Photo: Alan Morgan

Green River

2018 Water Quality Monitoring Report

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February 2019

Deerfield River Watershed Alliance

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Introduction

2018 was the second year of the volunteer water quality monitoring program for the Deerfield River Watershed Association (DRWA). This program is made possible by the Vermont Department of Environmental Conservation (VT DEC) LaRosa Analytical Services Grant, the Connecticut River Conservancy (CRC), the Green River Watershed Alliance (GRWA), and the amazing group of DRWA volunteers.

Summary of Past Monitoring Efforts

The Green River Watershed Preservation Alliance formed in 1989 over concerns of a proposed power plant along the river in Colrain, MA. As part of their goals to protect the beauty and character of the Green River, they initiated a water quality monitoring program in 1992 with help from the Vermont Agency of Natural Resources (VT ANR), the Greenfield Public Health Department, the Massachusetts Water Watch Partnership, and River Watch Network. They monitored 13 sites for turbidity, pH, alkanity, total and fecal coliforms, fecal streptococci, dissolved oxygen, and total phosphorus for two years. GRWPA eventually folded into DRWA as the Friends of the Green River.

DRWA conducted macroinvertebrate monitoring that focused on the Green River in 2005. The Green River study 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 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.

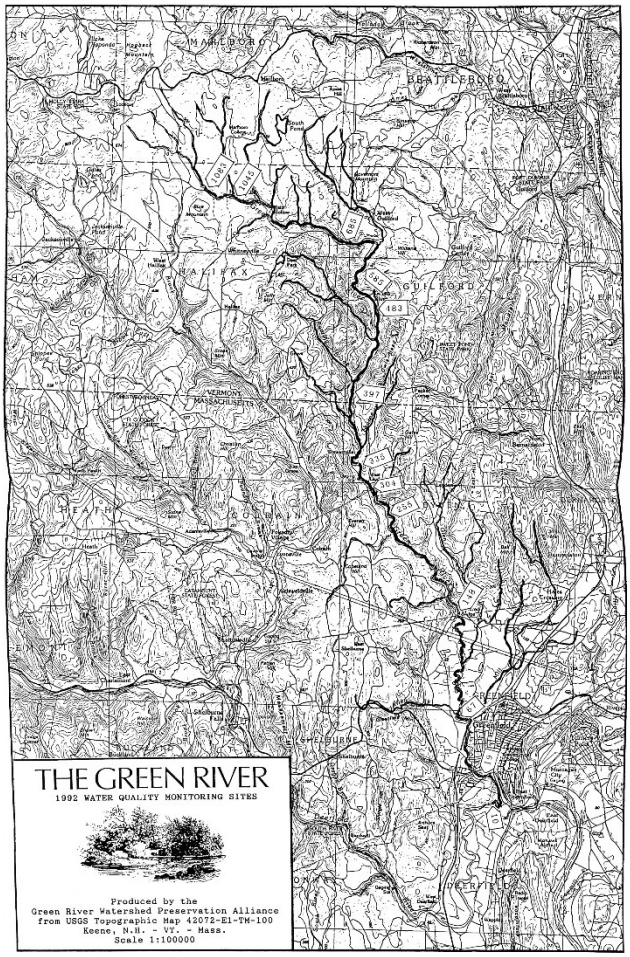


Figure 1- Map of 1992 Green River Monitoring Sites

Massachusetts's most recent state assessment report of the Deerfield Watershed was released in 2004. By analyzing data from the United States Geological Service (USGS) streamflow gauges on the Green River near Colrain, the river was identified as medium 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 lower reach of the Green River, impaired for primary contact recreation.

Goals

The primary goals of the new DRWA program started in 2017 are to align monitoring efforts across two states within the Deerfield River watershed and its subwatersheds and to provide swimming safety information about area recreation spots. A secondary goal is to identify both areas of high water quality that need to be protected and areas in need of water quality improvement that would benefit from restoration.

In collaboration with the newly formed Green River Watershed Alliance, DRWA added a focus on the Green River watershed in Vermont in an effort to once again document the high quality of the Green River. The expansion of the program was supported by a grant from the High Meadows Fund. With support of the DRWA board, we were also able to expand the monitoring in the Massachusetts portion of the watershed.

Methods

Sites Sampled

In 2017, DRWA sampled 3 sites in the Green River Watershed; two of these sites were in Vermont and one in Massachusetts. In 2018, with the support of the Green River Watershed Alliance, DRWA sampled 10 sites in the Green River watershed. Six sites were in Vermont and four were in Massachusetts. This report also includes some data from the Green River Swim and Recreation Area which is tested weekly for *E. coli* by the Greenfield Health Department.

Site ID	Site Name	Town	Sampled in 2017?
VT-PND_00.1	Pond Brook Mouth	Guilford, VT	
VT-GRN_23.4	Hinesburg Rd	Guilford, VT	●
VT-HBG_00.1	Hinesburg Brk Mouth	Guilford, VT	
VT-GRN_20.5	Above Timber Crib Dam	Guilford, VT	
VT-GRN_20.2	Below Timber Crib Dam	Guilford, VT	●
VT-GRN_16.8	VT-MA State Line	Guilford, VT/Colrain, MA	
MA-GRN_09.8	Bare Ass Beach	Colrain, MA	
GRSA[1]	Green River Swim & Rec Area	Greenfield, MA	●
MA-MPL_00.1	Maple Brook Mouth	Greenfield, MA	
MA-GRN_02.0	Between MA-2A and RR Bridge	Greenfield, MA	
MA-GRN_00.8	Green River Park, Petty Plain Rd	Greenfield, MA	●

Figure 2 - Sites Sampled

Sampling Procedure

Before the start of the season, each volunteer was required to attend a training session with the program coordinator or assistant. Most 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 27th to September 5th 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

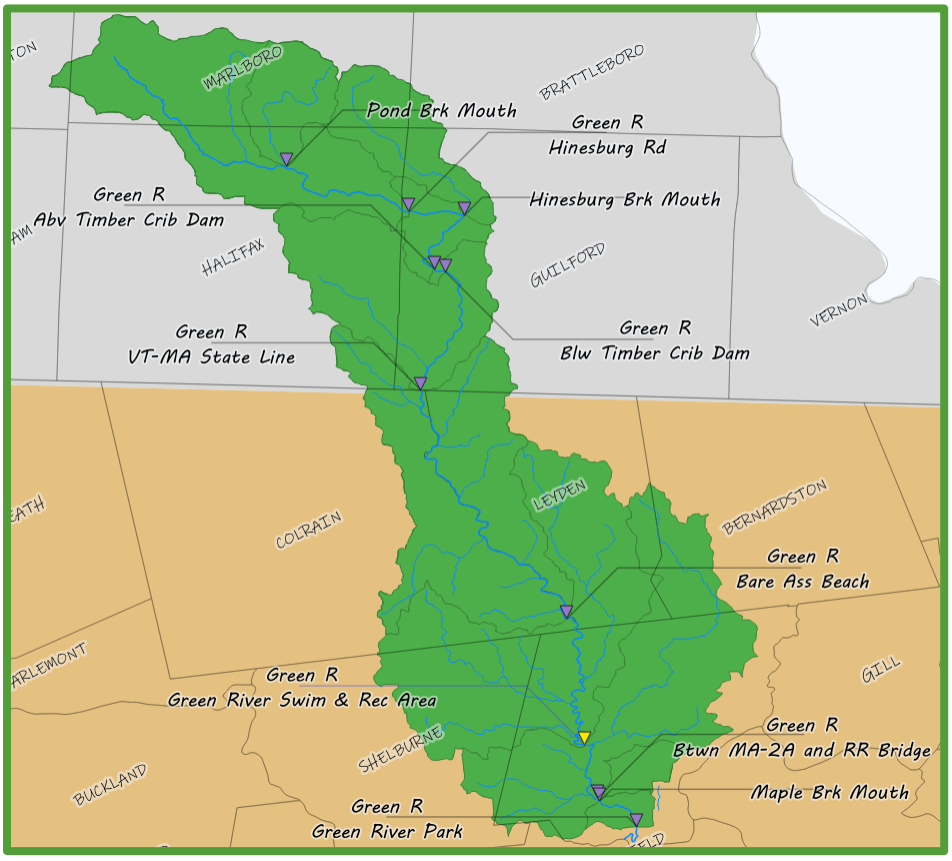


Figure 3 - Map of Sites Sampled

[1] Sampled by Greenfield Health Dept for *E. coli* only

collecting an additional bottle once a month. Samples and field sheets were delivered to the Connecticut River Conservancy (CRC) Lab in Greenfield by 10 am where most bottles were sorted and sent to the Vermont Environmental and Agricultural Lab (VAEL) in Burlington, VT, by courier. *E. coli* samples remained in Greenfield to be processed and tested immediately. Conductivity samples were tested by probe in the Greenfield lab that afternoon.

Parameters

Each site was tested for *E. coli*, total nitrogen, total phosphorus, turbidity, and conductivity. This is a change from 2017 where sites were tested for chloride instead of conductivity. This change was made at the request of the LaRosa partnership.

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 acceptable for primary contact recreation (i.e., swimming) 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; this number is 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. The Green River sites are all high or medium gradient cold-water streams which have a standard of 9 µg-P/L for Class A(1) and B(1) waters and 15 µg-P/L for Class B(2) waters. Currently, the Green River and its tributaries in Vermont are classified as B(2), but results are compared to both standards.

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 has 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 cold water streams.

Conductivity

Specific conductivity (also known as specific conductance) is a measure of how well water conducts electricity. Conductivity is easy to test for and gives a broad look at potential water quality issues. It can be affected by the underlying geology and soil (ions dissolved out of rocks and soil), acid mine drainage (variety of metals and other contaminants), agricultural runoff (including nitrates and phosphates), and road runoff (automobile fluids and road salt). Sudden changes in conductivity could indicate a change in water quality.

Conductivity is not in itself regulated but large fluctuations in values over time or between sites may be an indicator of a water quality issue not identified in other parameters.

Quality Assurance/Quality Control

DRWA follows strict Quality Assurance and Quality Control (QA/QC) standards as laid out in our Quality Assurance Project Plan (QAPP). For a full discussion of QA/QC about the results presented in this report, please see DRWA's 2019 General WQMP Report.

Results & Discussion

DRWA monitored 7 sites on the mainstem and 3 sites on tributaries to the Green River in 2018. DRWA monitored 3 sites on the mainstem in 2017. Vermont currently classifies the Green River and tributaries as Class B(2). At the state line, Massachusetts classifies the Green River and its tributaries as Class A (would be Class A(2) in VT), a classification reserved for drinking water sources, until river mile 8.4 at the outlet of the Greenfield drinking water supply reservoir. Below that, it is Class B. As of 2016, Massachusetts listed the portion of the Green River below the dam at the Greenfield swimming area as impaired and in need of a total maximum daily load (TMDL) for *E. coli* and fecal coliform bacteria.

Streamflow

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. Two observations were listed as regulated and occurred directly downstream of a dam, but that dam is static and does not directly regulate the flow although it does affect it. There is a USGS gage located between the Vermont and Massachusetts sites. Based on flows measured at the gage (presented below), 6/27 and 7/11 occurred during low flows, 7/25 and 9/5 occurred during moderate flows and 8/8 and 8/22 occurred during high flows.

Site ID	6/27		7/11		7/25		8/8		8/22		9/5	
	Level	Type	Level	Type	Level	Type	Level	Type	Level	Type	Level	Type
VT-PND_00.1	Low	Base	Low	Base	High	Freshet	High	Freshet	High	Freshet	Low	Base
VT-GRN_23.4	Low	Base	Low	Base	Mod	Freshet	Mod	Freshet	High	Freshet	Low	Base
VT-HBG_00.1	Low	Base	Low	Base	Mod	Freshet	Mod	Base	High	Freshet	Mod	Base
VT-GRN_20.5	Mod	Base	Low	Base	Mod	Freshet	Mod	Freshet	Mod	Freshet	Low	Base
VT-GRN_20.2	Mod	Base	Mod	Base	High	Freshet	High	Reg	High	Reg	Mod	Base
VT-GRN_16.8	Low	Base	Low	Base	High	Freshet	High	Freshet	High	Freshet	Mod	Base
MA-GRN_09.8	Mod	Base	Mod	Base	Mod	Freshet	Mod	Freshet	NT	NT	Mod	Base
MA-MPL_00.1	Low	Base	NR	NR	High	Freshet	High	Freshet	High	Freshet	Low	Base
MA-GRN_02.0	Mod	Base	Low	Base	High	Freshet	High	Freshet	High	Freshet	Low	Base
MA-GRN_00.8	Mod	Base	Low	Base	High	Freshet	Mod	Freshet	Mod	NR	Low	Base

Figure 4 - Streamflow Observations

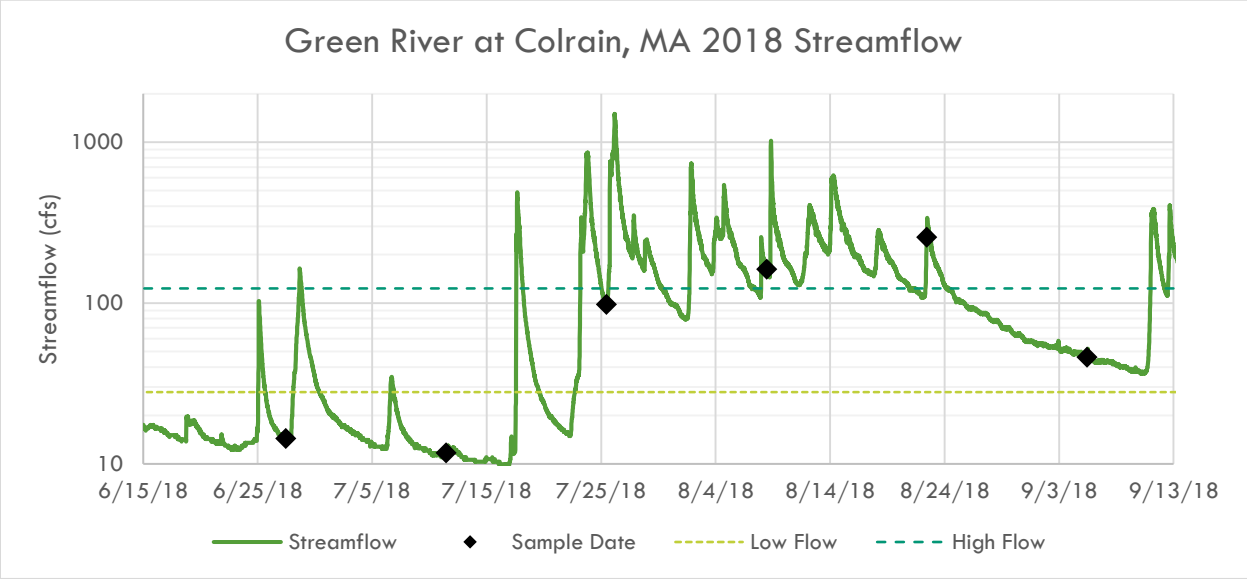


Figure 5 - Green River at Colrain 2018 Streamflow

Presented below is the streamflow chart for the 2017 season. 2018 was an atypical year as there was a drought in early summer follow by abnormally high rainfall amounts in the July and August. 2017 had higher than average flows but was more typical in terms of rainfall. Comparisons between 2017 and 2018 results at sites that were tested both years are presented for each parameter.

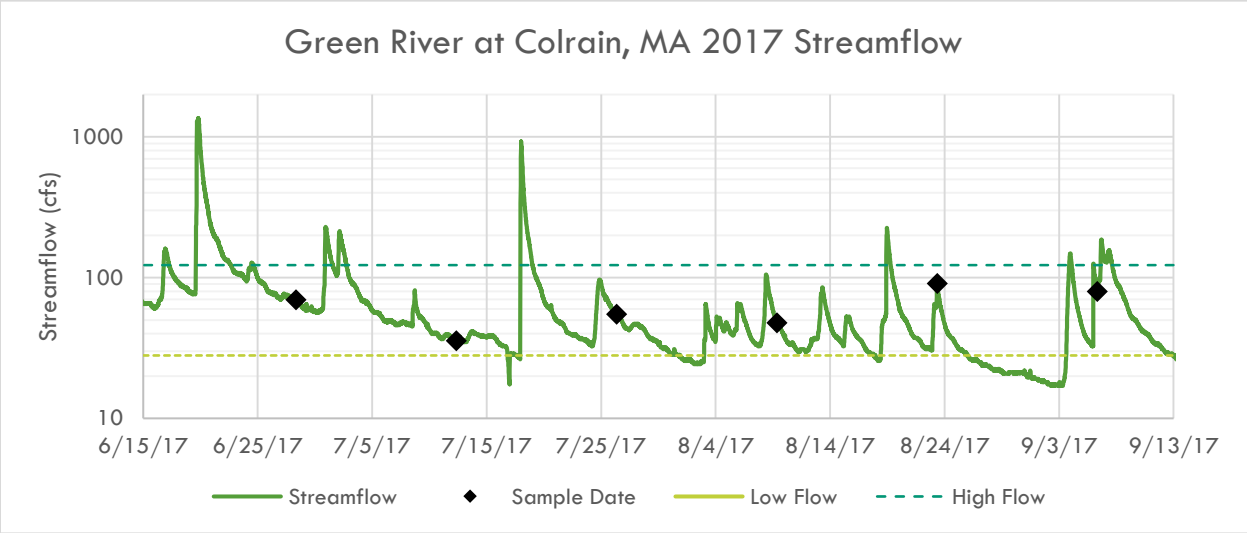
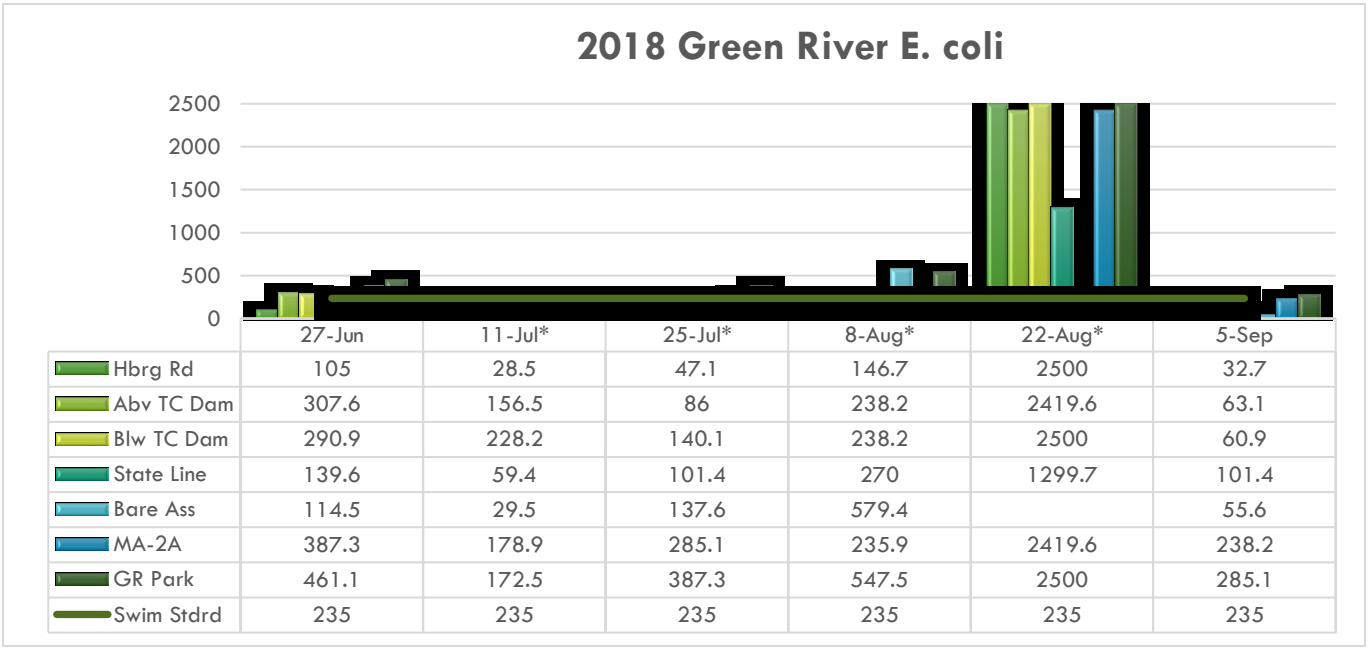


Figure 6 - Green River at Colrain 2017 Streamflow

E. coli

In general, mainstem and tributary sites upstream of Greenfield were near or below acceptable bacteria levels for swimming even after wet weather, while Greenfield sites tended to always be elevated. Maple Brook is in particularly rough shape; the brook, which is buried for almost its full length under the town of Greenfield, maxed out the test five of six times.

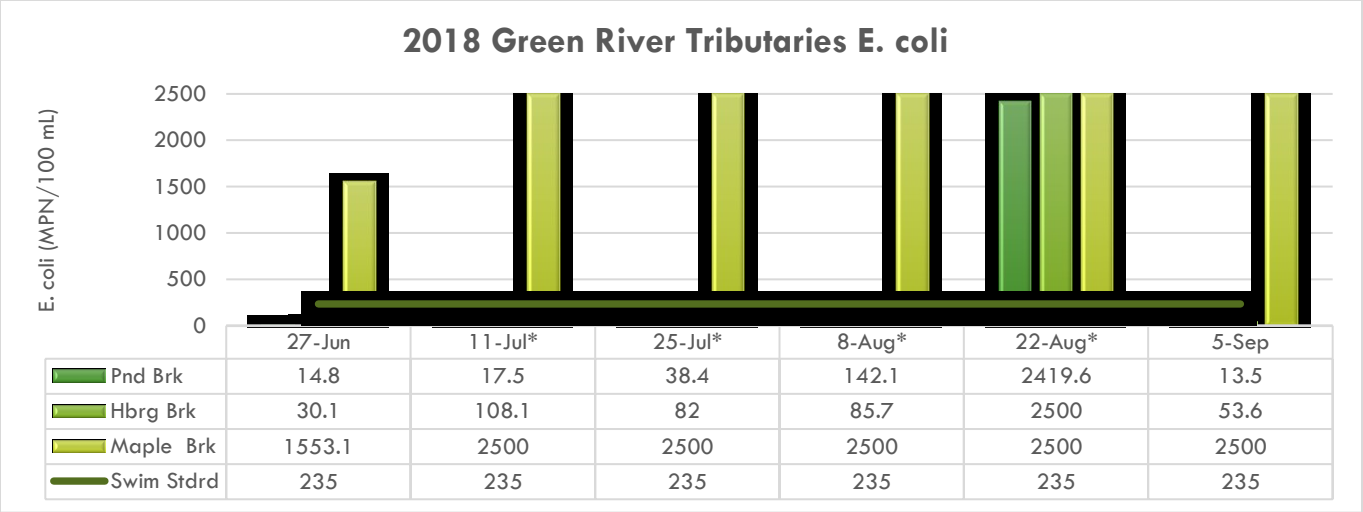
There are several somewhat notable occurrences the *E. coli* results from this season. The first is that the sites bracketing the Timber Crib dam in Guilford were elevated on June 27th which was considered a "dry weather" sampling event. For smaller rivers, the effects of significant rain are generally dissipated 24 hours after that rain. In this instance, it had rained two days prior to sampling but it seems like the dam may have still been holding the runoff which typically has elevated bacteria levels. Second, July 11th was considered a "wet weather" sampling day as it had rained more than 1/10 inch of rain in the 24 hours prior, yet drought conditions were so severe that the typical bacteria spike was not observed. Finally, August 22nd shows that rain fell on what must have been completely saturated ground resulting in very high streamflows and astronomically high E. coli levels at nearly all sites, including the headwater tributaries.



	27-Jun	11-Jul*	25-Jul*	8-Aug*	22-Aug*	5-Sep
Hbrg Rd	105	28.5	47.1	146.7	2500	32.7
Abv TC Dam	307.6	156.5	86	238.2	2419.6	63.1
Blw TC Dam	290.9	228.2	140.1	238.2	2500	60.9
State Line	139.6	59.4	101.4	270	1299.7	101.4
Bare Ass	114.5	29.5	137.6	579.4		55.6
MA-2A	387.3	178.9	285.1	235.9	2419.6	238.2
GR Park	461.1	172.5	387.3	547.5	2500	285.1
Swim Stdrd	235	235	235	235	235	235

Figure 7 - Green River E. coli Results[2]

[2] Note: Values listed as "2500" were above the maximum measurable value of the test (2419.6 MPN)
*wet weather day (>0.1" rain in 24 hrs prior)



	27-Jun	11-Jul*	25-Jul*	8-Aug*	22-Aug*	5-Sep
Pnd Brk	14.8	17.5	38.4	142.1	2419.6	13.5
Hbrg Brk	30.1	108.1	82	85.7	2500	53.6
Maple Brk	1553.1	2500	2500	2500	2500	2500
Swim Stdrd	235	235	235	235	235	235

Figure 8 - Green River Tributary E. coli Results

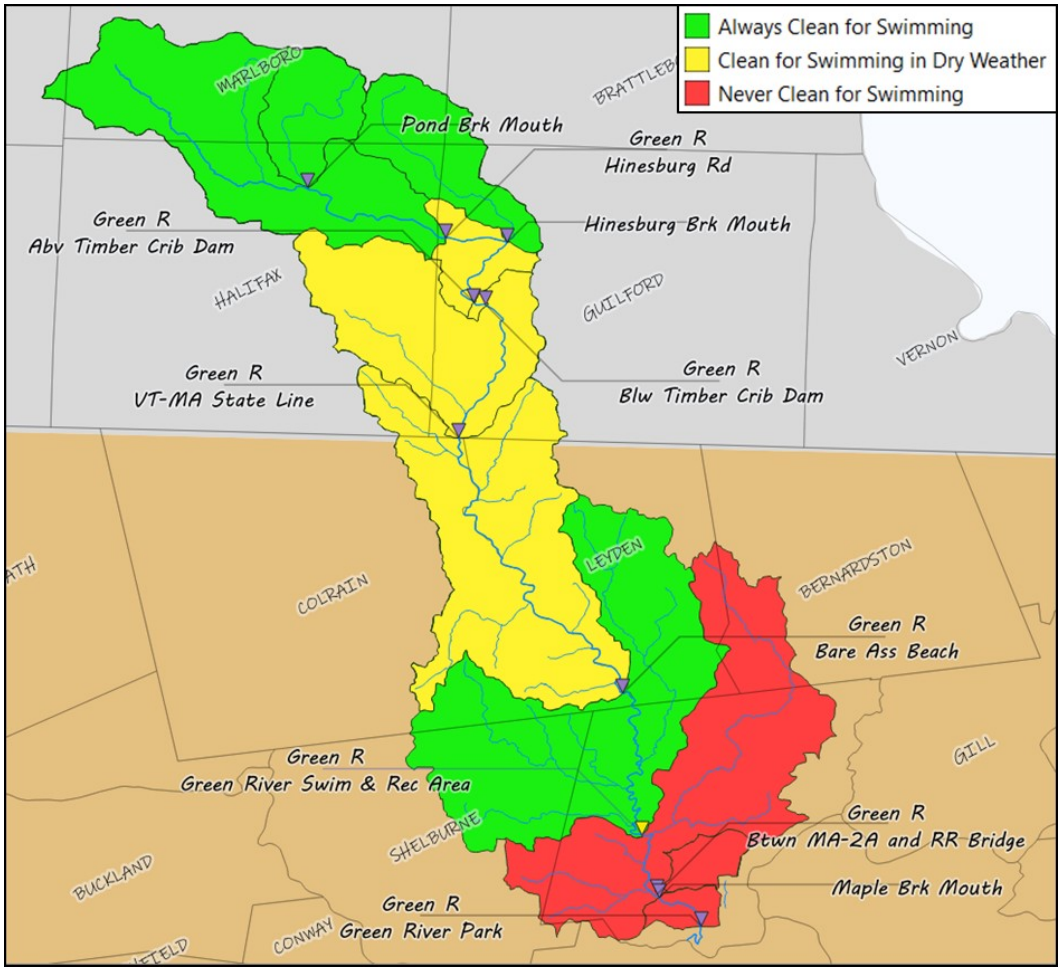


Figure 9 - Map of E. coli Results (8/22 excluded)

As 2018 was a particularly wet year, the results presented here give the impression of the upper portion of the watershed (upstream of Greenfield) being more impaired for bacteria than it may actually be. Comparing the 2018 results with 2017 shows that the two upstream sites that were measured both years (Hinesburg Rd and Below Timber Crib Dam) had lower results in both dry and wet weather in 2017. It is hypothesized that continued monitoring would show a watershed

that is plagued with bacteria-laden runoff only during the wettest periods. Interestingly, the Greenfield site monitored both years shows the opposite effect, perhaps influenced by the early season drought.

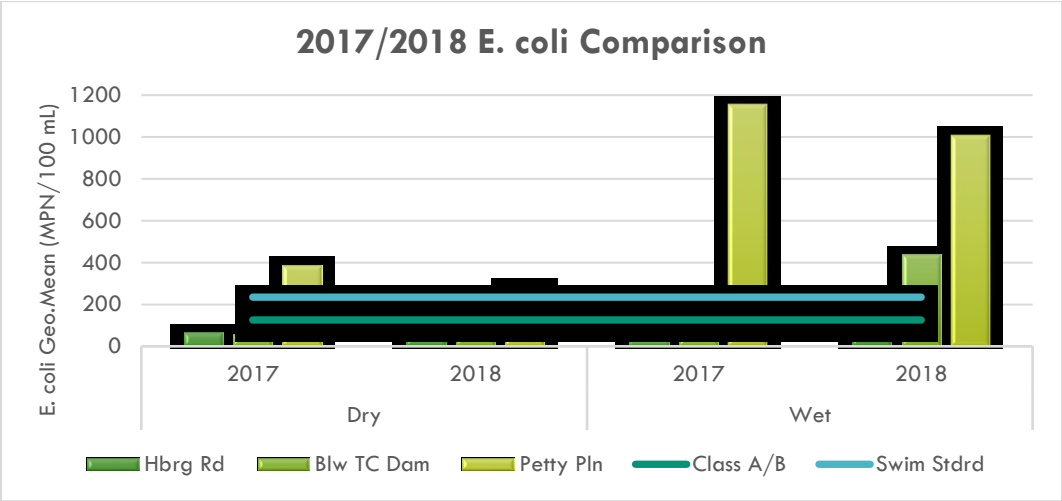


Figure 10 - E. coli Comparison

Nitrogen

All total nitrogen results were well below the Vermont standard of 5.0 mg/L. Most sites were also below the EPA's suggested level of 0.34 mg/L except for the mouth of Maple Brook and Green River Park/Petty Plain Rd. Maple Brook stands out as particularly impacted by high nitrogen levels.

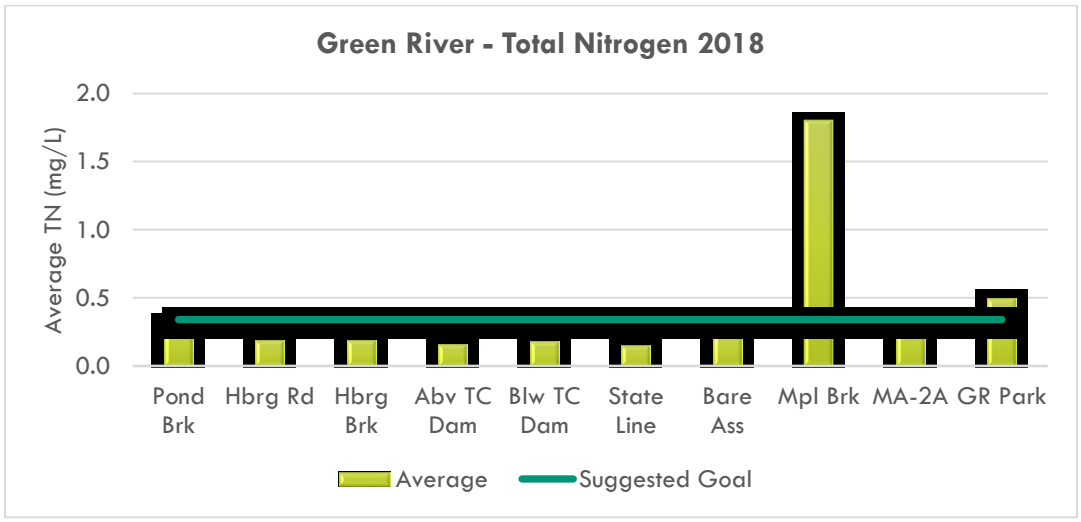


Figure 11 – Green River Total Nitrogen Results

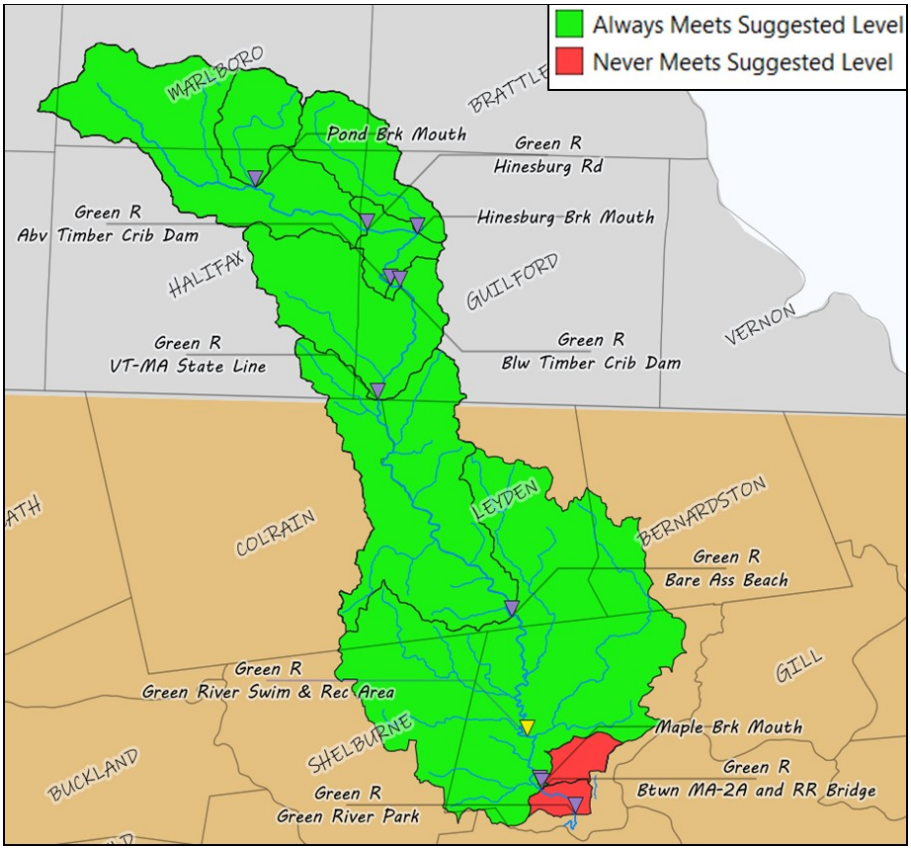


Figure 12 - Map of TN Results

Total nitrogen concentrations do not tend to fluctuate with weather and streamflow. In fact, sometimes high flows result in diluted concentrations. As such, there was not a significant difference between results from 2017 to 2018.

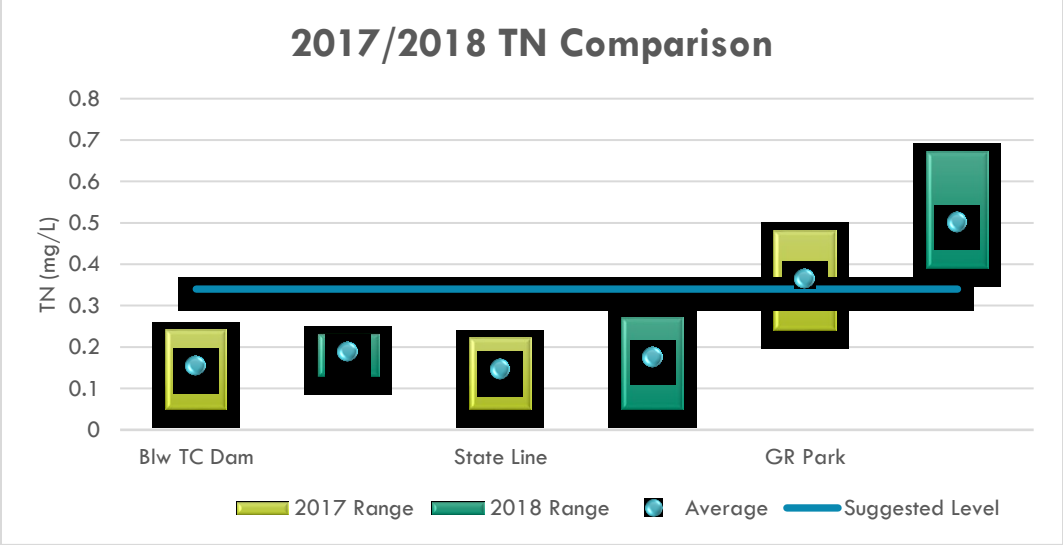


Figure 13 - TN Comparison

Phosphorus

All sites exceeded the Vermont class A(1)/B(1) standard for total phosphorus of 9 µg/L in both wet and dry weather conditions, except for Bare Ass Beach which is under during dry weather. Most sites met the Vermont class(2) standard in dry weather except Maple Brook and Petty Plain Rd/Green River Park; all sites exceeded this standard in wet weather.

Phosphorus tends to stick to sediments and is mobilized in high streamflow, which is seen very clearly in the results presented below. There are significant erosion issues in the Green River watershed since Tropical Storm Irene that are likely contributing to high phosphorus numbers even in the headwaters. Maple Brook once again stands out as being significantly impacted by high phosphorus levels.

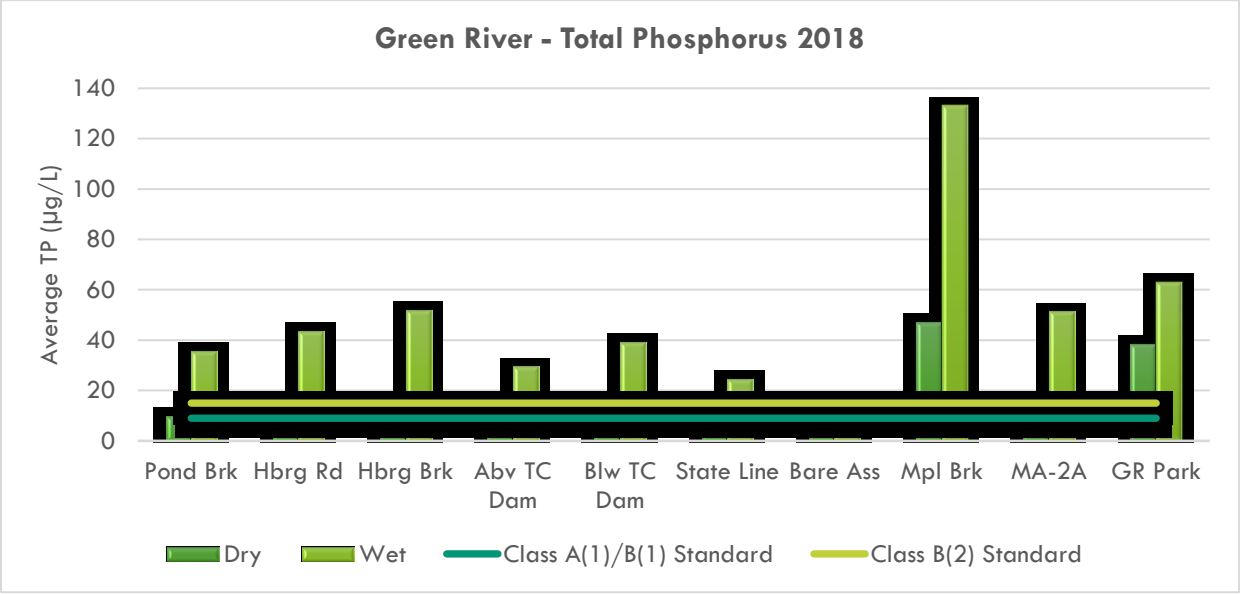


Figure 14 - Green River Total Phosphorus Results

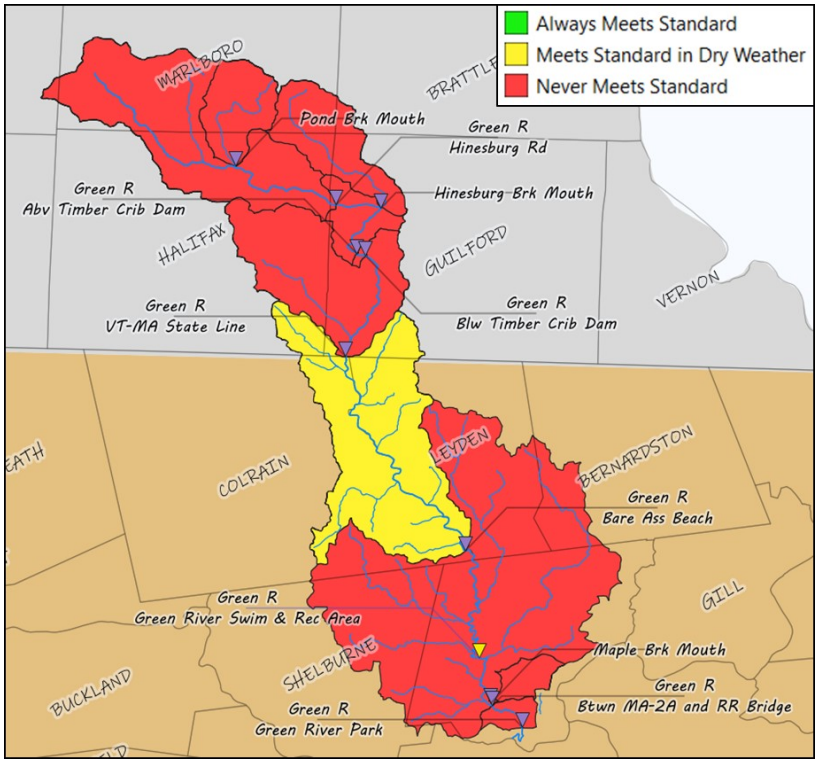


Figure 15 - Map of TP Results (Class A(1)/B(1) Standard used)

With regards to phosphorus, 2018 results were heavily influenced by the wet weather and high streamflows as pictured below.

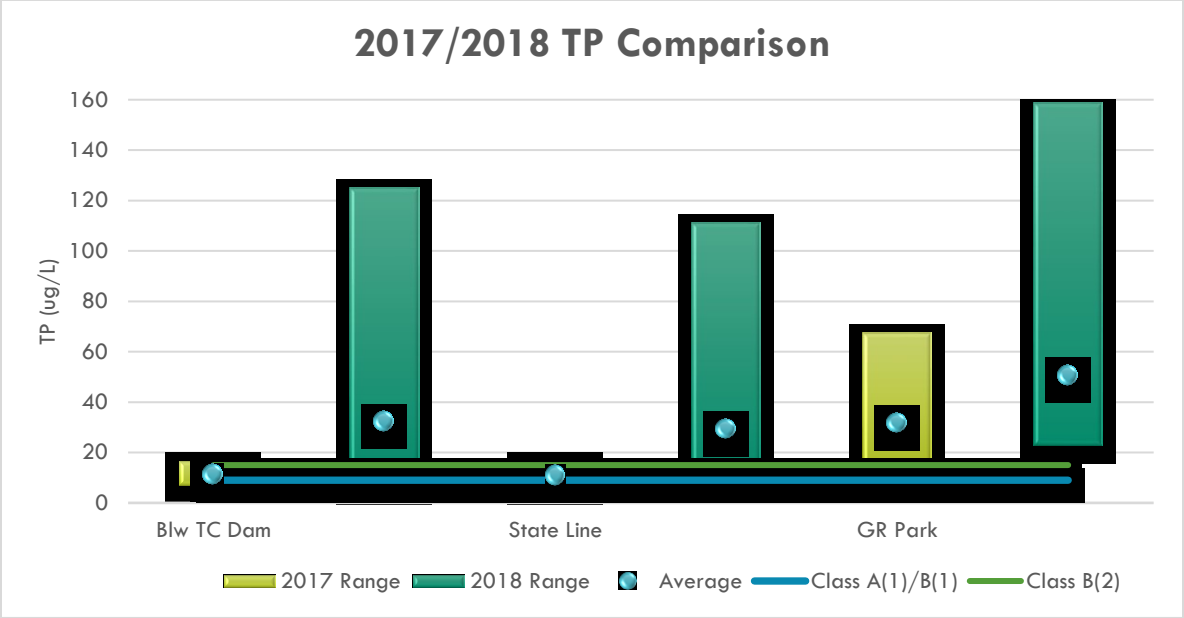


Figure 16 - TP Comparison

Turbidity

Compliance with turbidity standards are determined by an annual average (while most others are determined by status at low flows). In 2018, the two lowest Green River sites, Between MA-2A and RR Bridge and Green River Park/Petty Plain Rd, as well as Hinesburg Brook and Maple Brook exceeded the VT standard of 10 NTU, although it only technically applies to Hinesburg Brook. In wet weather, a few other sites also tended to exceed this 10 NTU threshold. This highlights the erosion issues discussed in the section above about phosphorus.

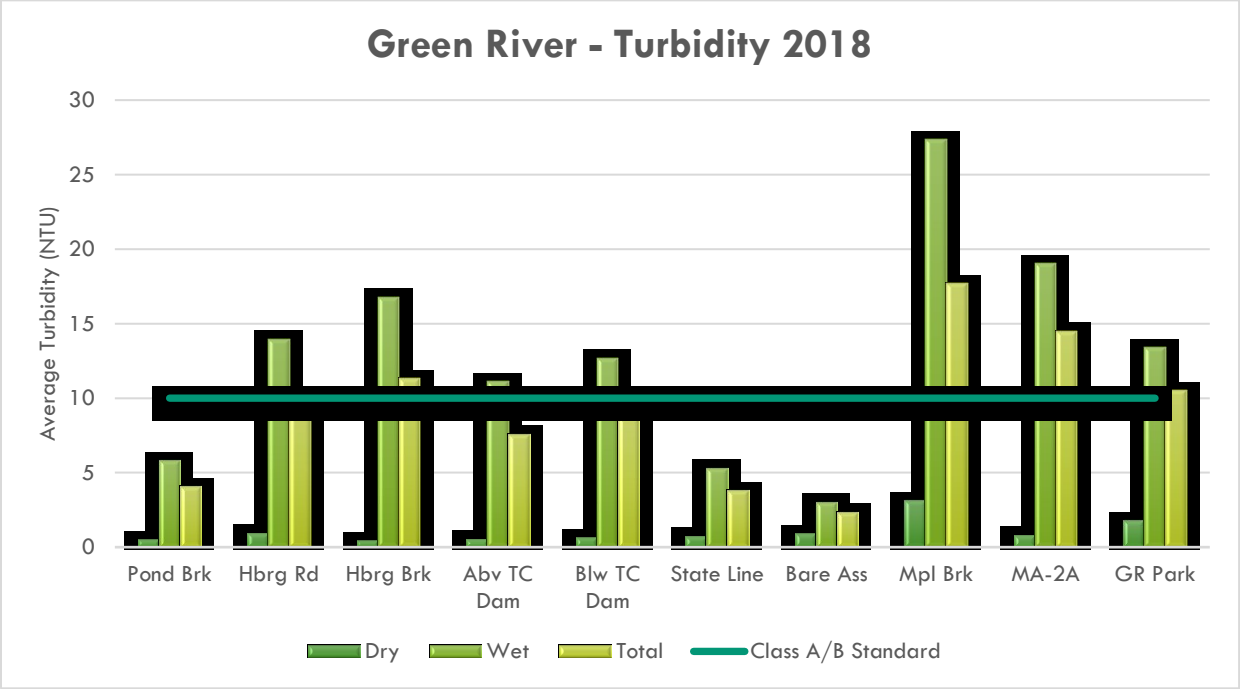


Figure 17 - Green River Turbidity Results

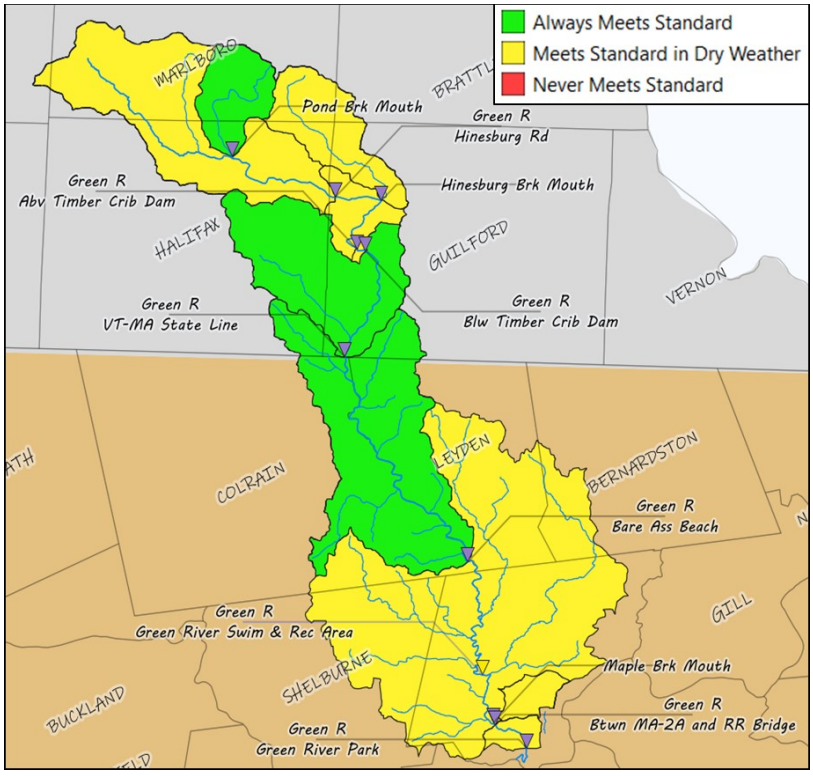


Figure 18 - Map of Turbidity Results

The comparison between 2017 and 2018 values below shows that the upper sites were affected by erosion during the high flows as the Green River Park/Petty Plain Rd site had comparable results between the two years. While high flows occurring in August is atypical as they are more likely to occur during early spring snowmelt, the turbidity standard was intended to include values from throughout the year. We are not usually sampling during the spring to capture the high flows, so it is very important to see how high flows affect the Green River's turbidity.

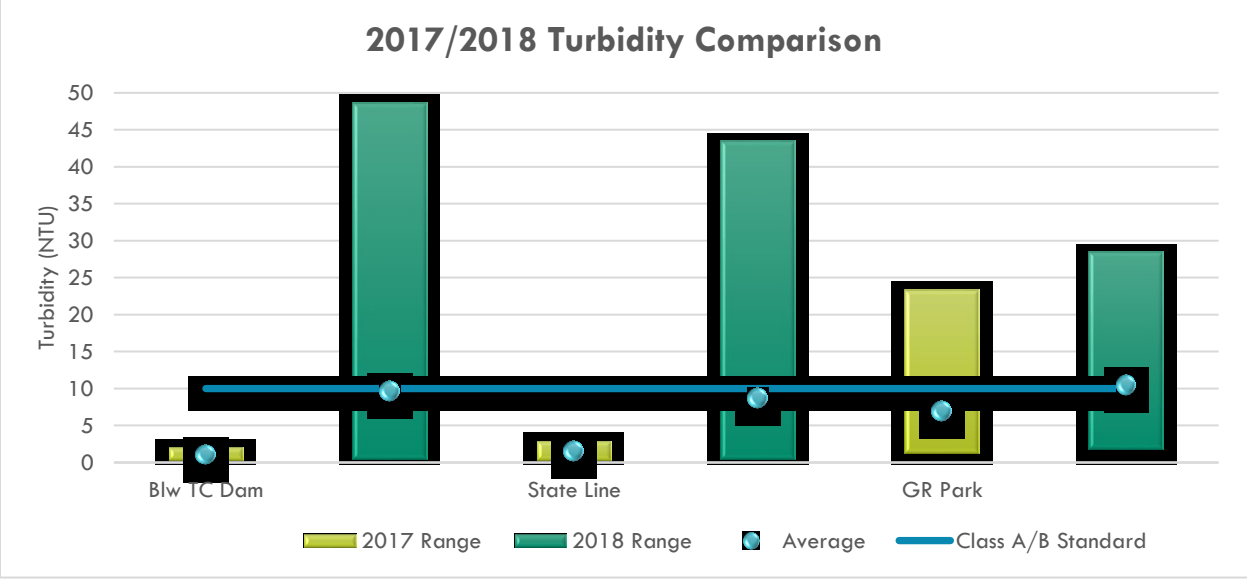


Figure 19 - Turbidity Comparison

Phosphorus & Conductivity Connection

As previously mentioned, phosphorus concentrations and turbidity values can be related. Phosphorus tends to "stick" to particles in water and so travels downstream when the particles are traveling downstream. The chart presented below

shows the correlation between phosphorus and conductivity. The data has been split between the sites upstream of Greenfield and the sites in Greenfield; the Greenfield sites are experiencing a more urban set of stressors than the upstream sites. Correlation values (R^2) indicate a stronger correlation between two values the closer they are to 1. The chart below demonstrates that the upstream sites have a nearly perfect correlation between turbidity and phosphorus, so it is likely that the main input of phosphorus into the waters is from erosion of sediment. While the Greenfield sites still have a strong correlation, it is likely there are other inputs as well.

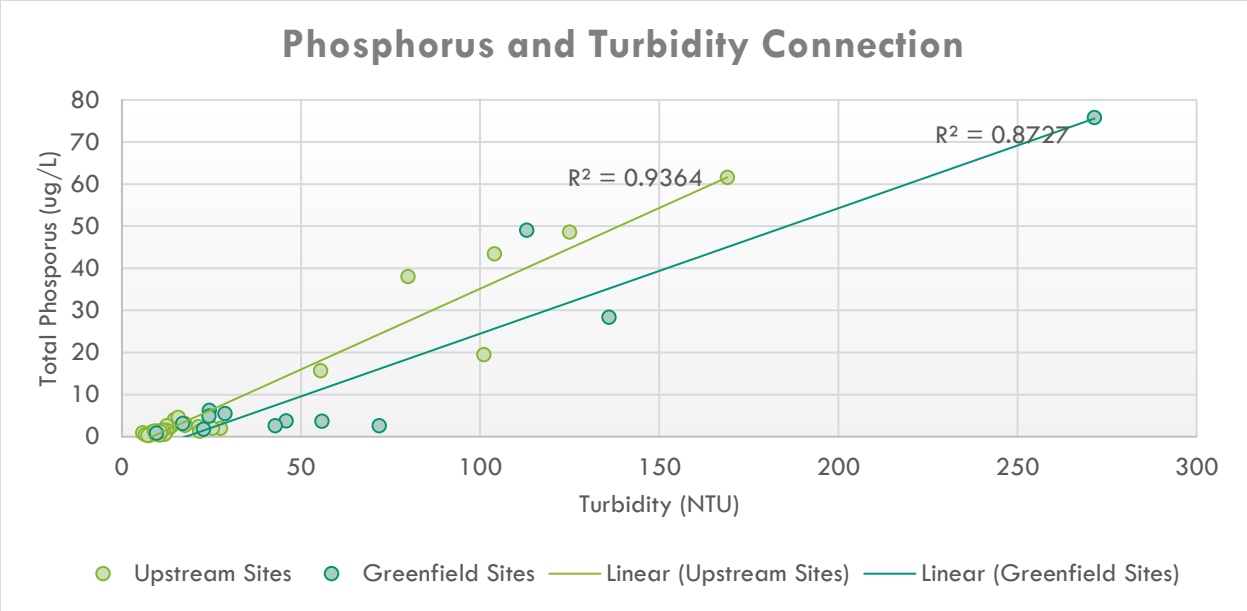


Figure 20 - Phosphorus and Turbidity Connection

Conductivity

Conductivity values do not tell much about water quality as a standalone test since many different factors affect conductivity values. Relatively high conductivity values or sudden changes spatially or temporally indicate a change in water quality that includes other parameters we do not measure for. Looking at the ranges of conductivity measured shows increasing conductivity from upstream to downstream with, as usual, Maple Brook standing out as heavily impacted. The high conductivity values in Maple Brook could include road salts in addition to the high amount of nitrogen and phosphorus ions indicated in earlier sections.

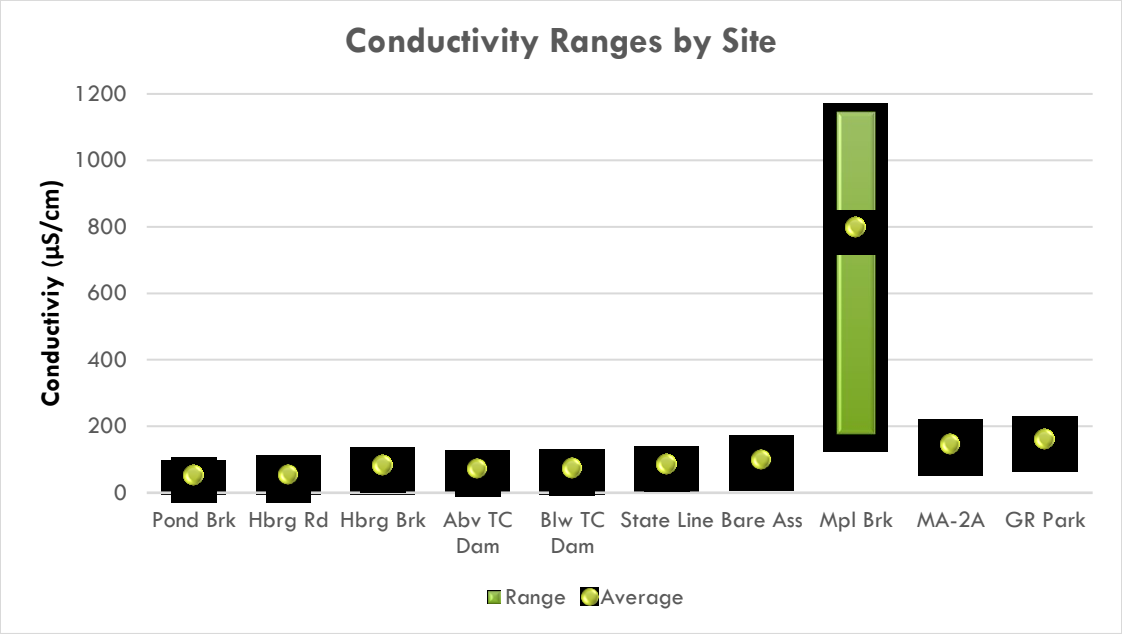


Figure 21 - Conductivity Results

Next Steps

Deerfield River Watershed Association is planning to continue focusing on the Green River in both Vermont and Massachusetts with its monitoring in the summer of 2019. We will continue to work with the Green River Watershed Alliance in the pursuit of reclassification of the Green River in Vermont to Class A. As opportunities arise, we may also pursue source tracking in Greenfield, particularly within Maple Brook.

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Appendix – Complete Green River Results

Date	Site	Time	CRC Sample #	Final E. Coli. (mpn/ 100ml)	Wet? (Y/N)	VAEL Sample #	TN (mg-N/l)	TP (µg P/L)	Turbidity (NTU)	Spec. Cond. (µS/cm)	Air Temp. °C	Water Temp °C	Water Level	Flow Type
6/27/18	MA-GRN_00.8	9:20	9-27-18	461.1	N	181176-22	0.64	49.2	NT	203.3	NR	NR	moderate	base
6/27/18	MA-GRN_02.0	7:10	9-26-18	387.3	N	181176-21	0.33	19.7	NT	194.8	16	18	moderate	base
6/27/18	MA-GRN_09.8	9:00	9-25-18	114.5	N	181176-19	0.16	9.55	NT	60.8	17	15.5	moderate	base
6/27/18	MA-MPL_00.1	7:20	9-28-18	1553.1	N	181176-20	1.67	53.3	NT	1018	15	14.5	low	base
6/27/18	VT-GRN_16.8	8:00	9-16-18	139.6	N	181176-18	0.17	11.2	1.04	102.8	14	14.5	low	base
6/27/18	VT-GRN_20.2	9:15	9-15-18	290.9	N	181176-17	0.2	12	0.85	61.4	18	14.5	moderate	base
6/27/18	VT-GRN_20.5	8:17	9-14-18	307.6	N	181176-16	0.21	11.5	0.82	53.3	16.5	14	moderate	base
6/27/18	VT-GRN_23.4	8:00	9-12-18	105	N	181176-13	0.23	12.5	1.47	43.5	15	14	low	base
6/27/18	VT-HBG_00.1	7:30	9-13-18	30.1	N	181176-15	0.18	11.9	0.58	105.7	14	12	low	base
6/27/18	VT-PND_00.1	7:25	9-11-18	14.8	N	181176-12	0.33	10.5	0.43	61.2	13	11	low	base
7/11/18	MA-GRN_00.8	8:30	13-27-18	172.5	N	181293-22	0.67	43.1	NT	123.9	22	23.5	low	base
7/11/18	MA-GRN_02.0	8:58	13-26-18	178.9	N	181293-21	0.31	13	NT	116.3	25	21	low	base
7/11/18	MA-GRN_09.8	9:15	13-25-18	29.5	N	181293-19	< 0.1	6.6	NT	145.5	23	20.5	moderate	base
7/11/18	MA-MPL_00.1	8:49	13-28-18	> 2419.6	N	181293-20	1.75	45.8	3.71	1144	25	17	NR	NR
7/11/18	VT-GRN_16.8	8:02	13-17-18	59.4	Y	181293-18	0.11	8.59	1.21	113.4	20	19	low	base
7/11/18	VT-GRN_20.2	8:22	13-16-18	228.2	Y	181293-17	0.17	11	1.36	105	21.5	18.5	moderate	base
7/11/18	VT-GRN_20.5	8:10	13-15-18	156.5	Y	181293-16	0.14	8.13	0.77	102.2	20.5	18.5	low	base
7/11/18	VT-GRN_23.4	7:55	13-13-18	28.5	Y	181293-13	0.22	8.58	0.67	86.1	16.5	17.5	low	base
7/11/18	VT-HBG_00.1	6:30	13-14-18	108.1	Y	181293-15	0.19	9.94	1.31	48.5	17	15.5	low	base
7/11/18	VT-PND_00.1	7:45	13-12-18	17.5	Y	181293-12	0.37	9.12	1.32	70.5	18	15	low	base
7/25/18	MA-GRN_00.8	9:40	17-24-18	387.3	Y	181425-24	0.4	24.4	6.27	119.7	26	21.5	high	freshet
7/25/18	MA-GRN_02.0	7:05	17-23-18	285.1	Y	181425-23	0.26	24.3	4.9	105.9	25	20	high	freshet
7/25/18	MA-GRN_09.8	9:02	17-22-18	137.6	Y	181425-22	0.18	13.9	2.57	74.1	NR	NR	moderate	freshet
7/25/18	MA-MPL_00.1	7:20	17-25-18	> 2419.6	Y	181425-25	1.96	71.8	2.63	760	24	20	high	freshet
7/25/18	VT-GRN_16.8	8:10	17-16-18	101.4	Y	181425-16	0.17	13.1	1.98	61.5	22	19	high	freshet
7/25/18	VT-GRN_20.2	8:30	17-15-18	140.1	Y	181425-15	0.19	14.6	4.02	55.6	21	19	high	freshet
7/25/18	VT-GRN_20.5	7:45	17-14-18	86	Y	181425-14	0.21	12.5	2.6	55.9	23	20	moderate	freshet
7/25/18	VT-GRN_23.4	8:00	17-12-18	47.1	Y	181425-12	0.16	15.7	4.55	43.6	20.5	10.7	moderate	freshet
7/25/18	VT-HBG_00.1	7:00	17-13-18	82	Y	181425-13	0.16	11.4	1.54	70.7	20.5	17.5	moderate	freshet

Date	Site	Time	CRC Sample #	Final E. Coli. (mpn/ 100ml)	Wet? (Y/N)	VAEL Sample #	TN (mg-N/l)	TP (µg P/L)	Turbidity (NTU)	Spec. Cond. (µS/cm)	Air Temp. °C	Water Temp °C	Water Level	Flow Type
7/25/18	VT-PND_00.1	7:50	17-11-18	38.4	Y	181425-11	0.22	10.8	1.15	40.3	20	17	high	freshet
8/8/18	MA-GRN_00.8	9:15	21-26-18	547.5	Y	181560-26	0.39	28.8	5.52	135	NR	NR	moderate	freshet
8/8/18	MA-GRN_02.0	8:35	21-25-18	235.9	Y	181560-25	0.22	17	3.15	118.5	23	20	high	freshet
8/8/18	MA-GRN_09.8	9:05	21-24-18	579.4	Y	181560-24	0.2	16.1	3.49	80.9	NR	NR	moderate	freshet
8/8/18	MA-MPL_00.1	8:25	21-27-18	> 2419.6	Y	181560-27	2.31	55.8	3.66	794	23	20	high	freshet
8/8/18	VT-GRN_16.8	7:50	21-17-18	270	Y	181560-16	0.17	21.3	2.35	59.5	20	18	high	freshet
8/8/18	VT-GRN_20.2	8:13	21-16-18	238.2	Y	181560-15	0.17	27.5	2	49.9	20	18.5	high	regulated
8/8/18	VT-GRN_20.5	8:10	21-15-18	238.2	Y	181560-14	0.17	17.5	3.14	51.4	24	19	moderate	freshet
8/8/18	VT-GRN_23.4	7:50	21-13-18	146.7	Y	181560-12	0.18	25.3	2.02	32.1	19.5	18	moderate	freshet
8/8/18	VT-HBG_00.1	7:05	21-14-18	85.7	Y	181560-13	0.13	17.6	2.7	68.4	20	17.5	moderate	base
8/8/18	VT-PND_00.1	7:55	21-12-18	142.1	Y	181560-11	0.22	21.7	1.31	37.6	19	18	high	freshet
8/22/18	MA-GRN_00.8	8:50	25-23-18	> 2419.6	Y	181672-26	0.45	136	28.4	179.9	18.5	NR	moderate	NR
8/22/18	MA-GRN_02.0	9:00	25-22-18	2419.6	Y	181672-25	0.36	113	49	148.4	18.5	18.5	high	freshet
8/22/18	MA-MPL_00.1	9:28	25-24-18	> 2419.6	Y	181672-27	0.97	271.5	75.8	177.8	20.5	19.5	high	freshet
8/22/18	VT-GRN_16.8	7:59	25-16-18	1299.7	Y	181672-16	0.24	55.5	15.7	80	20	16.8	high	freshet
8/22/18	VT-GRN_20.2	8:25	25-15-18	> 2419.6	Y	181672-15	0.27	104	43.4	76.1	18	16	high	regulated
8/22/18	VT-GRN_20.5	8:25	25-14-18	2419.6	Y	181672-14	0.15	79.9	38	78.8	18.5	17	moderate	freshet
8/22/18	VT-GRN_23.4	8:00	25-12-18	> 2419.6	Y	181672-12	0.21	125	48.6	48.3	17	15.5	high	freshet
8/22/18	VT-HBG_00.1	7:20	25-13-18	> 2419.6	Y	181672-13	0.42	169	61.6	91	17	16	high	freshet
8/22/18	VT-PND_00.1	7:50	25-11-18	2419.6	Y	181672-11	0.51	101	19.5	47.2	19	15	high	freshet
9/5/18	MA-GRN_00.8	9:15	29-25-18	285.1	N	181823-26	0.46	22.8	1.78	199.8	25	NR	low	base
9/5/18	MA-GRN_02.0	9:30	29-24-18	238.2	N	181823-25	0.33	9.61	0.82	191.8	24	20	low	base
9/5/18	MA-GRN_09.8	8:15	29-23-18	55.6	N	181823-24	0.68	5.8	0.92	133.2	NR	NR	moderate	base
9/5/18	MA-MPL_00.1	9:41	29-26-18	> 2419.6	N	181823-27	2.15	42.8	2.57	896	24	18	low	base
9/5/18	VT-GRN_16.8	8:55	29-16-18	101.4	N	181823-16	< 0.1	7.39	0.43	103.1	18	17.5	moderate	base
9/5/18	VT-GRN_20.2	8:30	29-15-18	60.9	N	181823-15	< 0.1	6.97	0.42	93.3	19	17	moderate	base
9/5/18	VT-GRN_20.5	8:20	29-14-18	63.1	N	181823-14	< 0.1	7.46	0.28	93.4	20	17	low	base
9/5/18	VT-GRN_23.4	7:50	29-12-18	32.7	N	181823-12	0.13	6.53	0.47	70.1	17.5	16.5	low	base
9/5/18	VT-HBG_00.1	7:00	29-13-18	53.6	N	181823-13	< 0.1	7.23	0.31	110.8	18	15.5	moderate	base
9/5/18	VT-PND_00.1	7:20	29-11-18	13.5	N	181823-11	0.26	9.33	0.6	58.8	NR	NR	low	base