Water Quality Monitoring

2017 Program Report

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Introduction

2017 was the inaugural year of a new water quality monitoring program in both the Vermont and Massachusetts portions of the Deerfield River Watershed conducted with the support of the Vermont Agency of Natural Resource's LaRosa Partnership, the Connecticut River Conservancy, and DRWA volunteers.

Past Monitoring Efforts

DRWA Past Volunteer Monitoring

DRWA monitored water quality in Deerfield River and several tributaries (primarily in Massachusetts) from 1990-2005. 1990-1998 focused on chemical data parameters including pH, alkalinity, and dissolved oxygen (DO). In 1998, DRWA reduced its chemical monitoring frequency and introduced testing for fecal coliform bacteria. After relying on outside labs for three years, DRWA established its own bacteria testing lab in Shelburne Falls in 2001. The program was discontinued after 2005. Generally, results from this period demonstrate that the watershed has low alkalinity and pH which can impact some aquatic species, and high dissolved oxygen which is good for supporting a coldwater fishery. Bacteria levels tended to be low during dry weather and become elevated at some sites after heavy rains.

DRWA Macroinvertebrate Monitoring

DRWA conducted macroinvertebrate sampling projects every year from 2005-2008 and in 2011. The projects focused on the Green River (2005), South River (2006), effects of regulated flows on macroinvertebrates (2006), North River (2007), Deerfield River Tributaries (2008), and Deerfield headwater streams (2011).

The Green River study conducted in 2005 sampled four mainstem Green River sites (one in Vermont and two in Massachusetts as well as eight sites (two in Vermont and six in Massachusetts) on lower reaches of Green River tributaries. Habitat conditions varied greatly with a general trend of becoming more degraded closer to Greenfield. Macroinvertebrates communities also reflected this trend of becoming more impacted the further down in the watershed and closer to Greenfield

The 2006 South River study sampled eight sites on the mainstem and five tributaries. Mainstem sites ranged from non-impacted to moderately impacted. Tributary sites ranged from non-impacted to slightly impacted.

Another 2006 study looked at the effects of regulated flows. Four sites in regulated reaches of Deerfield downstream of Fife Brook and three sites in unregulated reaches of tributaries were sampled twice, once in July and once in September. Water depth and velocity were recorded at each sampling and temperature loggers recorded 15-minute intervals from July-September. Results suggested that either hydrologic or thermal alterations affected macroinvertebrate community composition in comparison to non-regulated reaches. The effects of the dam appeared to be spatially limited as altered flow and temperature regimes were ameliorated downstream. This study has not been replicated and is inconclusive about the exact influences of regulated flows since dams affect flow, temperature, and nutrient availability. The report concluded that further study is necessary.

The 2007 North River study featured three sites on mainstem North, three sites on West Branch North, six sites on the East Branch North, and three sites in larger tributaries. North River watershed macroinvertebrate communities scored exclusively as not impaired.

The study conducted in 2008 looked at Deerfield River tributaries. Fifteen mid-watershed tributary sites were sampled for this project: Dunbar Brook (slightly impacted), Pelham Brook (not impacted), Mill Brook (Deerfield River tributary, not impacted), Bear River (not impacted), Cold River (three sites, not impacted), Tannery Brook (not impacted), Chickley River (three sites, not impacted), Mill Brook (Clesson Brook Tributary, slightly impacted), Clesson Brook (three sites, not impacted).

The 2011 headwater streams study sampled twenty headwater sites across six state forests in Massachusetts. Nineteen were headwater stream sites and one site was a spring/seep in headwater reach. Macroinvertebrate

community composition varied widely with great species richness. Some observed taxa potentially may have not been previously observed in Massachusetts. Brook trout were also observed at nearly half of the sites. Riparian habitats were all in good condition and likely responsible for supporting such great macroinvertebrate communities.

Vermont DEC Monitoring

There has never been comprehensive water quality monitoring in a majority of the Vermont portion of the Deerfield watershed. The state of Vermont conducts biomonitoring assessments (including fish, macroinvertebrate, and habitat) on a five-year cycle. Biomonitoring results show generally very good to excellent conditions for supporting aquatic life within the watershed except directly below the Harriman and Sherman reservoirs and below the ski resort area of Mt Snow. There is also a bacteria total maximum daily load plan (TMDL) for a portion of the North Branch of the Deerfield River in Dover due to bacteria levels consistently exceeding safe recreation levels and state standards.

Massachusetts DEP Monitoring

Massachusetts's most recent assessment report of the Deerfield Watershed was released in 2004. Water quality assessment relied on the results from DRWA's volunteer monitoring of water chemistry and fecal coliform bacteria. By analyzing data from USGS streamflow gauges, the Green River near Colrain, the North River at Shattuckville, and the South River near Conway were identified as medium stressed while Deerfield River at Charlemont and Deerfield River near West Deerfield were identified as low stressed. A 2003 assessment survey quantified whether the designated uses of aquatic life, primary and secondary contact recreation, and aesthetics were supported or impaired. Most sites surveyed supported all uses with the exception of the Davis Mine Brook, impaired for recreation and not supportive of aquatic life or aesthetics, and the lower reach of the Green River, impaired for primary contact recreation. Davis Mine Brook is severely impacted by the Davis sulfur mine which collapsed in 1910 and leaches extremely acidic water directly into the brook.

Program Goals

The primary goals of this new program are to align monitoring efforts across two states within the same watershed and to provide safe to swim information about area recreation spots. A secondary goal is to identify areas of high water quality that need to be protected as well as areas in need of water quality improvement that would benefit from restoration.

Methods

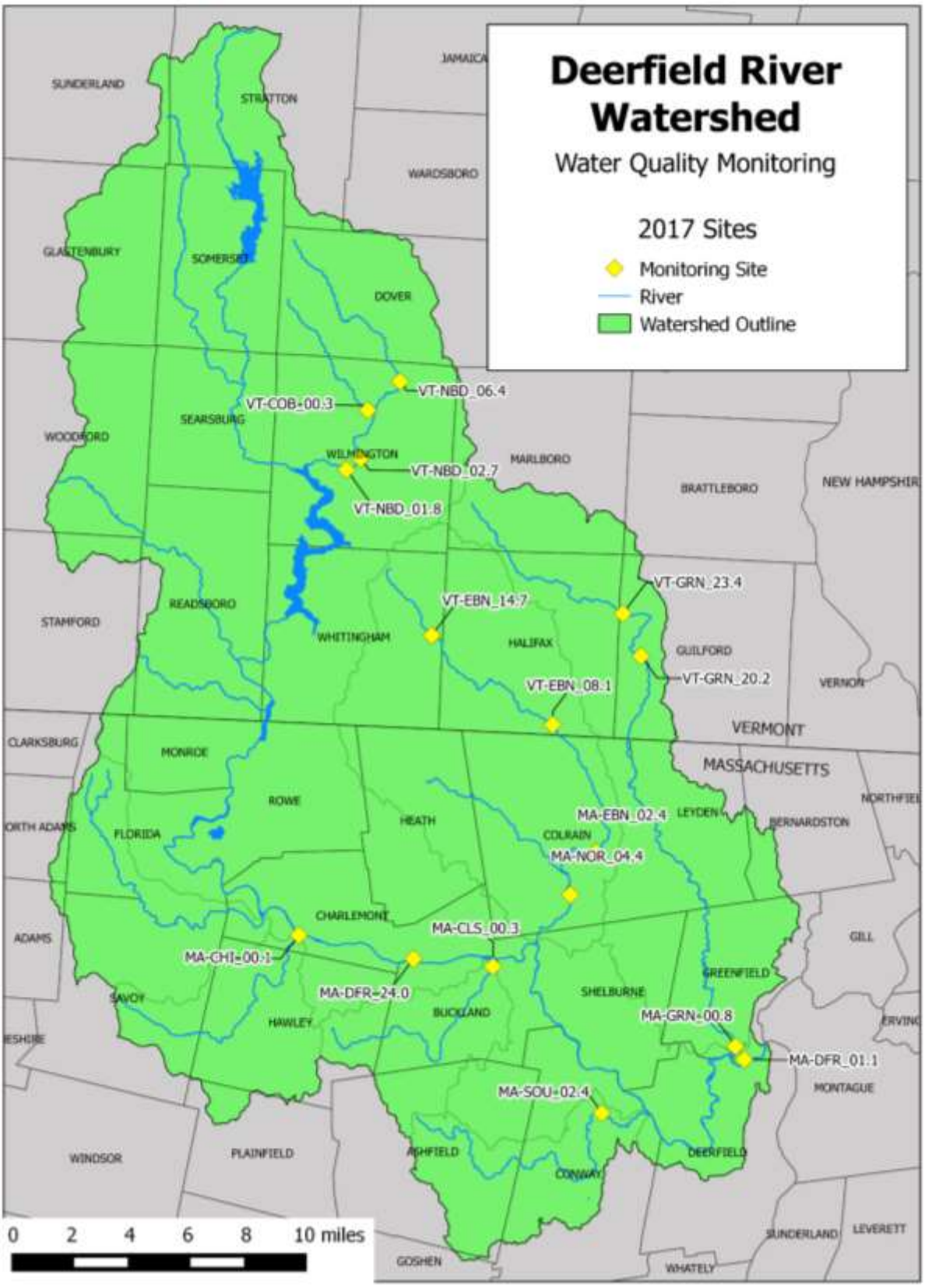
Sites Sampled

For the 2017 season, we set out with the goal of sampling 10 sites in Vermont and 8 in Massachusetts. To select the sites in Vermont, we worked with our VT ANR Watershed Coordinator, Marie Levesque Caduto, to select sites that the state was interested in knowing more about. We worked with CRC Massachusetts River Steward Andrea Donlon to select sites in Massachusetts that would give us an understanding of what was going on in each sub-watershed and the mainstem. Ultimately, we sampled 8 sites in Vermont and 8 in Massachusetts (Table 1 - Sites Sampled) due to volunteer availability

TABLE 1 - SITES SAMPLED

Site ID	Site Name	River	Town
VT-NBD_06.4	E. Dover Rd	N. Br. Deerfield River	Wilmington, VT
VT-NBD_02.7	Above Wilmington Center	N. Br. Deerfield River	Wilmington, VT
VT-NBD_01.8	Wilmington Center	N. Br. Deerfield River	Wilmington, VT
MA-DFR_24.0	Rte 2 below Academy at Charlemont	Deerfield River	Charlemont, MA
MA-DFR_01.1	5 & 10 Bridge	Deerfield River	Greenfield, MA
VT-COB_00.3	Above confluence with N. Br. Deerfield	Cold Brook	Wilmington, VT
MA-CHI_00.1	Tower Rd	Chickley River	Charlemont, MA
MA-CLS_00.3	Buckland Rec Area	Clesson Brook	Buckland, MA
VT-EBN_14.7	Below Jacksonville WWTF	E. Br. North River	Halifax, VT
VT-EBN_08.1	VT Route 112 above state line	E. Br. North River	Halifax, VT
MA-EBN_02.4	Foundry Village Rd Ballfields	E. Br. North River	Colrain, MA
MA-NOR_04.4	Call Rd	North River	Colrain, MA
MA-SOU_02.8	Reeds Bridge Rd	South River	Conway, MA
VT-GRN_23.4	Hinesburg Rd	Green River	Guilford, VT
VT-GRN_20.2	Green River Timber Crib Dam	Green River	Guilford, VT
MA-GRN_00.8	Petty Plain Rd	Green River	Greenfield, MA

FIGURE 1 - 2017 SITE MAP



Sampling Procedure

Before the start of the season, each volunteer was required to attend a training session with the program coordinator. Training sessions were held riverside so that each volunteer would have the opportunity to practice under the supervision of the coordinator before going out into the field.

Volunteers sampled sites on alternate Wednesday mornings from June 28th to September 6th before 10 am. In addition to collecting the suite of bottles to be tested for different parameters (see next section), volunteers recorded air and water temperature, flow conditions, and any other relevant notes about the site on the provided field sheet. They were also required to keep a chain of custody form for *E. coli* samples. On some days, volunteers collected additional quality control samples. We aided a University of Massachusetts water isotope study by collecting an additional bottle once a month. Samples and field sheets were delivered to the CRC Lab in Greenfield by 10 am where most bottles were sorted and sent to VAEL by courier. *E. coli* samples remained in Greenfield to be processed and tested immediately.

Parameters

Each site was tested for total nitrogen, total phosphorus, chloride, and turbidity. 10 of the 16 sites were tested for *E. coli.* See the discussion below for more information on each parameter.

TABLE 2 - PARAMETERS TESTED

Site ID	Site Name	E Coli	TN	TP	Cl	Turb
VT-NBD_06.4	E. Dover Rd	✓	✓	✓	✓	✓
VT-NBD_02.7	Above Wilmington Center	✓	✓	✓	✓	✓
VT-NBD_01.8	Wilmington Center	✓	✓	✓	✓	✓
MA-DFR_24.0	Rte 2 below Academy at Charlemont		✓	✓	✓	✓
MA-DFR_01.1	5 & 10 Bridge	✓	✓	✓	✓	✓
VT-COB_00.3	Above confluence with N. Br. Deerfield		✓	✓	✓	✓
MA-CHI_00.1	Tower Rd	✓	✓	✓	✓	✓
MA-CLS_00.3	Buckland Rec Area	✓	✓	✓	✓	✓
VT-EBN_14.7	Below Jacksonville WWTF		✓	✓	✓	✓
VT-EBN_08.1	VT Route 112 above state line		✓	✓	✓	✓
MA-EBN_02.4	Foundry Village Rd Ballfields		✓	✓	✓	✓
MA-NOR_04.4	Call Rd		✓	✓	✓	✓
MA-SOU_02.8	Reeds Bridge Rd	✓	✓	✓	✓	✓
VT-GRN_23.4	Hinesburg Rd	✓	✓	✓	✓	✓
VT-GRN_20.2	Green River Timber Crib Dam	✓	✓	✓	✓	✓
MA-GRN_00.8	Petty Plain Rd	✓	✓	✓	✓	✓

E. coli

Escheria coli (*E. coli*) is in the fecal coliform family of bacteria that is found in digestive tracts of all warm-blooded animals, including humans. Most *E. coli* will not make someone sick, but they do sometimes cause illnesses in people. The presence of *E. coli* in water indicates the presence of human or animal waste. It is relatively easy to test for in comparison to other more harmful waterborne pathogens, so it is used an indicator organism to determine the level of risk associated with primary recreation contact (swimming and wading), or secondary recreation contact (boating).

The US Environmental Protection Agency (EPA), Vermont, and Massachusetts standards for a single sample to be considered “safe to swim” is 235 *E. coli* organisms per 100 mL of water. The state standards for results over a

period of time are that the geometric mean (a way of averaging living populations) should not exceed 126 E. coli/100 mL; Vermont also requires that no more than 10% samples exceed 235 E. coli/100 mL.

Total Nitrogen

Total nitrogen (TN) tests for nitrogen in all its forms, including nitrate (NO_3-), nitrite (NO_2-), ammonium (NH_4+), and as part of organic matter. Nitrogen is an essential nutrient for plants and can be found in the atmosphere as well as all living beings. It is also an important component of fertilizers. An overabundance of nitrogen in our waterways can contribute to eutrophication (over growth of algae) and anoxia (lack of oxygen) in saltwater systems, such as Long Island Sound.

There is no numerical state standard for nitrogen in Massachusetts and the standard in Vermont is a very lax 5.0 mg-N/L of water. No sites that we test come close to exceeding that standard. The EPA currently recommends a limit of 0.34 mg-N/L for waters entering Long Island Sound that support eelgrass based on literature values. We choose to compare our results to the EPA suggested standard.

Total Phosphorus

Total phosphorus (TP) tests for phosphorus in all its forms, including organic and inorganic phosphates (PO_4^{-3}). Organic phosphates are those that are bound to plant or animal tissue and formed primarily through biological processes, but they may occur from the breakdown of organic pesticides. Inorganic phosphates include orthophosphates, produced in natural processes and found in sewage, and polyphosphates, used in treating boiler waters and in detergents. An overabundance of phosphorus in our waterways can contribute to toxic algae blooms, eutrophication, and anoxia in freshwater systems, such as lakes and ponds.

There is no numerical state standard for phosphorus in Massachusetts and the standard in Vermont is based on gradient and temperature. Most of DRWA's site are in cold-water streams which have a standard of 15 µg-P/L. The only site that is warm water is the lowest Deerfield site sampled at the 5 & 10 Bridge, which would have a standard of 27 µg/L if it were in Vermont.

Chloride

Chlorides are naturally found in both salt and fresh water environments. Chloride ions separate from chloride salts such as sodium chloride (table salt), potassium chloride or magnesium chloride. Concentrations of chlorides in the environment have increased sharply since the widespread adoption of using road salts as a deicer starting in the 1970s. Chlorides can also come from water softener discharge, wastewater effluent, or fertilizers. Chloride concentrations tend to be higher in areas with lots of pavement and other treated surfaces. High chloride concentrations in fresh water systems can stress or kill aquatic plants and animals.

There are no standards for chlorides in either Vermont or Massachusetts. US EPA has recommended that waters not exceed 860 mg/L for acute toxicity or 230 mg/L for chronic toxicity.

Turbidity

Turbidity is a measure of how murky or cloudy water is. Clay, silt, finely divided inorganic and organic matter, algae, soluble colored organic compounds, and microscopic organisms all contribute to how turbid water is. Low and slow flows in streams tend to be less turbid while high flows after rain events are usually more turbid. Turbidity is a measured by the intensity of light scattered by particles suspended in a water sample. It is measured in nephometric turbidity units (NTU). Typically, low flowing, clear water have turbidity values of 10 NTU or lower.

The Massachusetts standard for turbidity is stated as "These waters shall be free from color and turbidity in concentrations or combinations that are aesthetically objectionable or would impair any use assigned to this Class." Vermont water quality standards state that average annual turbidity should not exceed 10 NTU in Class A and cold water fishery Class B waters; the average should not exceed 25 NTU in warm water fishery Class B waters.

Results & Discussion

Deerfield River Mainstem & Branches

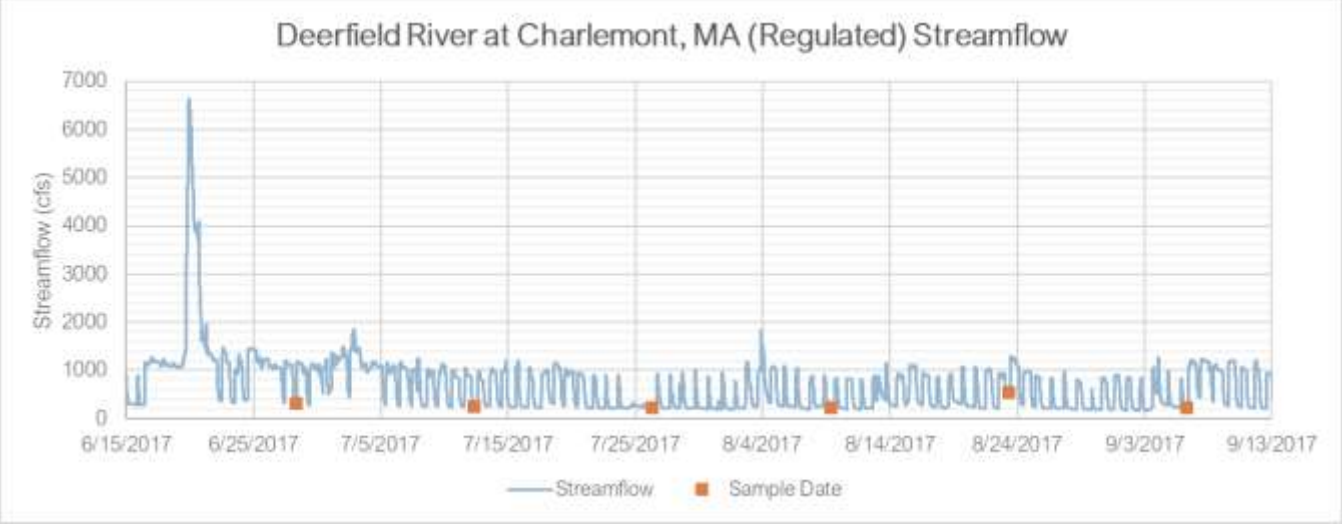
DRWA monitored three sites on the North Branch of the Deerfield River in Vermont and two sites on the mainstem of the Deerfield in Massachusetts. With the exception of the furthest downstream site in Massachusetts which is classified as warm water Class B, all of the sites are classified as cold water Class B. All of the North Branch Deerfield and mainstem Deerfield sites were monitored for total nitrogen, total phosphorus, chloride, and turbidity; all except for the mainstem site in Charlemont (MA-DFR_24.0), were monitored for *E. coli*.

TABLE 3 - FLOW OBSERVED AT DEERFIELD SITES SAMPLED

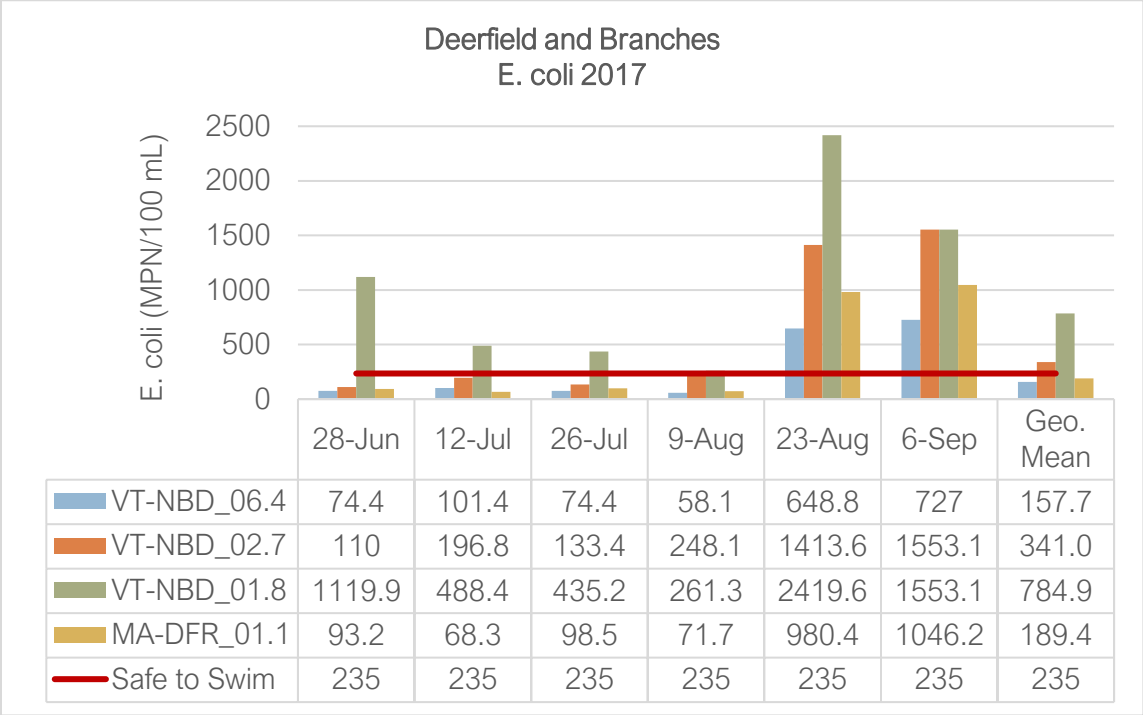
Site ID	6/28		7/12		7/26		8/9		8/23		9/6	
	Level	Type	Level	Type	Level	Type	Level	Type	Level	Type	Level	Type
VT-NBD_06.4	Mod	Freshet	Mod	Base	Mod	Base	Mod	Base	High	Freshet	High	Freshet
VT-NBD_02.7	Mod	Freshet	Mod	Base	Mod	Base	Mod	Base	High	Freshet	High	Freshet
VT-NBD_01.8	Mod	Freshet	Mod	Base	Mod	Base	Mod	Base	High	Freshet	High	Freshet
MA-DFR_24.0	Low	Reg	Low	Reg	Low	Reg	Low	Reg	High	Freshet	Mod	Reg
MA-DFR_01.1	Mod	Reg	Low	Reg	Low	Reg	Low	Reg	High	Freshet	Mod	Reg

Volunteers are required to note the level and type of flow at each site at the time of sampling, presented above. These observations are inherently subjective, based on individual observations at specific sites. They cannot be corroborated by any gages due to the highly regulated nature of the Deerfield River. It has two USGS gages in the portion of the river that is subjected to daily hydropower and recreational releases. The streamflow recorded at the upstream gage (near MA-DFR_24.0) and time sampled are depicted below. Samples were collected while flows were low each morning before the releases.

FIGURE 2 - DEERFIELD RIVER STREAMFLOW SUMMER 2017

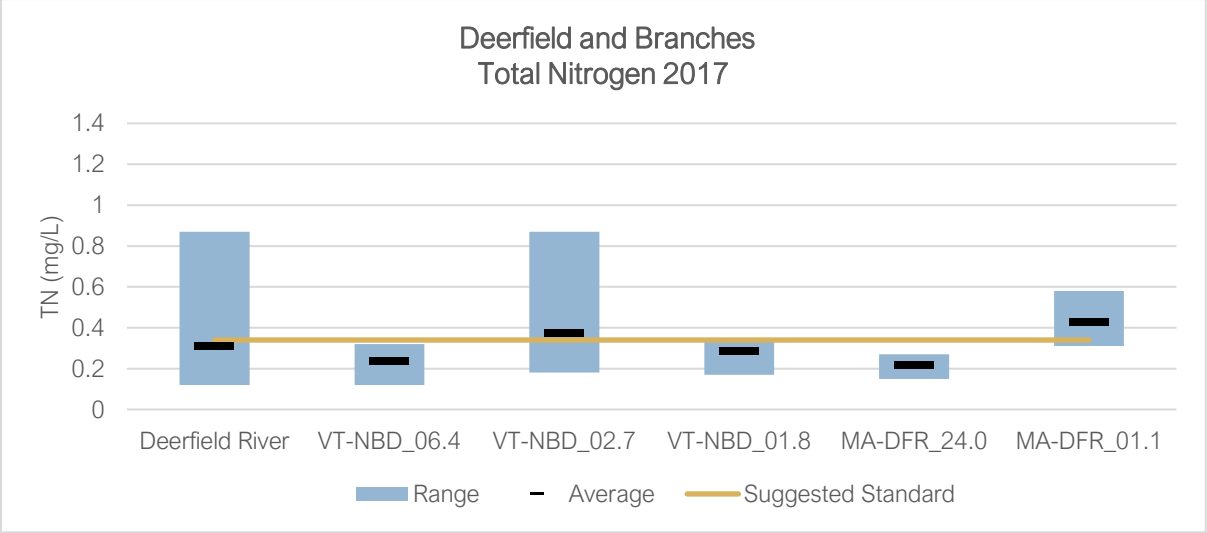


The results for all parameters are presented in the graphs below.

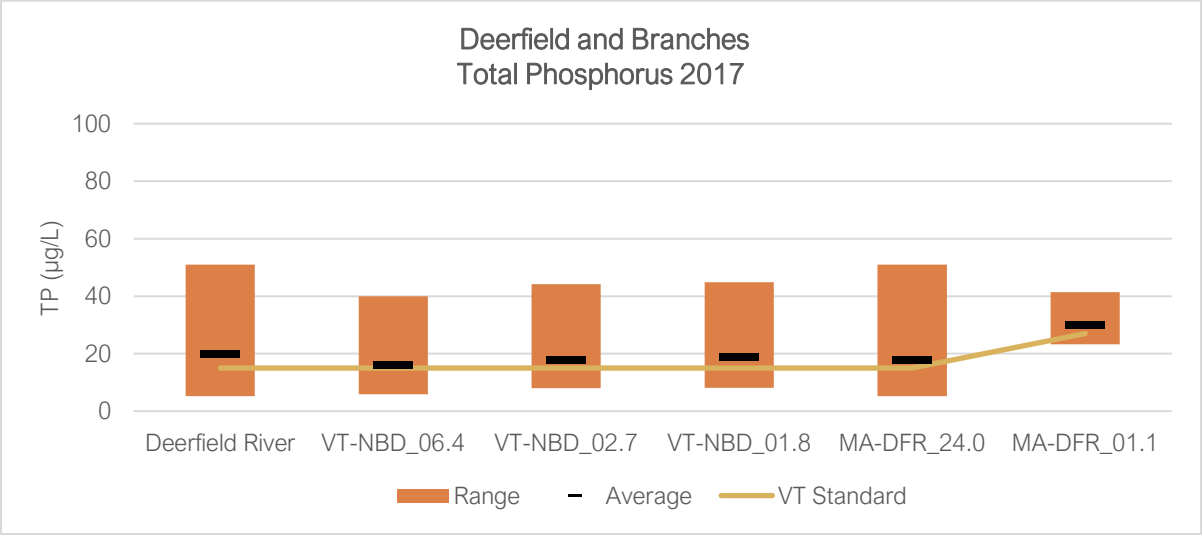


	28-Jun	12-Jul	26-Jul	9-Aug	23-Aug	6-Sep	Geo. Mean
VT-NBD_06.4	74.4	101.4	74.4	58.1	648.8	727	157.7
VT-NBD_02.7	110	196.8	133.4	248.1	1413.6	1553.1	341.0
VT-NBD_01.8	1119.9	488.4	435.2	261.3	2419.6	1553.1	784.9
MA-DFR_01.1	93.2	68.3	98.5	71.7	980.4	1046.2	189.4
Safe to Swim	235	235	235	235	235	235	235

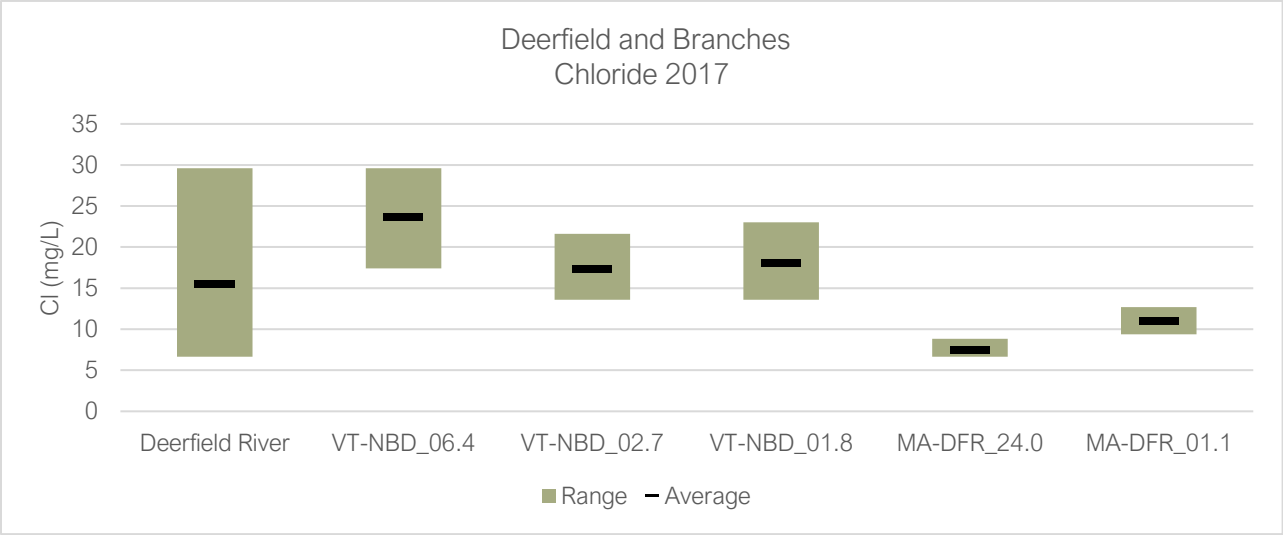
Most sites were at or near safe to swim levels during dry weather (first four sample dates) apart from VT-NBD_01.8 (N. Br. Deerfield, Wilmington Center), which was consistently elevated. All sites exceeded safe to swim levels after heavy rains (last two sample dates). All sites exceeded the acceptable geometric mean for the year in both VT and MA of 126 *E. coli*/100 mL.



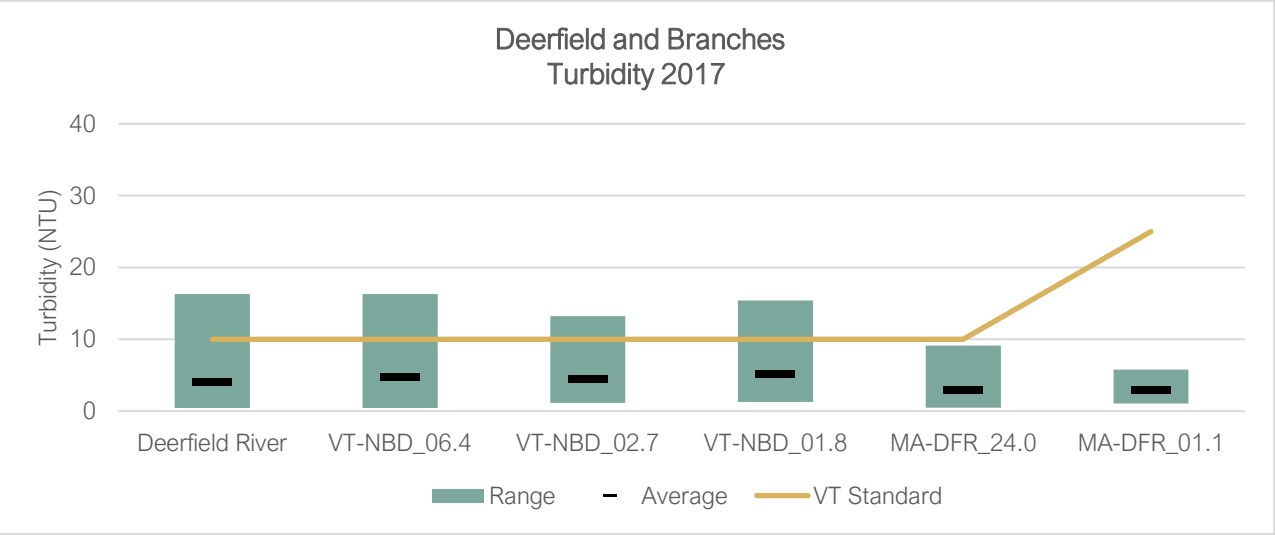
The averages for all sites as well as the whole river were below the VT standard of 5.0 mg-N/L. VT-NBD_02.7 (N. Br. Deerfield, Above Wilmington) and MA-DFR_01.1 (Deerfield, 5 & 10 Bridge) exceeded the EPA's current suggested standard of 0.34 mg-N/L. VT-NBD_02.7 is in the middle of predominately agricultural land use and MA-DFR_01.1 is downstream of most of Greenfield, MA as well as all major tributaries.



The averages for all sites as well as the whole river were all above the VT standard for cold water streams of 15 µg-P/L (27 µg-P/L for the one warm water site). No one site stands out as particularly egregious.



There is no standard for chlorides in either state and all results were well below chronic toxicity levels. It is particularly notable that the furthest north site, VT-NBD_06.4 (N Br. Deerfield, N. Dover Rd, Wilmington), has the highest chloride levels. This could be due to a higher rate of road salt use at the higher elevation and closer proximity to winter recreation areas.



Turbidity averages are well under the Vermont standard for annual values. The North Branch Deerfield sites were above this annual level after heavy rains so incorporating turbidity values from spring runoff season (if they become available or feasible to collect) may push that average over the acceptable limit.

North River

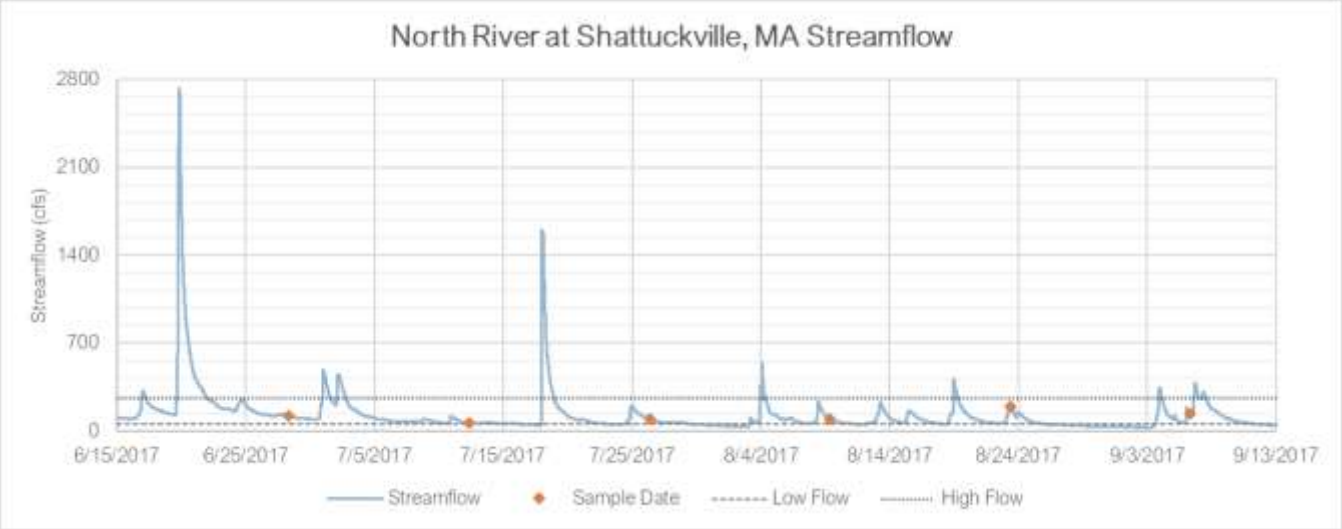
DRWA monitored three sites on the East Branch North River, two in Vermont and one in Massachusetts, and one site on the North River mainstem in Massachusetts. The North River and its branches are considered class B cold water streams. All sites were monitored for total nitrogen, total phosphorus, chloride, and turbidity; they were not monitored for *E. coli*.

TABLE 4 – FLOW OBSERVED AT NORTH RIVER SITES SAMPLED

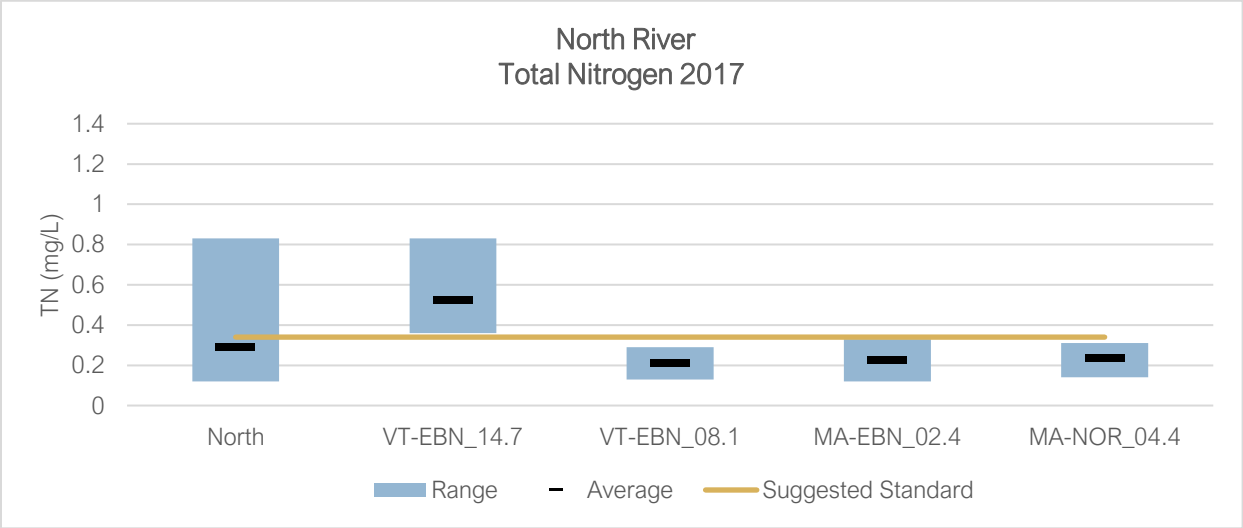
Site ID	6/28		7/12		7/26		8/9		8/23		9/6	
	Level	Type	Level	Type	Level	Type	Level	Type	Level	Type	Level	Type
VT-EBN_14.7	NT	NT	Mod	Base	Mod	Base	Mod	Base	Mod	Freshet	High	Freshet
VT-EBN_08.1	Mod	Freshet	Mod	Base	Mod	Base	Mod	Base	Mod	Freshet	High	Freshet
MA-EBN_02.4	Mod	Base	Mod	Base	Mod	Base	Mod	Base	High	Freshet	Mod	Freshet
MA-NOR_04.4	Mod	Base	Mod	Base	Mod	Freshet	Mod	Base	High	Freshet	Mod	Freshet

Volunteers are required to note the level and type of flow at each site at the time of sampling, presented above. These observations are inherently subjective, based on individual observations at specific sites. There is a USGS gage located downstream of all the sites. Based on flows measured at the gage, all sampling dates occurred during moderate flow levels.

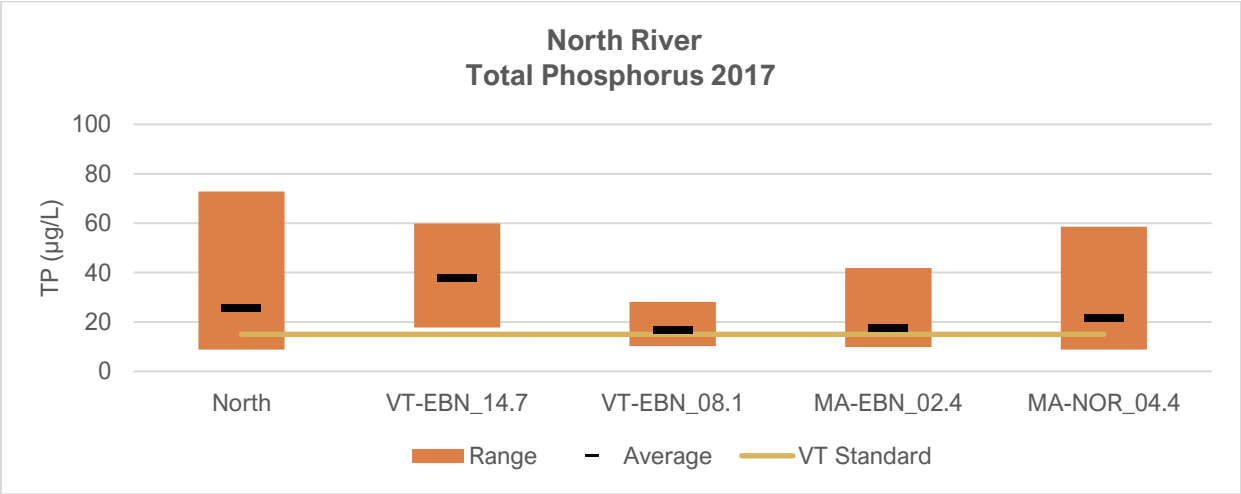
FIGURE 3 - NORTH RIVER STREAMFLOW SUMMER 2017



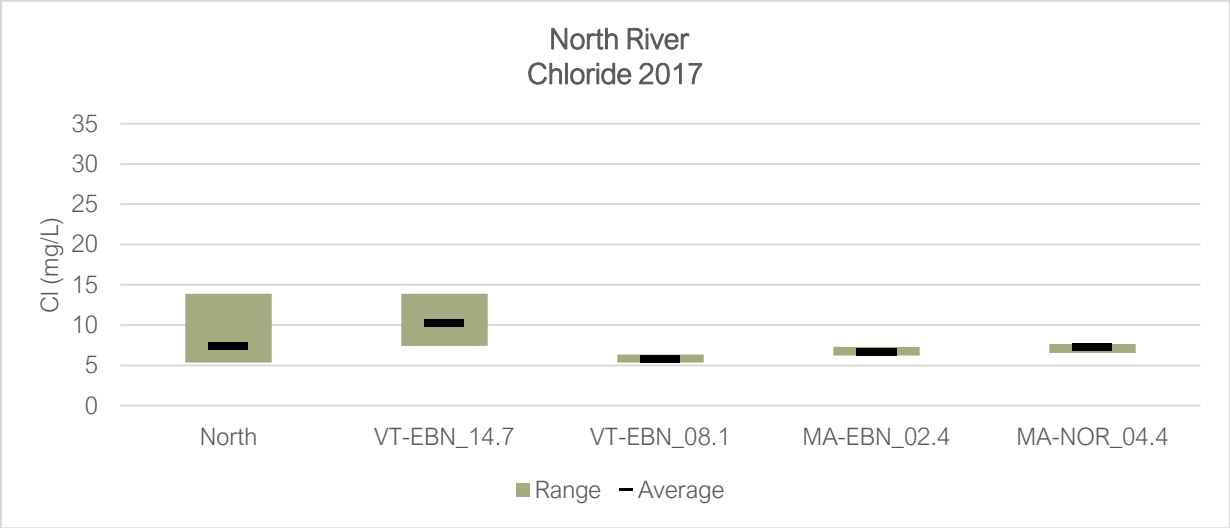
The results for all parameters are presented below.



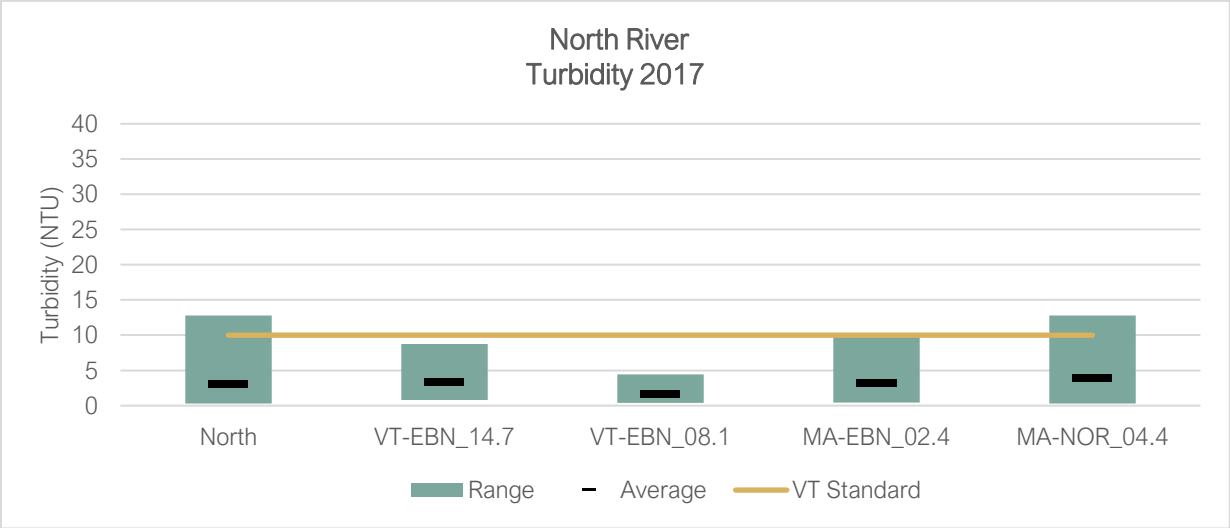
The averages for all sites as well as the whole river were below the VT standard of 5.0 mg-N/L. VT-EBN_14.7 (E. Br. North, Below Jacksonville WWTF) always exceeded the EPA's current suggested standard of 0.34 mg-N/L. The elevated nitrogen levels at VT-EBN_14.7 could be from the wastewater treatment facility discharge, but more investigation is needed to determine the exact cause.



The averages for all sites as well as the whole river were all above the VT standard for cold water streams of 15 µg-P/L. VT-EBN_14.7 (E. Br. North, Below Jacksonville WWTF) always exceeded the standard, which could once again be from the wastewater treatment facility discharge, but more investigation is needed to determine the exact cause.



There is no standard for chlorides in either state and all results were well below chronic toxicity levels. The highest and widest ranging chloride levels were at VT-EBN_14.7 (E. Br. North, Below Jacksonville WWTF) which was sampled from a bridge. The proximity to the road and increased exposure to road salt could account for this higher level. Wastewater treatment facility effluent could also contribute to increased chloride levels. More investigation is warranted.



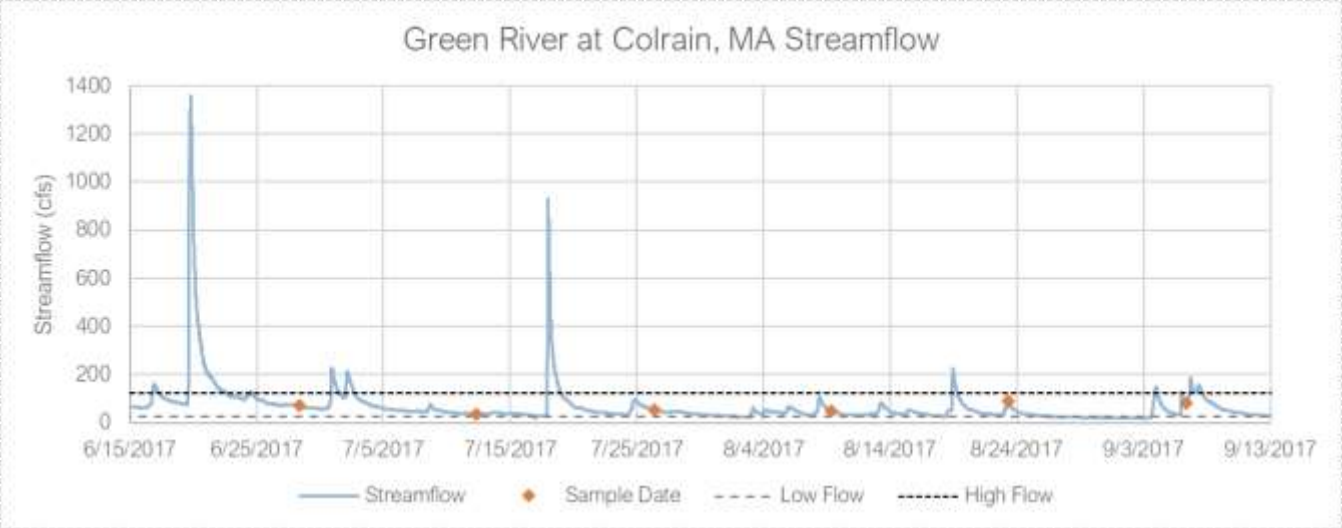
Turbidity averages are well under the Vermont standard for annual values. The Massachusetts sites were at or above this annual level after heavy rains so incorporating turbidity values from spring runoff season (if they become available or feasible to collect) may push that average over the acceptable limit

Green River

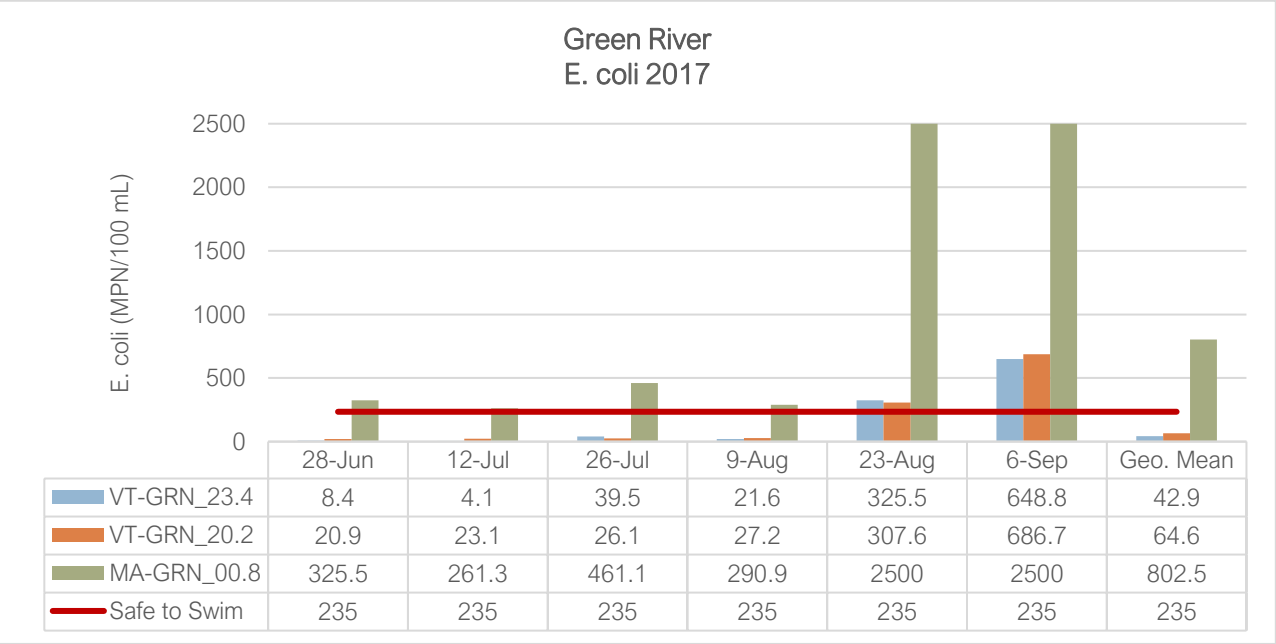
DRWA monitored two sites on the Green River in Vermont and one in Massachusetts. All the sites are considered in Class B cold water streams although a portion of the Green River in Massachusetts that we did not monitor is class A. All sites were monitored for *E. coli*, total nitrogen, total phosphorus, chloride, and turbidity.

Site ID	6/28		7/12		7/26		8/9		8/23		9/68	
	Level	Type	Level	Type	Level	Type	Level	Type	Level	Type	Level	Type
VT-GRN_23.4	Mod	Freshet	Low	Base	High	Freshet	Mod	Base	High	Freshet	High	Freshet
VT-GRN_20.2	Mod	Freshet	Low	Base	High	Freshet	Mod	Base	High	Freshet	High	Freshet
MA-GRN_00.8	Mod	Base	Low	Base	Low	Base	Mod	Base	High	Freshet	High	Freshet

Volunteers are required to note the level and type of flow at each site at the time of sampling, presented above. These observations are inherently subjective, based on individual observations at specific sites. There is a USGS gage located between the Vermont and Massachusetts sites. Based on flows measured at the gage, all sampling dates occurred during moderate flow levels.



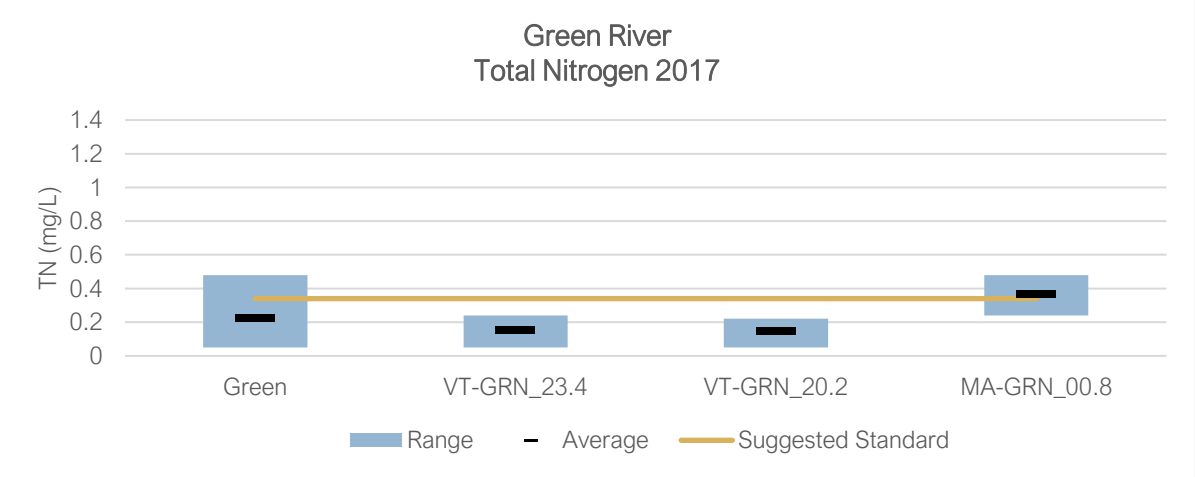
Results from all parameters are presented below.



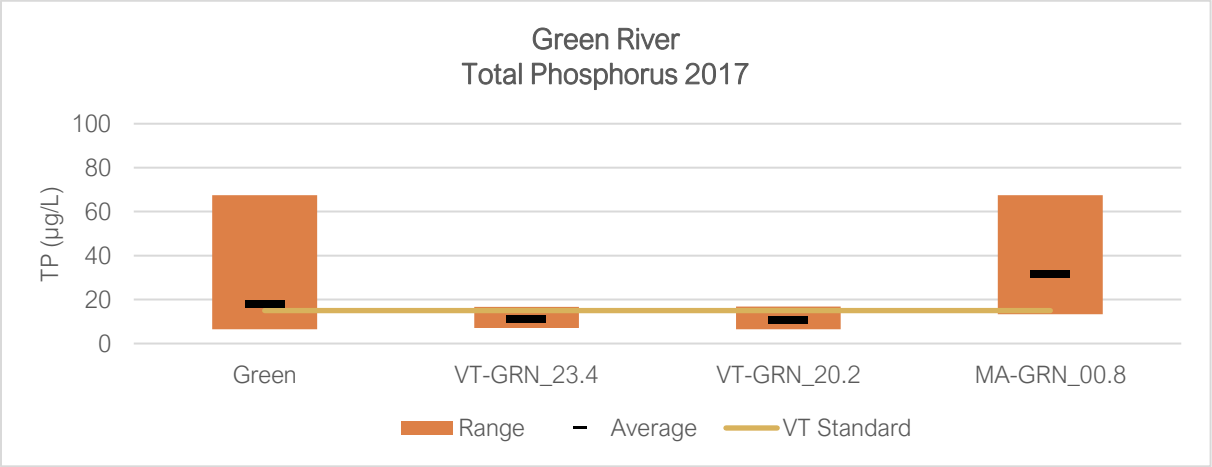
	28-Jun	12-Jul	26-Jul	9-Aug	23-Aug	6-Sep	Geo. Mean
VT-GRN_23.4	8.4	4.1	39.5	21.6	325.5	648.8	42.9
VT-GRN_20.2	20.9	23.1	26.1	27.2	307.6	686.7	64.6
MA-GRN_00.8	325.5	261.3	461.1	290.9	2500	2500	802.5
Safe to Swim	235	235	235	235	235	235	235

Note: Values listed as "2500" were above the maximum measurable value of the test (2419.6 MPN)

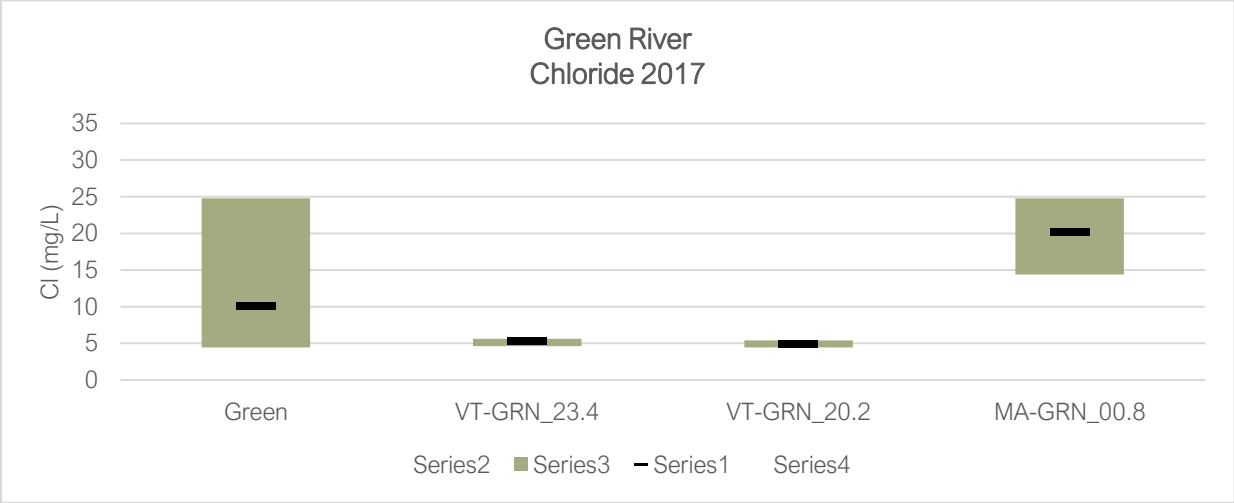
The Vermont Green River sites were well below safe to swim levels during dry weather (first four sample dates) and MA-GRN_00.8 (Green River, Petty Plain Rd, Greenfield) was consistently above safe to swim levels. All sites exceeded safe to swim levels after heavy rains (last two sample dates) with MA-GRN_00.8 maxing out the test. MA-GRN_00.8 exceeded the acceptable geometric mean for the year in both VT and MA of 126 *E. coli*/100 mL.



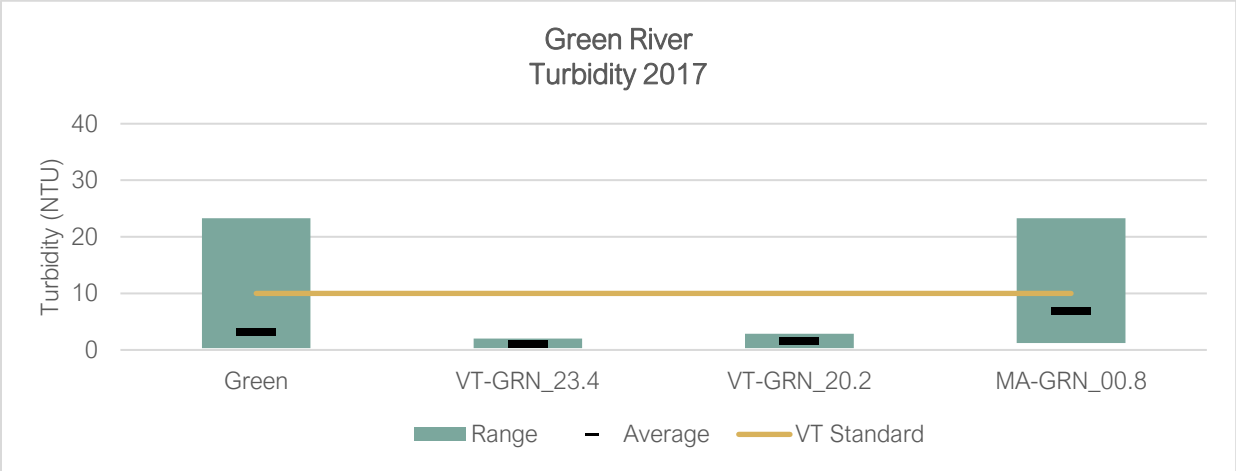
The averages for all sites as well as the whole river were below the VT standard of 5.0 mg-N/L. MA-GRN_00.8 (Green River, Petty Plain Rd, Greenfield) exceeded the EPA's current suggested standard of 0.34 mg-N/L. MA-GRN_00.8 is downstream of most of Greenfield, MA, but not below the wastewater treatment plant discharge.



The averages for the Massachusetts site as well as the whole river were above the VT standard for cold water streams of 15 µg-P/L; the Vermont sites were below the standard. MA-GRN_00.8 is downstream of most of Greenfield, MA, but not below the wastewater treatment plant discharge.



There is no standard for chlorides in either state and all results were well below chronic toxicity levels. The highest and widest ranging chloride levels were at MA-GRN_00.8 (Green River, Petty Plain Rd, Greenfield) which is downstream of most of Greenfield as well as close to several major roads.



Turbidity averages are well under the Vermont standard for annual values. MA-GRN_00.8 (Green River, Petty Plain Rd, Greenfield) was above this annual level after heavy rains so incorporating turbidity values from spring runoff season (if they become available or feasible to collect) may push that average over the acceptable limit, if the site were in Vermont.

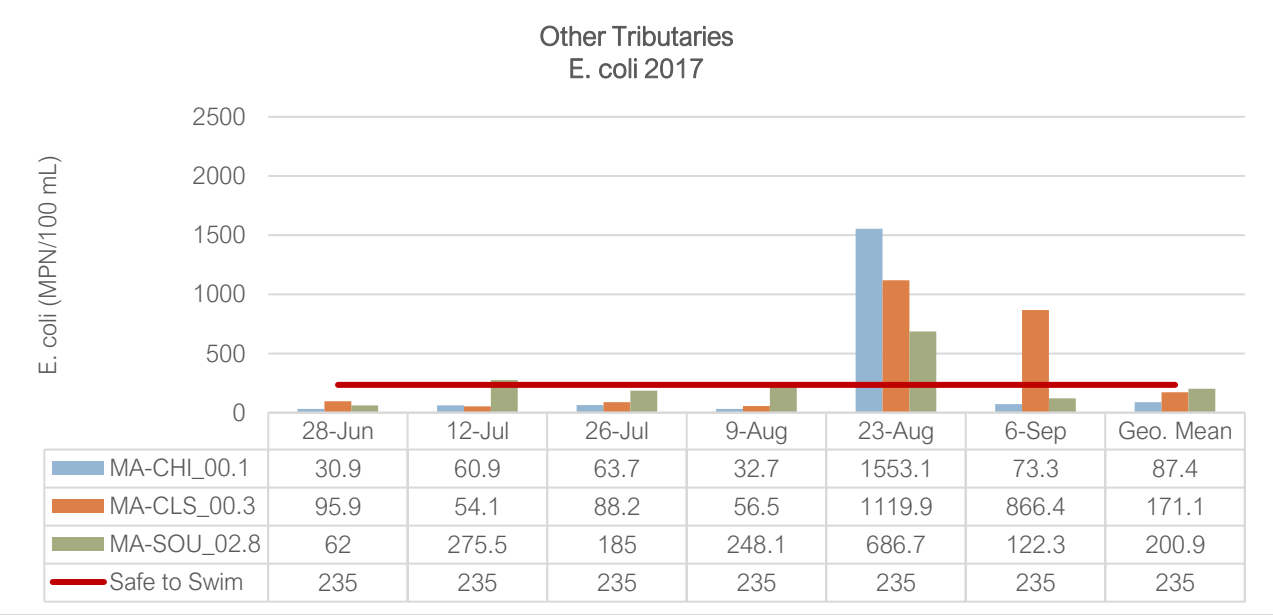
Other Tributaries

DRWA monitored single sites on several other tributaries within the Deerfield Watershed. Cold Brook, a tributary to the North Branch Deerfield in Vermont, was monitored for total nitrogen, total phosphorus, chloride and turbidity. The Chickley River, Clesson Brook, and South River, tributaries to the Deerfield River in Massachusetts, were monitored for *E. coli*, total nitrogen, total phosphorus, chloride, and turbidity. All of these tributaries are considered Class B cold water streams.

Site ID	6/28		7/12		7/26		8/9		8/23		9/6	
	Level	Type	Level	Type	Level	Type	Level	Type	Level	Type	Level	Type
VT-COB_00.3	Mod	Base	Mod	Base	Mod	Base	Mod	Base	High	Freshet	High	Freshet
MA-CHI_00.1	Mod	Base	Low	Base	Low	Base	Mod	Base	High	Freshet	Mod	Freshet
MA-CLS_00.3	Mod	Freshet	Mod	Base	Mod	Freshet	Mod	Base	Mod	Freshet	Mod	Freshet
MA-SOU_02.8	High	Freshet	Mod	Base	Mod	Base	Mod	Base	Mod	Freshet	High	Freshet

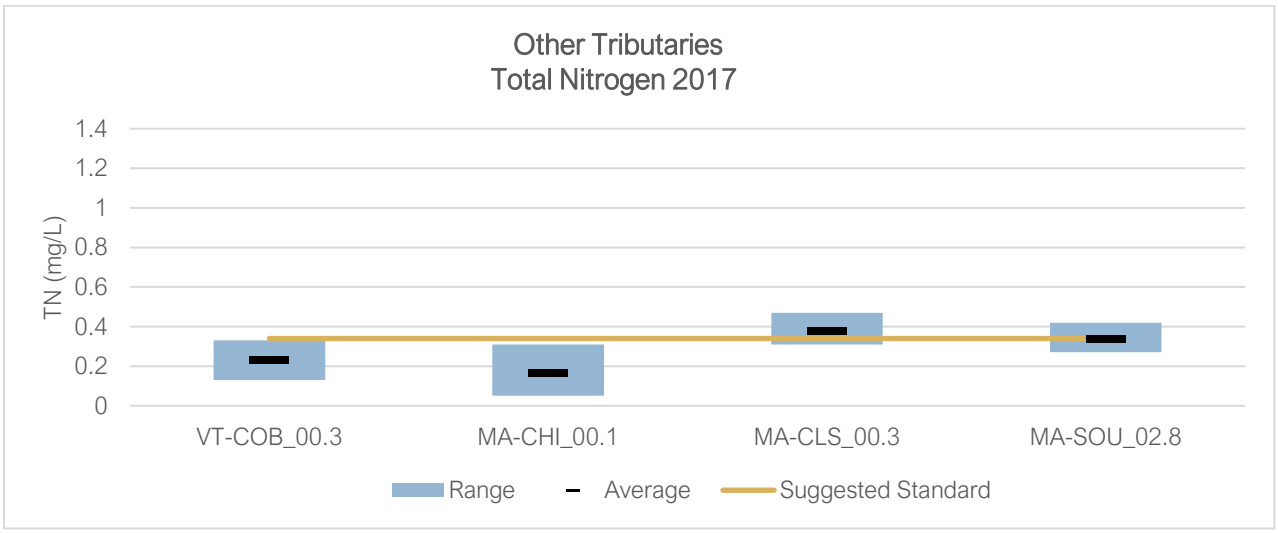
Volunteers are required to note the level and type of flow at each site at the time of sampling, presented above. These observations are inherently subjective, based on individual observations at specific sites. There is a USGS gage located above the site on the South River, but all of the other tributaries are ungagged. Based on flow levels recorded at the South River gage and the flows recorded on the unregulated tributaries discussed above, all samples were taken during moderate flow levels.

Results from all parameters are presented below.

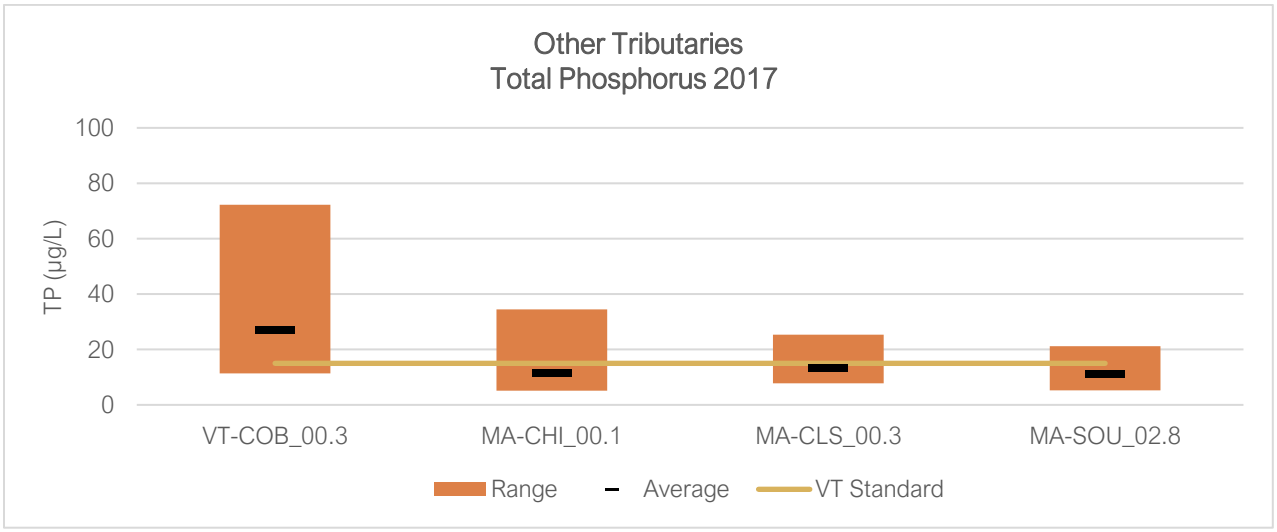


	28-Jun	12-Jul	26-Jul	9-Aug	23-Aug	6-Sep	Geo. Mean
MA-CHI_00.1	30.9	60.9	63.7	32.7	1553.1	73.3	87.4
MA-CLS_00.3	95.9	54.1	88.2	56.5	1119.9	866.4	171.1
MA-SOU_02.8	62	275.5	185	248.1	686.7	122.3	200.9
Safe to Swim	235	235	235	235	235	235	235

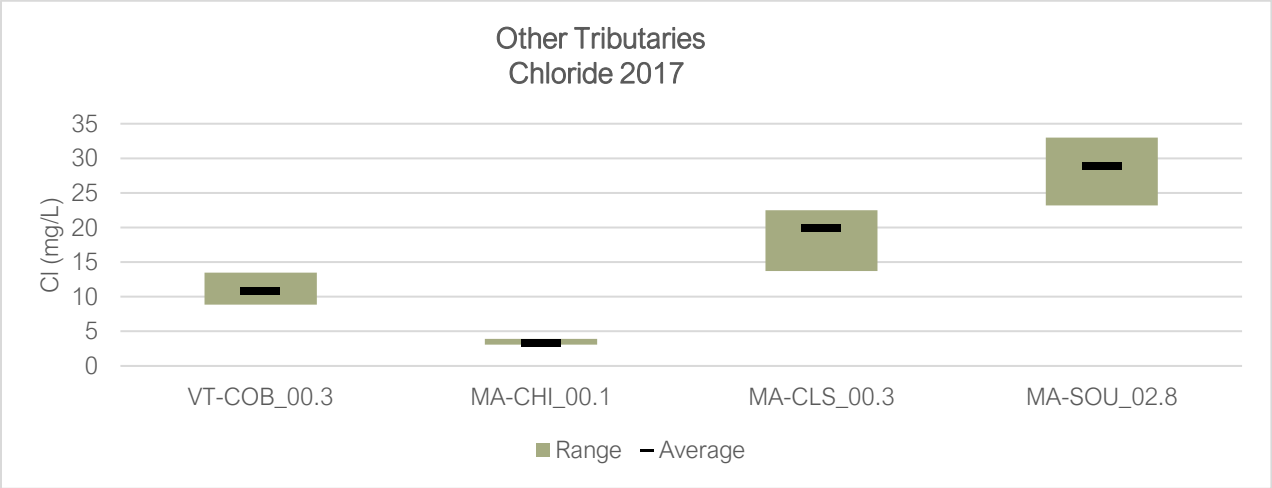
The Chickley River was well below safe to swim levels except after very heavy rains (August 23). Clesson Brook was well below safe to swim levels except for after significant rains (August 23 and September 6). The South River was sometimes above safe to swim levels during dry weather (first four sampling dates) but puzzlingly not always above after significant rains; further investigation is warranted. All three sites were below the geometric mean standard of 126 *E. coli*/100mL.



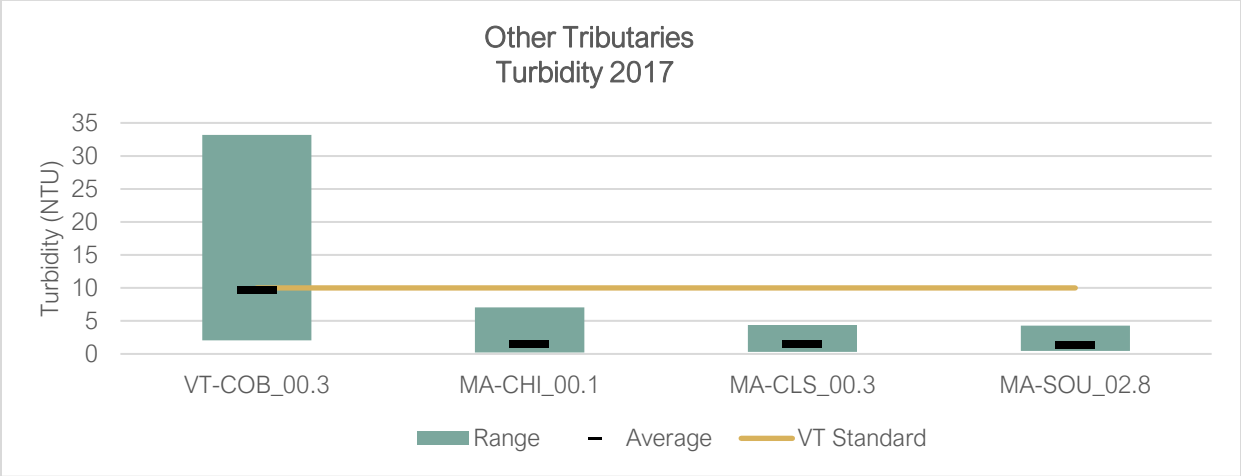
The averages for all these tributary sites were below the VT standard of 5.0 mg-N/L. The average for MA-CLS_00.3 (Clesson Brook, Behind Buckland Rec Area) exceeded the EPA's current suggested standard of 0.34 mg-N/L and MA-SOU_02.8 (South River, Reeds Bridge Rd) was right at 0.34 mg-N/L. The Clesson Brook and South River watersheds both encompass significant agricultural areas.



The averages for the Massachusetts tributaries were below the VT standard for cold water streams of 15 µg-P/L; the Vermont Cold Brook site was average was above the standard. The Cold Brook watershed does contain some agricultural land use.



There is no standard for chlorides in either state and all results were well below chronic toxicity levels. The South River had the highest chloride levels of any site tested this year by DRWA.



These tributary turbidity averages were all under the Vermont standard for annual values. The Cold Brook average was right below the standard and single values greatly exceeded it after heavy rains.

Quality Assurance/Quality Control

As part of participation with the LaRosa Partnership program, DRWA is required to prepare and follow an approved Quality Assurance Project Plan (QAPP) to ensure that the data we collect are scientifically valid. The following charts illustrate our commitment to quality assurance and quality control within our program. The full QAPP is available from DRWA by request.

QAPP Part 7b – Quality Control Samples

Anomalies (highlighted in bold) from the following two tables will be discussed in the next section.

TABLE 5 - FIELD DUPLICATE RELATIVE PERCENT DIFFERENCE (RPD) RESULTS

Site ID	QC ID	Date	CRC	VAEL			
			E. coli	Cl	TN	TP	Turb
MA-EBN_02.4	DF-QCA1	6/28	N/A	4%	8%	**150%**	13%
MA-SOU_02.8	DF-QCA2	6/28	32%	1%	0%	3%	2%
VT-NBD_02.7	DF-QCA1-3	7/12	37%	1%	7%	0%	26%
MA-DFR_01.1	DF-QCA2-4	7/12	16%	1%	**37%**	**41%**	41%
VT-EBN_14.7	DF-QCA3	7/26	N/A	1%	**28%**	10%	5%
MA-CLS_02.2	DF-QCA4	7/26	5%	1%	0%	6%	30%
VT-GRN_20.2	DF-QCA5	8/9	41%	4%	10%	9%	15%
MA-NOR_04.4	DF-QCA6	8/9	N/A	3%	4%	9%	5%
VT-EBN_08.1	DF-QCA5	8/23	N/A	4%	0%	3%	3%
MA-DFR_01.1	DF-QCA6	8/23	30%	1%	17%	**55%**	18%
VT_NBD_01.8	DF-QCA-11	9/6	N/A	0%	0%	1%	1%
MA-GRN_00.8	DF-QCA12	9/6	0%	1%	11%	15%	21%
Mean RPD			**23%**	**2%**	**10%**	**25%**	**15%**
RPD Goal			**≤50%**	**≤5%**	**≤20%**	**≤30%**	**≤15%**
			≤125 %				**≤50%**
			(< 25 mpn)				**(< 2 NTU)**

RPD formula used: $RPD_{field\ duplicate\ pair} = \frac{|sample_1 - sample_2|}{Average(sample_1, sample_2)}$

TABLE 6 - FIELD BLANK RESULTS

Site ID	Sample ID	Date	CRC	VAEL			
			E. coli	Cl	TN	TP	Turb
VT-COB_00.3	DF-QCB1	6/28	NT	< 2	< 0.1	< 5	< 0.2
MA-GRN_00.8	DF-QCB2	6/28	< 1	< 2	< 0.1	< 5	< 0.2
VT-GRN_23.4	DF-QCB1-3	7/12	< 1	< 2	< 0.1	< 5	< 0.2
MA-EBN_02.4	DF-QCB2-4	7/12	NT	< 2	< 0.1	< 5	< 0.2
MA-CHI_00.1	DF-QCB4	7/26	< 1	< 2	< 0.1	< 5	0.21
VT-NBD_06.4	DF-QCB5	8/9	3	< 2	< 0.1	< 5	< 0.2
MA-DFR_24.0	DF-QCB6	8/9	NT	< 2	< 0.1	< 5	< 0.2
VT-EBN_14.7	DF-QCB5	8/23	NT	< 2	< 0.1	< 5	< 0.2
MA-CHI_00.1	DF-QCB6	8/23	< 1	< 2	< 0.1	< 5	< 0.2
VT-GRN_20.2	DF-QCA11	9/6	NT	< 2	< 0.1	6.94	0.38
MA-SOU_02.8	DF-QCB12	9/6	< 1	< 2	< 0.1	< 5	< 0.2
Reporting Limit:			**1**	**2**	**0.1**	**5**	**0.2**

TABLE 7 - QAPP PART 7C – PROJECT COMPLETENESS

Parameter	Number of Samples Anticipated	Number of Valid Samples Collected & Analyzed	Percent Complete
Chloride	108	118	109%
Total and Dissolved Phosphorus	108	117	108%
E. coli	66	73	111%
Turbidity	108	118	109%
Total nitrogen (persulfate digestion)	108	118	109%
Temperature	108	91	84%

DRWA exceeded the number of planned samples in most parameters. We failed to take into consideration that we would not be collecting stream temperature from samples collected by bucket, so that is why there is a lower percentage completion for that parameter.

TABLE 8 - QUALITY CONTROL COMPLETENESS

	Parameter				
	E. Coli	Cl	TN	TP	Turb
Total Number of Samples	73	118	118	117	118
Total Number of Field Duplicates	7	12	12	12	12
% of Field Dups (Goal is ≥ 10%)	10%	10%	10%	10%	10%
Total Number of Field Blanks	6	11	11	11	11
% of Field Blanks (Goal is ≥ 10%)	8%	9%	9%	9%	9%

The number of field duplicates collected met the 10% goal. One set of field blanks was unable to be collected, which would have brought the percentage up to 10%.

QA Discussion

In 2017, DRWA collected samples to test for *E. coli*, total nitrogen (TN), total phosphorous (TP), chloride (Cl), and turbidity; volunteers also recorded air and water temperature measurements at each site using and alcohol thermometer and observed flow level and type while collecting their samples. *E. coli* samples were analyzed by the CRC lab in Greenfield, MA; Cl, TN, TP, and turbidity samples were analyzed by the Vermont Environmental and Agricultural Laboratory (VAEL).

Field Duplicates: Most field duplicates were within acceptable RPD goals (see Table 5). One result was rejected due to exceeding the RPD goal, but the duplicate value was accepted in its place. See the discussion of QA anomalies below for more information. All RPD means for the 2017 season were within acceptable ranges.

Field Blanks: Most field blanks were at or below the detection limit for all parameters. See the discussion of QA anomalies below for more information.

E. coli: All *E. coli* samples were delivered to the CRC lab within the 6 hours of sample collection and were set up for testing within the allotted 8-hour time frame. Although not all samples were below 4°C upon delivery, all samples showed evidence of cooling during transport. The CRC lab met all other QA criteria for E. coli testing. All E. coli field duplicates were below or near the RPD goal of 50% for samples ≥25 MPN or 125% for <25 MPN.

Chloride: No Cl field duplicates exceeded the RPD goal of 5% in 2017.

Total Nitrogen: No TN results were rejected. Two TN field duplicates exceeded the RPD goal of 20% but were accepted. Both sets of duplicates were collected from the same bucket of water from a bridge. While not all duplicates from bridge samples exceeded RPD goals, all samples that exceeded RPD goals except for one were from buckets. We will be making a slight change to our bucket sampling procedure for 2018.

Total Phosphorous: One TP result was rejected but we used the duplicate value in its place for calculations in this report as it was more in line with expected values. It is likely that the bottle was contaminated or a piece of organic matter was collected with the original sample. Two additional TP field duplicates exceeded the RPD goal of 20% but were accepted. Both sets of duplicates were collected from the same bucket of water from a bridge. While not all duplicates from bridge samples exceeded RPD goals, all samples that exceeded RPD goals except for one were from buckets. We will be making a slight change to our bucket sampling procedure for 2018.

Turbidity: In January 2015, e-mail discussions between Southeastern Vermont Watershed Alliance and Jim Kellogg resulted in SeVWA deciding to accept turbidity RPD values of up to 50% for initial values below 2 NTU in addition to the accepted RPD goal of up to 15%. DRWA will also be following this RPD goal. No field duplicates exceeded this goal in 2017.

Temperature: All thermometers used for air and water temperatures were calibrated with a NIST thermometer at the CRC laboratory before the 2017 monitoring season began.

QA Anomalies not resulting in data rejection:

- 7/12/17, MA-DFR_01.1/DF-QCA2-4, TN & TP – Results exceeded RPD goals for TN and TP; results were not atypical from other days and sites on the same river, and other parameters' duplicates met their goals at this site, so the results were accepted. This was sampled from a bucket and the procedure will be revised slightly in 2018 to address this slight QC problem.
- 7/26/17, VT_EBN_14.7/DF-QCA3, TN – Results exceeded RPD goals for TN; results were not atypical from other days and sites on the same river, and other parameters' duplicates met their

goals at this site, so the results were accepted. This was sampled from a bucket and the procedure will be revised slightly in 2018 to address this slight QC problem

- 7/26/17, VT_EBN_14.7/DF-QCA3, TN – Results exceeded RPD goals for TN; results were not atypical from other days and sites on the same river, and other parameters' duplicates met their goals at this site, so the results were accepted. This was sampled from a bucket and the procedure will be revised slightly in 2018 to address this slight QC problem
- 7/12/17, MA-DFR_01.1/DF-QCA6, TP – Results exceeded RPD goals for TP; results were not atypical from other days and sites on the same river, and other parameters' duplicates met their goals at this site, so the results were accepted. This was sampled from a bucket and the procedure will be revised slightly in 2018 to address this slight QC problem.

QA Anomalies resulting in data rejection:

- 6/28/17, MA-EBN_02.4/DFQCA1, TP – RPD value was 150%; MA-EBN_02.4 value was extremely elevated but QCA1 was in line with typical results. Original sample result rejected but duplicate result was used for calculations in this report.

Next Steps

After a successful first year of monitoring, Deerfield River Watershed Alliance is planning on another year. We have become involved with the Green River Watershed Alliance, a collaboration with Windham Regional Commission, Vermont River Conservancy, Connecticut River Conservancy, Vermont Performance Lab, the towns of Guilford, Marlboro, and Halifax (Vermont), local schools and an increasing number of local partners, supported by a grant from the High Meadows Fund. As part of that collaboration, we are increasing monitoring on the Vermont portion of the Green River watershed. One goal of the group is to have the Green River reclassified as Class A and maybe even pursue Wild and Scenic status. The DRWA board is mostly based out of Greenfield, MA, where the Green River is in much worse shape. The board has also expressed interest in increasing monitoring in the Massachusetts portion of the Green River watershed with a particular focus on Maple Brook, a tributary in the heart of Greenfield. After high levels downstream of the Jacksonville Wastewater Treatment Plant in Halifax, VT, we will be adding a site upstream to bracket the plant. Our final goal for the 2018 season is to locate the source of high bacteria in downtown Wilmington, VT.

In addition to monitoring, the Connecticut River Conservancy (of which DRWA is a chapter) has received a Watershed Grant to conduct landowner outreach and education as well as identify potential tree planting and restoration projects on the Beaver Brook in Wilmington, Vermont. The Beaver Brook runs along VT Route 9 and empties into the North Branch of the Deerfield River in the center of Wilmington, the locus of high bacteria.

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Appendix – Full Monitoring Results

			CRC			LaRosa					DRWA				
Date	Site	Time	Sample #	Final E. Coli. (mpn/ 100ml)	Wet? (Y/N)	Sample #	Cl (mg/L)	TN (mg-N/l)	TP (µg P/L)	Turbidity (NTU)	Air Temp. °C	Water Temp °C	Water Level	Flow Type	Sample or QA Notes:
6/28/2017	VT-NBD_06.4	7:52	12-01-2017	74.4	Y	170454-06	20.9	0.12	7.38	0.5	17	12	Mod	Fresh	
6/28/2017	VT-NBD_02.7	8:23	12-02-2017	110	Y	170454-05	16.9	0.18	9.4	1.16	18	12.5	Mod	Fresh	oily sheen on river banks
6/28/2017	VT-NBD_01.8	8:36	12-03-2017	1119.9	Y	170454-04	17.8	0.17	9	1.29	18	12.5	Mod	Fresh	white bubbles on surface
6/28/2017	MA-DFR_24.0	8:07	NT	NT	NT	170454-12	7.61	0.18	9.27	0.86	NT	NT	Low	Reg	
6/28/2017	MA-DFR_01.1	9:28	12-04-2017	93.2	N	170454-11	9.96	0.31	28.7	2.69	NT	NT	Mod	Reg	
6/28/2017	VT-COB_00.3	8:03	NT	NT	NT	170454-08	8.88	0.13	12.7	2.82	16	12	Mod	Base	
6/28/2017	MA-CHI_00.1	7:49	12-09-2017	30.9	N	170454-18	3.16	< 0.1	8.1	0.45	NT	NT	Mod	Base	
6/28/2017	MA-CLS_00.3	9:13	12-10-2017	95.9	Y	170454-13	18.9	0.31	9.75	0.29	NT	NT	Mod	Fresh	
6/28/2017	VT-EBN_14.7	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	
6/28/2017	VT-EBN_08.1	9:02	NT	NT	NT	170454-03	6.13	0.13	11.5	0.4	18	12.5	Mod	Fresh	
6/28/2017	MA-EBN_02.4	7:10	NT	NT	NT	170454-14	7.19	0.12	72.8	0.67	10.5	12	Mod	Base	EBN_02.4 TP value rejected - sub QC value for calculations
6/28/2017	MA-NOR_04.4	7:23	NT	NT	NT	170454-15	7.34	0.14	8.75	0.3	11	12	Mod	Base	
6/28/2017	MA-SOU_02.8	8:15	12-11-2017	62	Y	170454-17	23.2	0.27	9.72	0.58	13	14	High	Fresh	
6/28/2017	VT-GRN_23.4	8:58	12-4-2017	8.4	Y	170454-10	5.15	0.05	8.87	0.41	16	12.5	Mod	Fresh	
6/28/2017	VT-GRN_20.2	8:35	12-6-2017	20.9	Y	170454-07	4.67	0.05	8.01	0.31	17	12	Mod	Fresh	
6/28/2017	MA-GRN_00.8	9:11	12-8-2017	325.5	N	170454-16	17.4	0.35	16.1	2.74	NT	NT	Mod	Base	
6/28/2017	DF-QCA1	7:12	NT	NT	NT	170454-19	6.92	0.13	10.3	0.59					MA-EBN_02.4 - duplicate TP Value accepted, EBN_02.4 value rejected
6/28/2017	DF-QCA2	8:20	12-12-2017	85.7	Y	170454-20	23.4	0.27	10	0.57					MA-SOU_02.8
6/28/2017	DF-QCB1	8:10	NT	NT	NT	170454-21	< 2	< 0.1	< 5	< 0.2					VT-COB_00.3
6/28/2017	DF-QCB2	9:02	12-13-2017	< 1	N	170454-22	< 2	< 0.1	< 5	< 0.2					MA-GRN_00.8
7/12/2017	VT-NBD_06.4	8:11	14-01-17	101.4	Y	170455-06	25.8	0.2	6.1	0.61	25	16	Mod	Base	

			CRC			LaRosa					DRWA				
Date	Site	Time	Sample #	Final E. Coli. (mpn/ 100ml)	Wet? (Y/N)	Sample #	Cl (mg/L)	TN (mg-N/l)	TP (µg P/L)	Turbidity (NTU)	Air Temp. °C	Water Temp °C	Water Level	Flow Type	Sample or QA Notes:
7/12/2017	VT-NBD_02.7	8:34	14-02-17	196.8	Y	170455-05	21.6	0.27	10.3	2.25	23	17	Mod	Base	oily sheen on river banks
7/12/2017	VT-NBD_01.8	8:50	14-014-17	488.4	Y	170455-04	23	0.25	10.5	1.79	23	17	Mod	Base	
7/12/2017	MA-DFR_24.0	8:25	NT	NT	NT	170455-12	6.64	0.15	8.37	0.49	21	16	Low	Reg	
7/12/2017	MA-DFR_01.1	9:25	14-07-17	68.3	Y	170455-11	9.37	0.46	23.2	1.06	NT	NT	Low	Base	
7/12/2017	VT-COB_00.3	8:20	NT	NT	NT	170455-08	9.98	0.16	12.9	2.72	25	16	Mod	Base	
7/12/2017	MA-CHI_00.1	8:05	14-09-17	60.9	Y	170455-18	3.06	0.12	6.97	0.21	21	17.5	Low	Base	
7/12/2017	MA-CLS_00.3	7:35	14-10-17	54.1	Y	170455-13	22.5	0.37	7.8	0.33	20.5	17.5	Mod	Base	
7/12/2017	VT-EBN_14.7	9:11	NT	NT	NT	170455-09	13.9	0.36	17.8	0.78	23	17	Mod	Base	
7/12/2017	VT-EBN_08.1	9:33	NT	NT	NT	170455-03	6.33	0.16	10.3	0.69	23	16	Mod	Base	
7/12/2017	MA-EBN_02.4	8:55	NT	NT	NT	170455-14	7.28	0.18	9.91	0.43	22	18.5	Mod	Base	
7/12/2017	MA-NOR_04.4	9:14	NT	NT	NT	170455-15	7.65	0.23	12.4	0.65	21.5	19	Mod	Base	non regulatory dam upstream, hazy
7/12/2017	MA-SOU_02.8	8:00	14-11-17	275.5	Y	170455-17	27.84	0.36	10.9	0.48	21	19	Mod	Base	
7/12/2017	VT-GRN_23.4	8:36	14-05-17	4.1	Y	170455-10	5.52	0.05	7.07	0.31	20.5	16	Low	Base	large amount of algae growth throughout river segment
7/12/2017	VT-GRN_20.2	7:55	14-06-17	23.1	Y	170455-07	5.22	0.05	10.4	1.34	20	16	Low	Base	small pocket of oil sheen seen on water
7/12/2017	MA-GRN_00.8	9:05	14-08-17	261.3	Y	170455-16	22.4	0.24	16.1	1.25	NT	NT	Low	Base	
7/12/2017	DF-QCA1-3	8:40	14-12-17	285.1	Y	170455-19	21.8	0.29	10.3	1.74					VT-NBD_02.7
7/12/2017	DF-QCA2-4	9:25	14-13-17	58.3	N	170455-20	9.5	0.67	35.1	1.6					MA-DFR_01.1
7/12/2017	DF-QCB1-3	8:50	14-14-17	< 1	N	170455-21	< 2	< 0.1	< 5	< 0.2					VT-GRN_23.4
7/12/2017	DF-QCB2-4	8:45	NT	NT	NT	170455-22	< 2	< 0.1	< 5	< 0.2					MA-EBN_02.4
7/26/2017	VT-NBD_06.4	8:20	20-01-17	74.4	Y	170941-05	27.8	0.24	6.3	0.8	15	13	Mod	Base	
7/26/2017	VT-NBD_02.7	8:48	20-02-17	133.4	Y	170941-04	19.6	0.27	7.99	1.15	18	14	Mod	Base	
7/26/2017	VT-NBD_01.8	8:58	20-03-17	435.2	Y	170941-03	20.4	0.29	8.09	1.57	20	14	Mod	Base	
7/26/2017	MA-DFR_24.0	8:25	NT	NT	NT	170941-11	8.83	0.18	7.22	0.53	13	16	Low	Reg	
7/26/2017	MA-DFR_01.1	9:12	20-07-17	98.5	N	170941-12	12.7	0.4	23.9	1.5	NT	NT	Low	Reg	

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Date	Site	Time	Sample #	Final E. Coli. (mpn/ 100ml)	Wet? (Y/N)	Sample #	Cl (mg/L)	TN (mg-N/l)	TP (µg P/L)	Turbidity (NTU)	Air Temp. °C	Water Temp °C	Water Level	Flow Type	
7/26/2017	VT-COB_00.3	8:38	NT	NT	NT	170941-06	10.3	0.21	11.4	2.07	17	13	Mod	Base	
7/26/2017	MA-CHI_00.1	8:13	20-09-17	63.7	Y	170941-18	3.89	0.16	5.86	0.35	13	8	Low	Base	
7/26/2017	MA-CLS_00.3	8:41	20-10-17	88.2	Y	170941-17	21.7	0.38	8.48	0.81	14	13	Mod	Fresh	
7/26/2017	VT-EBN_14.7	9:11	NT	NT	NT	170941-07	10.6	0.4	32.9	1.67	21	14	Mod	Base	
7/26/2017	VT-EBN_08.1	9:33	NT	NT	NT	170941-08	5.33	0.2	12.6	1.07	22	14	Mod	Base	
7/26/2017	MA-EBN_02.4	8:57	NT	NT	NT	170941-13	6.29	0.19	10.8	1.28	18.5	14.5	Mod	Base	recent signs of flooding
7/26/2017	MA-NOR_04.4	9:21	NT	NT	NT	170941-14	6.98	0.2	10.1	1.17	19.5	15	Mod	Fresh	signs of recent flooding
7/26/2017	MA-SOU_02.8	8:10	20-11-17	185	N	170941-16	27.4	0.32	8.31	0.75	16	15	Mod	Base	
7/26/2017	VT-GRN_23.4	8:24	20-05-17	39.5	N	170941-09	5.02	0.15	7.96	0.97	16	13	High	Fresh	
7/26/2017	VT-GRN_20.2	8:01	20-06-17	26.1	N	170941-10	4.63	0.13	6.55	1.09	13.5	13	High	Fresh	
7/26/2017	MA-GRN_00.8	9:05	20-08-17	461.1	N	170941-15	17.8	0.32	13.3	2.24	NT	NT	Low	Base	
7/26/2017	DF-QCA3	9:20	NT	NT	NT	170941-19	10.5	0.53	36.4	1.76					VT-EBN_14.7
7/26/2017	DF-QCA4	8:45	20-12-17	83.9	Y	170941-20	21.4	0.38	8	0.6					MA-CLS_02.2
7/26/2017	DF-QCB3	NT	NT	NT	NT	NT	NT	NT	NT	NT					
7/26/2017	DF-QCB4	8:15	20-13-17	< 1	N	170941-22	< 2	< 0.1	< 5	0.21					MA-CHI_00.1
8/9/2017	VT-NBD_06.4	8:35	24-01-17	58.1	Y	171063-05	29.6	0.29	5.93	0.46	18	13	Mod	Base	
8/9/2017	VT-NBD_02.7	9:00	24-02-17	248.1	Y	171063-04	16.3	0.87	10.3	1.49	17	13	Mod	Base	oily sheen on river banks
8/9/2017	VT-NBD_01.8	9:10	24-03-7	261.3	Y	171063-03	17.1	0.33	10	1.88	16	13	Mod	Base	
8/9/2017	MA-DFR_24.0	8:40	NT	NT	NT	171063-11	8.04	0.26	5.19	0.66	18	15	Low	Reg	
8/9/2017	MA-DFR_01.1	9:25	24-06-17	71.7	Y	171063-12	10.2	0.38	24.1	1.77	NT	NT	Low	Reg	
8/9/2017	VT-COB_00.3	8:45	NT	NT	NT	171063-06	13.5	0.26	NT	5.6	18	13	Mod	Base	
8/9/2017	MA-CHI_00.1	8:20	24-08-17	32.7	Y	171063-18	3.62	0.23	5.16	0.4	18	14	Mod	Base	
8/9/2017	MA-CLS_00.3	6:40	24-09-17	56.5	Y	171063-17	22.4	0.47	8.6	1.42	11	12	Mod	Base	
8/9/2017	VT-EBN_14.7	8:15	NT	NT	NT	171063-07	10.7	0.83	39.1	2.91	17	15	Mod	Base	

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Date	Site	Time	Sample #	Final E. Coli. (mpn/ 100ml)	Wet? (Y/N)	Sample #	Cl (mg/L)	TN (mg-N/l)	TP (µg P/L)	Turbidity (NTU)	Air Temp. °C	Water Temp °C	Water Level	Flow Type	Sample or QA Notes:
8/9/2017	VT-EBN_08.1	7:45	NT	NT	NT	171063-08	5.63	0.26	12.4	0.76	18	15	Mod	Base	
8/9/2017	MA-EBN_02.4	8:53	NT	NT	NT	171063-13	6.72	0.28	11.1	1	17.5	15	Mod	Base	
8/9/2017	MA-NOR_04.4	9:16	NT	NT	NT	171063-14	7.55	0.28	11.6	1.07	18.5	15	Mod	Base	
8/9/2017	MA-SOU_02.8	8:30	24-10-17	248.1	N	171063-16	33	0.37	5.27	0.73	15	10	Mod	Base	
8/9/2017	VT-GRN_23.4	8:37	24-04-17	21.6	N	171063-09	5.64	0.21	11.2	0.67	16	14	Mod	Base	
8/9/2017	VT-GRN_20.2	8:15	24-05-17	27.2	N	171063-10	5.4	0.21	7.69	1.01	17.5	14	Mod	Base	
8/9/2017	MA-GRN_00.8	9:10	24-07-17	290.9	Y	171063-15	14.4	0.35	21.4	2.29	NT	NT	Mod	Base	
8/9/2017	DF-QCA5	8:22	24-11-17	41.4	Y	171063-19	5.6	0.19	7.06	0.87					VT-GRN_20.2
8/9/2017	DF-QCA6	9:18	NT	NT	NT	171063-20	7.35	0.27	10.6	1.12					MA-NOR_04.4
8/9/2017	DF-QCB5	8:40	24-12-17	3	Y	171063-21	< 2	< 0.1	< 5	< 0.2					VT-NBD_06.4
8/9/2017	DF-QCB6	8:25	NT	NT	NT	171063-22	< 2	< 0.1	< 5	< 0.2					MA-DFR_24.0
8/23/2017	VT-NBD_06.4	6:52	28-01-17	648.8	Y	171176-05	20.2	0.32	40	16.3	17	18	High	Fresh	Very turbid
8/23/2017	VT-NBD_02.7	7:15	28-02-17	1413.6	Y	171176-04	16.1	0.33	24.4	7.33	17	18	High	Fresh	
8/23/2017	VT-NBD_01.8	7:25	28-03-17	2419.6	Y	171176-03	16.1	0.34	31.3	9.24	17	18	High	Fresh	sudsy
8/23/2017	MA-DFR_24.0	8:15	NT	NT	NT	171176-11	6.87	0.27	25.2	9.11	18	18	High	Fresh	
8/23/2017	MA-DFR_01.1	9:20	28-06-17	980.4	N	171176-12	11.1	0.58	37.6	4.93	NA	NA	High	Fresh	QCA6
8/23/2017	VT-COB_00.3	7:03	NT	NT	NT	171176-06	12.5	0.28	26.1	11.4	17	19	High	Fresh	
8/23/2017	MA-CHI_00.1	7:50	28-08-17	1553.1	N	171176-18	3.17	0.31	34.5	7.06	18	18	High	Fresh	
8/23/2017	MA-CLS_00.3	8:10	28-10-17	1119.9	Y	171176-17	13.7	0.4	25.3	4.37	17.5	17	Mod	Fresh	flow level is higher than last 2-3 times
8/23/2017	VT-EBN_14.7	7:47	NT	NT	NT	171176-07	8.88	0.55	38.9	2.31	NA	NA	Mod	Fresh	
8/23/2017	VT-EBN_08.1	8:03	NT	NT	NT	171176-08	6.04	0.29	28.1	4.45	18	18	Mod	Fresh	
8/23/2017	MA-EBN_02.4	8:57	NT	NT	NT	171176-13	6.54	0.25	21.9	5.62	20.5	18.5	High	Fresh	water was visibly cloudy with debris and running faster. indications water was even higher in last 24 hours
8/23/2017	MA-NOR_04.4	9:17	NT	NT	NT	171176-14	7.6	0.26	27	7.56	21.5	19	High	Fresh	water was visibly cloudy with debris and running faster. indications water was even higher in last 24 hours; smells slightly fishy

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8/23/2017	MA-SOU_02.8	8:16	28-11-17	686.7	Y	171176-16	32.4	0.42	21.2	4.31	19	21.5	Mod	Fresh	
8/23/2017	VT-GRN_23.4	8:43	28-04-17	325.5	N	171176-09	5.49	0.24	16.4	1.99	19	17	High	Fresh	
8/23/2017	VT-GRN_20.2	8:23	28-05-17	307.6	N	171176-10	4.9	0.22	15.6	2.89	19.5	17.5	High	Fresh	
8/23/2017	MA-GRN_00.8	9:05	28-07-17	> 2419.6	Y	171176-15	24.3	0.48	67.5	23.3	NA	NA	High	Fresh	
8/23/2017	DF-QCA5	8:06	NT	NT	NT	171176-19	6.27	0.29	27.3	4.31					VT-EBN_08.1
8/23/2017	DF-QCA6	9:20	28-12-17	727	N	171176-20	11.2	0.69	66.1	5.92					MA-DFR_01.1
8/23/2017	DF-QCB5	7:51	NT	NT	NT	171176-21	< 2	< 0.1	< 5	< 0.2					VT-EBN_14.7
8/23/2017	DF-QCB6	7:50	28-13-17	< 1	N	171176-22	< 2	< 0.1	< 5	< 0.2					MA-CHI_00.1
9/6/2017	VT-NBD_06.4	8:11	32-01-17	727	Y	171220-05	17.4	0.26	30.4	9.96	19	14	High	Fresh	
9/6/2017	VT-NBD_02.7	8:27	32-02-17	1553.1	Y	171220-04	13.6	0.31	44.2	13.2	19	14	High	Fresh	
9/6/2017	VT-NBD_01.8	8:38	32-03-17	1553.1	Y	171220-03	13.6	0.33	44.9	15.4	19	13	High	Fresh	
9/6/2017	MA-DFR_24.0	8:30	NT	NT	NT	171220-10	6.85	0.25	51	6	17	16	Mod	Reg	
9/6/2017	MA-DFR_01.1	9:20	32-06-17	1046.2	N	171220-11	12.4	0.42	41.4	5.8	NA	NA	Mod	Reg	
9/6/2017	VT-COB_00.3	8:18	NT	NT	NT	171220-06	9.4	0.33	72.3	33.2	19	13	High	Fresh	
9/6/2017	MA-CHI_00.1	8:10	32-08-17	73.3	N	171220-17	3.22	0.13	9.13	0.64	18	15	Mod	Fresh	
9/6/2017	MA-CLS_00.3	7:40	32-09-17	866.4	Y	171220-16	20.4	0.32	19.5	1.52	18	15	Mod	Fresh	
9/6/2017	VT-EBN_14.7	8:55	NT	NT	NT	171220-07	7.4	0.47	59.9	8.76	20	13	High	Fresh	
9/6/2017	VT-EBN_08.1	9:12	NT	NT	NT	171220-22	5.44	0.24	24	2.52	19.5	13	High	Fresh	
9/6/2017	MA-EBN_02.4	8:45	NT	NT	NT	171220-12	6.21	0.33	41.9	9.87	18	15.5	Mod	Fresh	water was visibly cloudy with debris
9/6/2017	MA-NOR_04.4	9:05	NT	NT	NT	171220-13	6.52	0.31	58.6	12.8	17.5	15.5	Mod	Fresh	water was visibly cloudy with debris
9/6/2017	MA-SOU_02.8	8:05	32-10-17	122.3	N	171220-15	29.4	0.29	11.2	0.81	NT	NT	High	Fresh	
9/6/2017	VT-GRN_23.4	7:06	32-04-17	648.8	Y	171220-08	4.61	0.23	16.7	1.8	17	14	High	Fresh	
9/6/2017	VT-GRN_20.2	7:18	32-05-17	686.7	Y	171220-09	4.44	0.22	16.8	2.47	17	15	High	Fresh	
9/6/2017	MA-GRN_00.8	9:05	32-07-17	> 2419.6	Y	171220-14	24.8	0.45	56.5	9.66	NA	NA	High	Fresh	

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9/6/2017	DF-QCA-11	8:40	NT	NT	NT	171220-18	13.6	0.33	44.5	15.2					VT_NBD_01.8
9/6/2017	DF-QCA12	9:05	32-11-17	> 2419.6	N	171220-19	24.6	0.5	65.8	7.85					MA-GRN_00.8
9/6/2017	DF-QCA11	7:20	NT	NT	NT	171220-20	< 2	< 0.1	6.94	0.38					VT-GRN_20.2
9/6/2017	DF-QCB12	8:05	32-12-17	< 1	N	171220-21	< 2	< 0.1	< 5	< 0.2					MA-SOU_02.8