of chart), phosphorus concentrations showed an increasing trend with distance downstream from the Middlebury Gorge (MIR5.7), consistent with historic results. Phosphorus concentrations at the tributary stations were generally lower than concentrations along the main stem on all sample dates, with the exception of the Halnon Brook station. Phosphorus concentrations at this location were elevated during all flow conditions relative to the other Middlebury River stations. This station is located downstream from a fish hatchery.

Alkalinity detected at tributary monitoring sites during the summer sampling dates ranged from 10 to 185 mg CaCO₃ per liter. Highest values were consistently detected at the Halnon Brook station, MRHT.01.

2016: Beginning in 2016, Middlebury River watershed will rotate out of focused monitoring, and sampling will be conducted for a reduced number of parameters at sentinel stations only. A third sentinel station in the upper watershed (MIR10.6 at Natural Turnpike crossing of Middle Branch) has now been established to complement long-time sentinel stations at the East Middlebury gorge (MIR5.7) and Shard Villa Road bridge (MIR1.5).

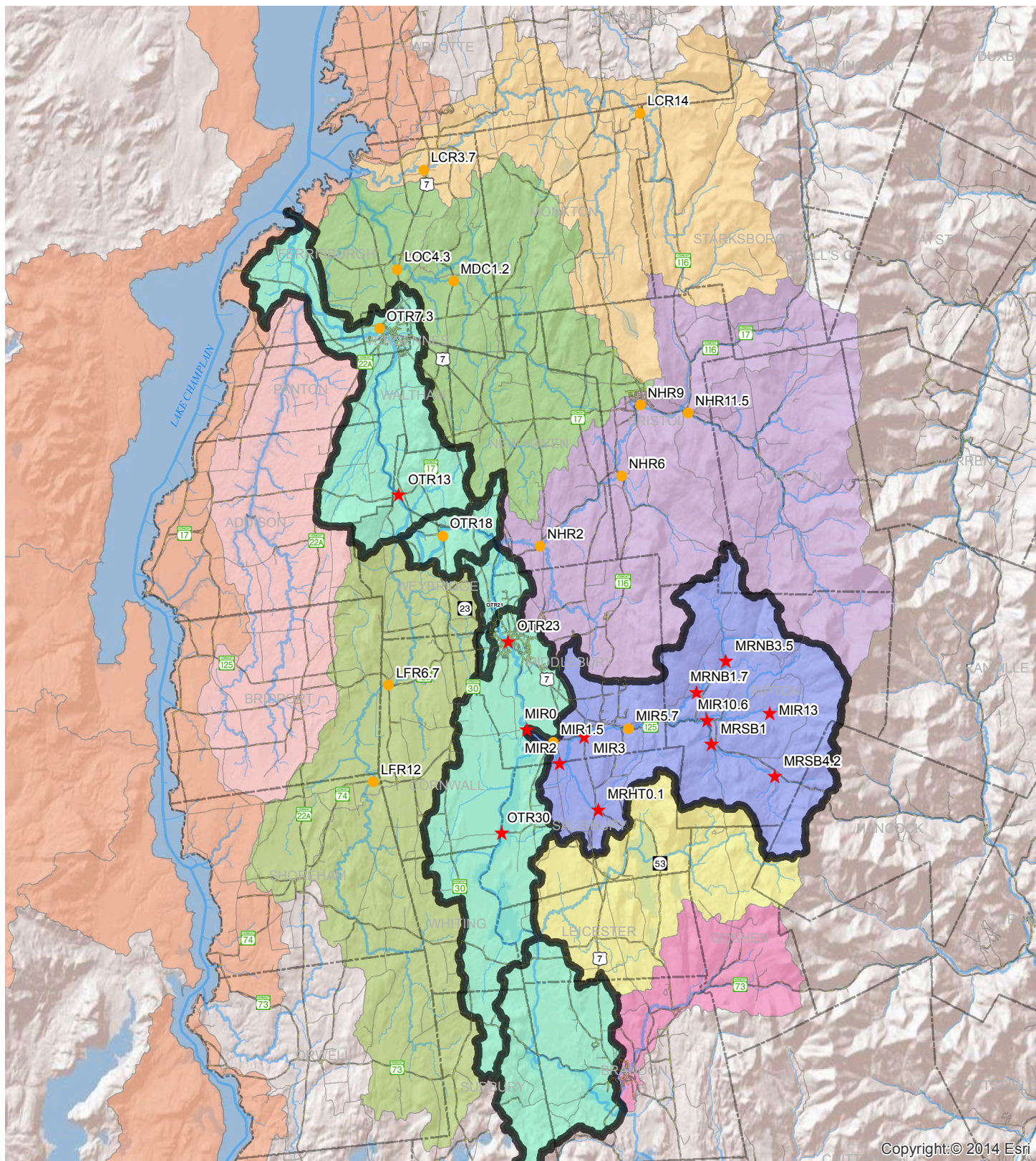
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Addison County River Watch Collaborative


Water Quality Monitoring Sites by Watershed, 2015



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- ★ Rotational Site
- Sentinel Site

Roads
 — Pavement
 — Gravel

Rotational Basins 2015
 Otter Creek
 Middlebury River

Lake Champlain Direct
 Lewis Creek
 Little Otter Creek
 Otter Creek
 New Haven River

Dead Creek
 Lemon Fair River
 Leicester River
 Middlebury River
 Neshobe River



The Addison County River Watch 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.