

New Haven River - 2016 Water Quality Summary
Addison County River Watch Collaborative

Site	Location	Town
NHR0.5	Former Dog Team Tavern	New Haven
NHR2	Muddy Branch confluence	New Haven
NHR5	New Haven Mills / Munger St Bridge	New Haven
NHR6	Route 116 Bridge, Sycamore Park	Bristol
NHR9	South St. Bridge	Bristol
NHR11.5	Bartlett's Falls Pool	Bristol
NHR13	York Hill Rd Bridge	Lincoln
NHR15	S. Lincoln Bridge (Gap Rd.)	Lincoln
NHM0.4	Just above confluence at Nash Farm	New Haven
NHM1.4	Halpin Covered Bridge Rd	New Haven
NHM3.6	Painter Road crossing	Middlebury
NHM5.2	Munger Road crossing	Middlebury
NHWB0.2	Cove Road crossing	Bristol
NHWB2.7	Rt 116 below Elephant Mtn Campground	Bristol

The Addison County River Watch Collaborative has been monitoring water quality in the New Haven River since 1993. For the 2016 and 2017 seasons, the New Haven River is the subject of a more intensive monitoring focus, where rotational as well as sentinel stations are monitored and additional parameters are being tested to better define spatial variability in pathogen, sediment and nutrient concentrations. New Haven River is listed as a stressed water, with *E.coli* and sediment impacting contact recreation and aquatic habitat uses (VTDEC, 2016).

Monitoring was resumed at four historic water quality stations on the main stem to complement sentinel stations NHR2 and NHR9 and established swimming hole sites NHR6 and NHR11.5. In addition, six new bracket monitoring stations were established on two tributaries of the lower main stem to better define the degree and extent of water quality conditions on these waters. Four new stations were established at road crossings on the Muddy Branch which drains the northeastern third of the town of Middlebury and joins the New Haven River at the former Nash Bridge. Two new stations were set up on the West Brook tributary which drains north along VT Route 116 and joins the New Haven River nearly one mile downstream of Sycamore Park.

During 2016, sampling occurred on two spring dates (April 6 and May 4) and four summer dates (June 1, July 6, August 3, and September 7). Following a February thaw and final ice-out and snowmelt in early March, the April and May sampling events took place during relatively low flows, characterized as baseflow conditions on the river, based on streamflow gaging records from the USGS streamflow gage on the New Haven River at Brooksville. Given below-normal rainfall, the June, July, August and September events occurred during low to very-low flows also representative of baseflow conditions (i.e., relatively stable flow stage, not significantly rising or falling in response to a rainfall or snowmelt event). On an average annual basis, flows in 2016 were below normal in the six Addison County watersheds monitored by the Collaborative.

Samples were tested for *E.coli*, phosphorus (total and dissolved), total nitrogen, total suspended solids, and turbidity; *E.coli* was tested only on the summer dates.

E.coli counts at sites in the New Haven River watershed ranged from 3.0 to 1,553 organisms/100 mL. 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. The box-and-whisker chart in Figure 1 summarizes *E. coli* concentrations detected at all stations on summer sampling dates. The whiskers extend to the maximum and minimum values, 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. The horizontal, gray dashed lines in Figure 1 represent the health-based and geomean standards for *E.coli*.

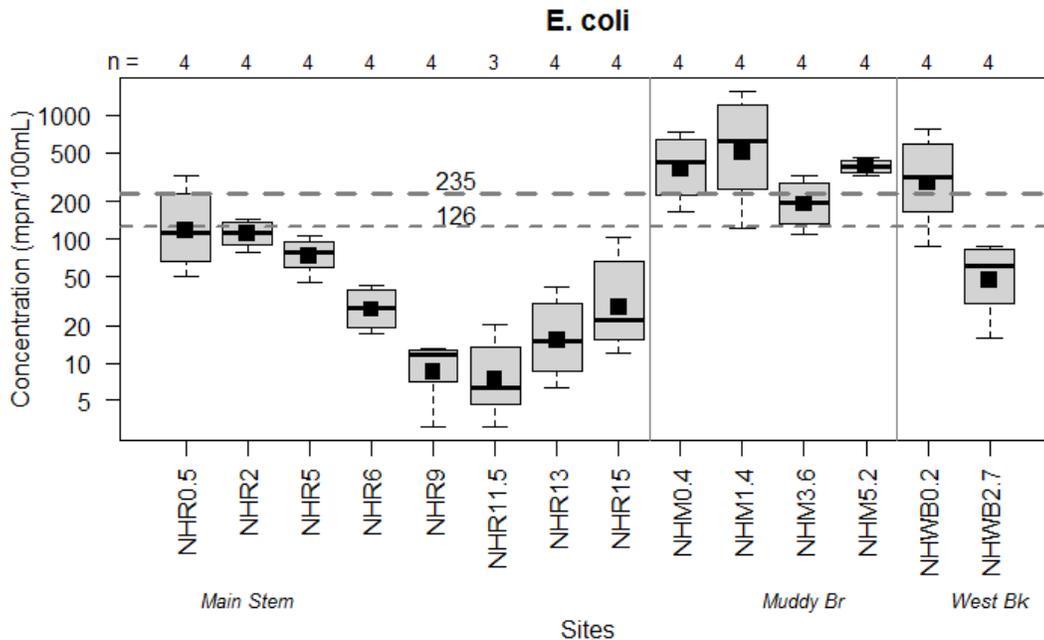


Figure 1. *E. coli* measured at New Haven River watershed stations on four dry-weather, low-flow dates in 2016.

Consistent with historic results, an increasing trend in *E.coli* levels is evident with distance downstream along the main stem from station NHR11.5 (Bartlett’s Falls) to NHR2 (Nash Bridge). Developed and agricultural land uses are more prevalent in the lower New Haven River watershed. Newly-monitored West Brook joins the main stem nearly one mile downstream of Sycamore Park, between stations NHR6 and NHR5. Muddy Branch joins the main stem at the Nash Bridge just above station NHR2. *E.coli* counts in these tributary stations were elevated above the health-based standard on one or more summer sampling dates, except for the uppermost station on West Brook at the VT Route 116 crossing just downstream of Elephant Mountain campground. The geometric mean of concentrations for all four Muddy Branch stations and the downstream-most West Brook station were also elevated above the 126 org/100mL geomean standard. The incremental drainage areas of these tributary stations are dominated by agricultural (24 to 58%) and developed (1 to 13%) land uses, while the uppermost site on West Brook (NHWP2.7) has a drainage area that is 96% forested.

E. coli counts at popular recreational sites (e.g., Bartlett’s Falls [NHR11.5], Sycamore Park [NHR6], and New Haven Mills [NHR5]) were below the health-based standard of 235 org/100 mL on all summer dates except for the September 3 sample from Nash Bridge in New Haven (NHR2).

Turbidity levels at the New Haven River watershed sites ranged from <0.2 to 35.5 NTUs for the six sample dates. The Vermont state standard of 10 NTUs (for Class B cold-water fisheries) is applicable during dry-weather, baseflow conditions which were relevant to all six sample dates.

The box-and-whisker plot in Figure 2 below shows the full distribution of Turbidity results for samples collected during six spring and summer events in 2016. 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. Detected concentrations were below the standard at all main stem sites on all six sample dates, and the mean of results was below this standard for each of the new stations on West Brook. On the other hand, the Turbidity standard was exceeded on multiple sample dates for all four of the Muddy Branch stations.

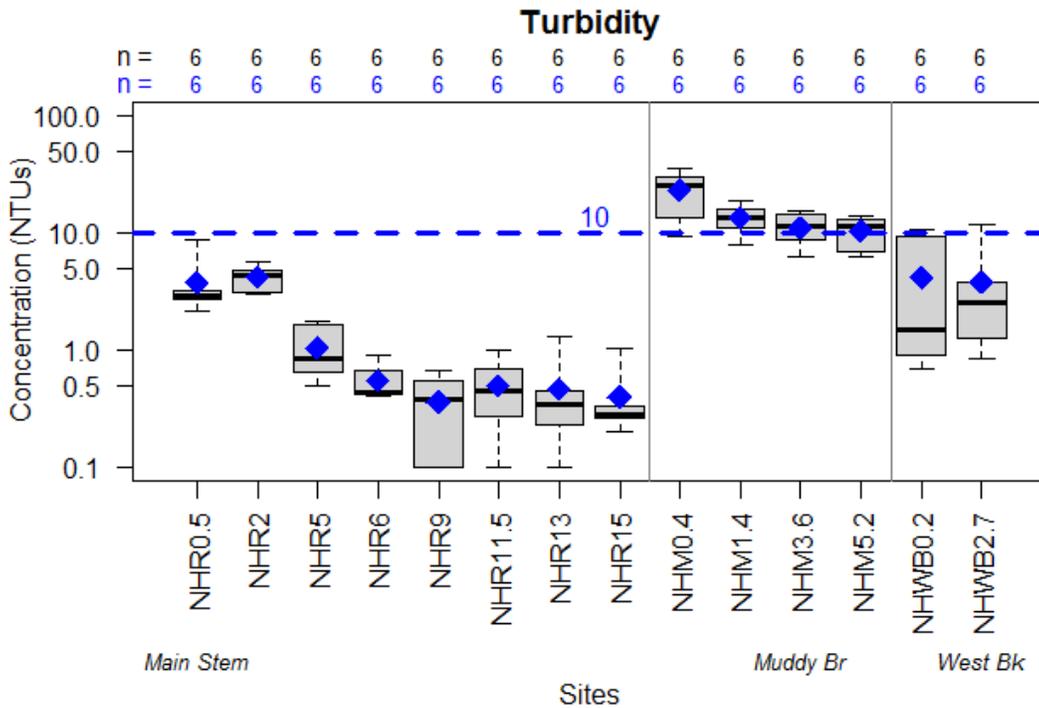


Figure 2. Summary of Turbidity results for New Haven River, 2016.

Based on past years' monitoring 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 Bristol Flats. A slight increasing trend in turbidity with distance downstream is generally observed during all flow conditions.

Nitrogen was tested in samples collected only from the new stations established in West Brook and Muddy Branch, and was detected at relatively low concentrations at most stations during the six spring and summer sampling dates, ranging from 0.3 to 4.2 mg/L. Highest nitrogen concentrations were detected at the downstream station on West Brook, which has an incremental drainage area characterized by 58% agricultural land use. According to Vermont Water Quality Standards, nitrogen as nitrate (NO₃) is not to exceed 5.0 mg/L at flows exceeding the low median monthly discharge. In order to evaluate nitrogen levels in the New Haven River with respect to this standard, a more specific lab test will be scheduled for these stations in 2017 to distinguish between nitrite and nitrate forms of nitrogen.

Phosphorus was detected at low to moderate concentrations on the New Haven River during the spring and summer sampling dates. Concentrations ranged from 5.0 to 73 µg/L, with an average of 22.5 µg/L. The instream phosphorus criterion of 27 µg/L for warm-water medium gradient (WWMG) Wadeable Stream Ecotypes in Class B waters is applicable at low median monthly flow during June through October. Based on gaging records from the New Haven River at Brooksville, flows were below the low median monthly flow on the July, August, and September sample dates. The mean of the results available for these three summer sampling dates exceeded the standard at all four stations on the Muddy Branch (Figure 3). Historic results for both sentinel and rotational sites have shown an increasing trend in phosphorus concentration with distance downstream, as well as a tendency for elevated phosphorus concentrations during high flows. Dissolved phosphorus was also tested at each of the six new sites in 2016. As a percentage of Total Phosphorus, DP ranged from 31 to 100% during these six sample dates which occurred during dry-weather, low-flow conditions.

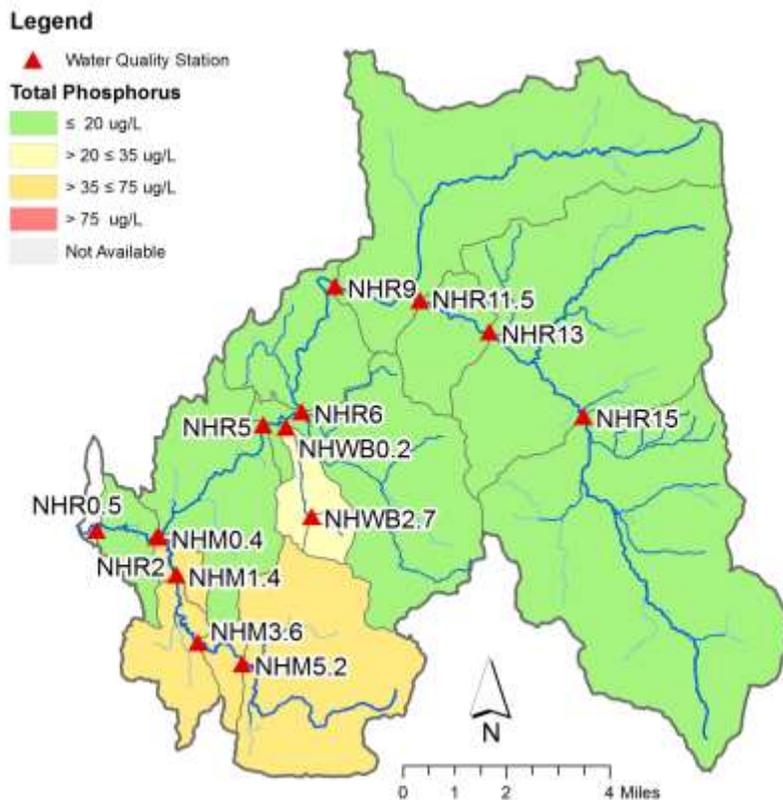


Figure 3. Mean value of Total Phosphorus detected on July, August and September sample dates during low flow conditions at or below the Low-Median-Monthly Flow, New Haven River, 2016

2017: The New Haven River will continue to be a focus watershed in 2017, with the same sentinel and rotational sites monitored for *E.coli*, total and dissolved phosphorus, total nitrogen, and turbidity. Given the elevated nitrogen concentrations in tributary sites, an additional lab analysis has been scheduled to distinguish between nitrite and nitrate forms of nitrogen. Beginning in year 2018 and continuing through 2021, the number of sampling locations in this watershed will be reduced to two sentinel stations, NHR2 and NHR9, and two swimming hole sites, NHR11.5 and NHR6, as the focus of more intensive sampling rotates to another Collaborative watershed.

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