

2008 WATER QUALITY MONITORING REPORT

**By Elaine Blodgett
Poultney Mettowee Watershed Partnership**



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Elaine Blodgett
October 15, 2008**

Introduction

The Poultney Mettowee Watershed Partnership (PMWP) in conjunction with the Poultney Mettowee Natural Resources Conservation District (PMNRCD) collected water quality samples at 19 sites between March and August, 2008. The samples were collected by both staff and volunteers and analyzed by the Vermont Department of Environmental Conservation's (DEC) LaRosa Environmental Lab (LaRosa) in Waterbury, VT, as part of their Volunteer Water Quality Monitoring Laboratory Services Partnership grant program.

Funding for this year's water quality monitoring program was provided through a Lake Champlain Basin Program Organization Support Grant and a Vermont DEC Watershed Grant. This funding was essential to our program's success.

This summer, with the help of our Green Mountain College interns Charlie Willame and James Holt, the Poultney Mettowee Watershed Partnership monitored five streams in the watershed. We sampled the Poultney River for the sixth year in a row; the Mettowee River, Flower Brook, and Beaver Brook were sampled for the fourth year, and the Castleton River was sampled for the third year.

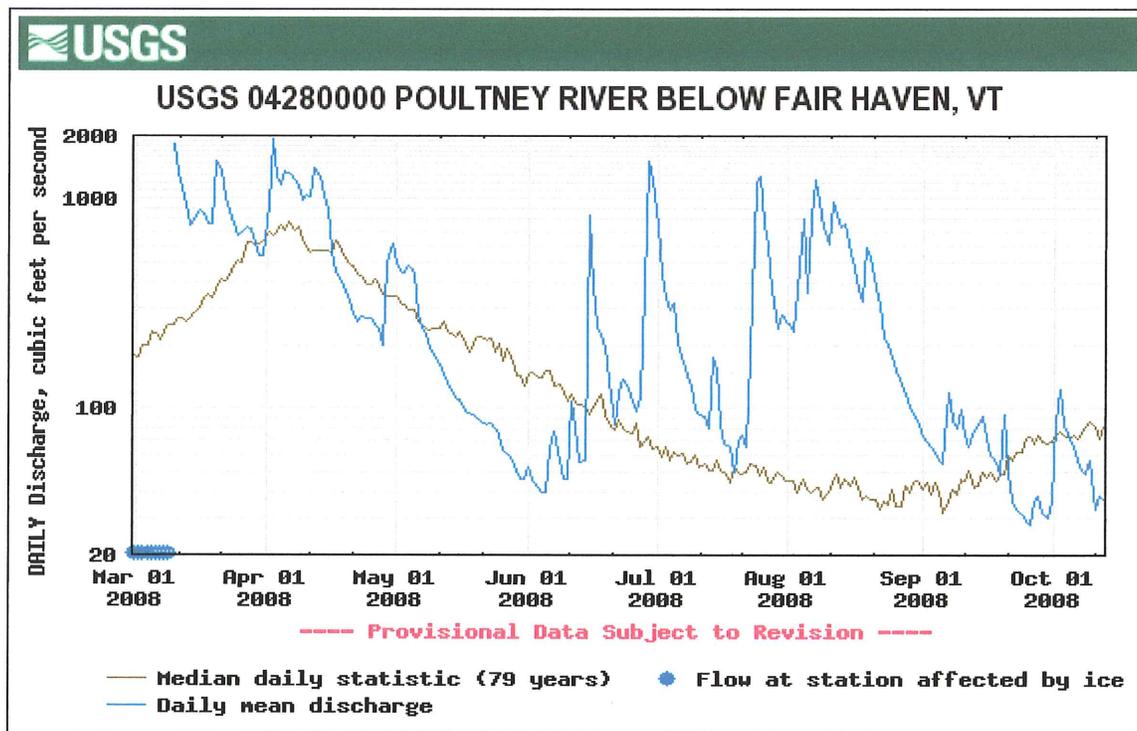
Scientists at LaRosa analyzed the water samples for *E. coli*, turbidity, total phosphorus and nitrogen. *E. coli* tests measure the number of bacterial colonies in the water sample, while turbidity is a measure of water clarity (or conversely sediment levels) in the water and total phosphorus and nitrogen indicates the nutrient levels in the water.

The PMWP collected samples every Wednesday during the winter/spring months beginning March 19th and ending May 7th. The PMWP collected samples every other Wednesday during the summer months beginning June 4th and ending on August 27th. These samples were collected on scheduled days, based on the lab availability, and as a result were not always collected at times that provided the most information.

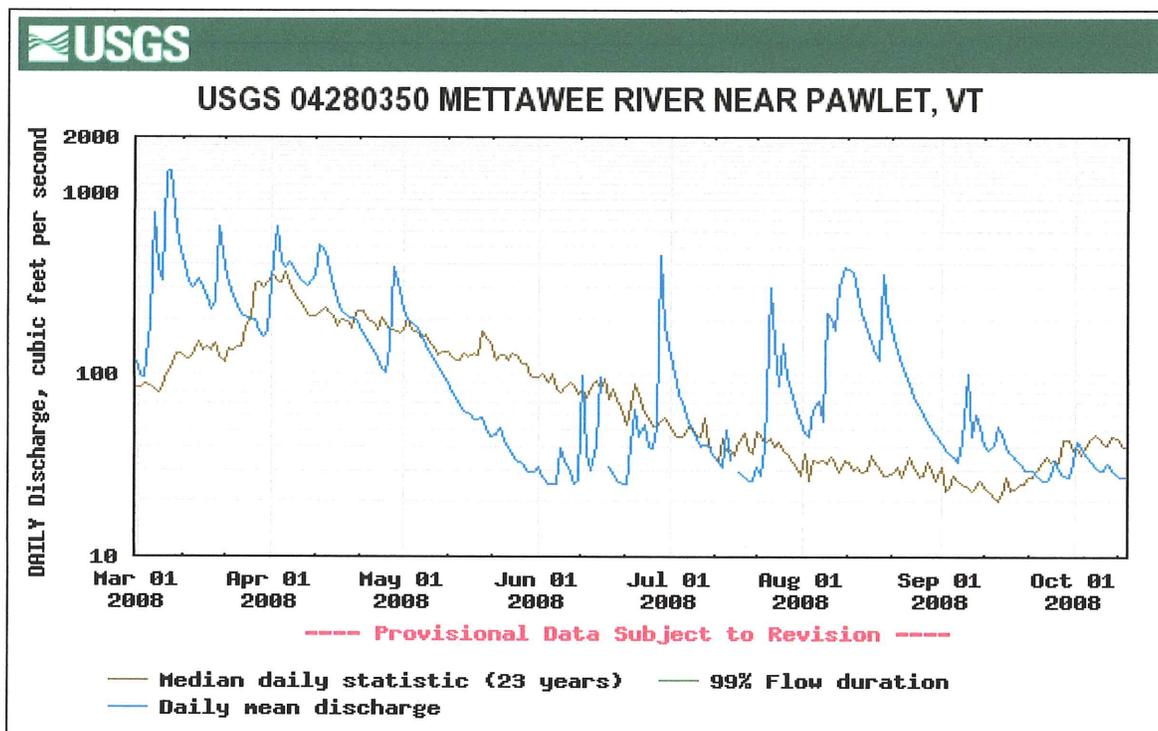
Flow Data

The following graphs contain US Geologic Survey (USGS) Flow Data for two gage stations in our watershed. The first graph shows flow data for the Poultney River recorded at the USGS station downstream of Fair Haven, VT. The second graph consists of flow data recorded at the USGS station on the Mettowee River at Bette's Bridge in Pawlet, VT.

Graph 1: Poultney River flow data (March 1 to October 1, 2008).



Graph 2: Mettowee River flow data (March 1 to October 1, 2008).



E. coli

Table 1: *E. coli* data for the 2008 sampling season.

Site	3/19/08	3/26/08	4/2/08	4/9/08	4/23/08	4/30/08	5/7/08	6/4/08	6/18/08	7/2/08	7/16/08	7/30/08	8/13/08	8/27/08	gm
PR01	X	X	X	X	X	X	X	34.00	88.00	179.00	53.00	39.00	X	23.00	54
PR02	X	X	X	X	X	X	X	345.00	117.00	137.00	155.00	104.00	X	26.00	115
PR03	X	X	X	X	X	X	X	144.00	50.00	142.00	88.00	84.00	X	31.00	78
PR05	X	X	X	X	X	X	X	133.00	96.00	86.00	75.00	38.00	147.00	21.00	71
PR06	X	X	X	X	X	X	X	166.00	161.00	86.00	56.00	81.00	129.00	34.00	89
PR07	X	X	X	X	X	X	X	435.00	141.00	114.00	104.00	89.00	99.00	37.00	115
PR08	X	X	X	X	X	X	X	308.00	345.00	172.00	261.00	260.00	517.00	64.00	234
METT01.5	X	X	X	X	X	X	X	28.00	132.00	101.00	87.00	99.00	86.00	47.00	74
METT02	X	X	X	X	X	X	X	64.00	86.00	201.00	114.00	248.00	124.00	105.00	123
METT02.25	X	16.00	X	20.00	210.00	88.00	66.00	214.00	172.00	308.00	649.00	228.00	166.00	249.00	132
METT02.5	X	16.00	X	12.00	326.00	272.00	411.00	120.00	387.00	299.00	153.00	219.00	172.00	84.00	138
METT03	X	11.00	X	4.00	50.00	236.00	228.00	179.00	291.00	326.00	172.00	162.00	137.00	111.00	98
FLOWER01	X	29.00	X	18.00	54.00	70.00	250.00	219.00	326.00	172.00	291.00	261.00	147.00	62.00	112
BEAVER01	X	X	X	X	X	X	X	411.00	365.00	649.00	X	86.00	285.00	86.00	240
CA01	X	X	X	X	X	X	X	133.00	387.00	313.00	687.00	866.00	225.00	980.00	417
CA02	X	X	X	X	X	X	X	1990.00	236.00	152.00	687.00	308.00	99.00	365.00	339
CA03	X	X	X	X	X	X	X	93.00	225.00	291.00	126.00	179.00	153.00	291.00	178
CA05	X	X	X	X	X	X	X	78.00	228.00	308.00	152.00	128.00	225.00	162.00	170
CA06	X	X	X	X	X	X	X	78.00	201.00	345.00	129.00	261.00	219.00	435.00	209

= above Vermont *E. Coli* standard
 = Above Vermont & US EPA *E. Coli* standards

Guidelines or standards for *E. coli* levels in streams fall under jurisdiction of State and Federal regulations. Vermont's Water Quality Standard for single samples collected from the rivers and streams similar to those found in our watershed is 77 colonies of *E. coli* per 100 ml of water. This number is one of the most protective of human health in the country (more information about the Vermont state standard can be found on our website (www.poutneymettowee.org) or the Vermont DEC website (http://www.anr.state.vt.us/dec/waterq/htm/wq_monitoring.htm)). Please refer to the *Citizen's Guide to Bacteria Monitoring in Vermont Waters*). The US EPA standard for like water bodies is set at 235 *E. coli* colonies per 100 ml of water. Vermont is governed by the more

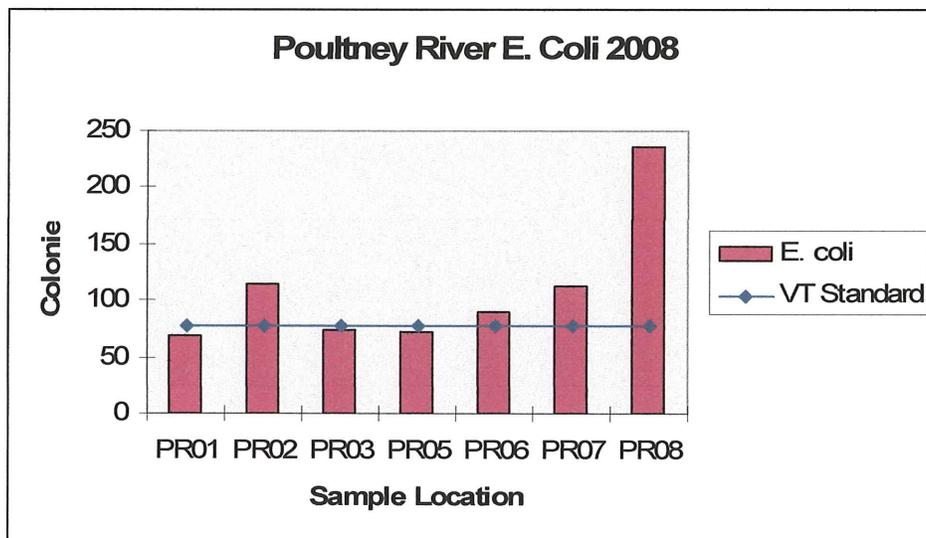
stringent 77 colonies per 100 ml of water; however, the US EPA standard can be used as a secondary benchmark against which to compare our results.

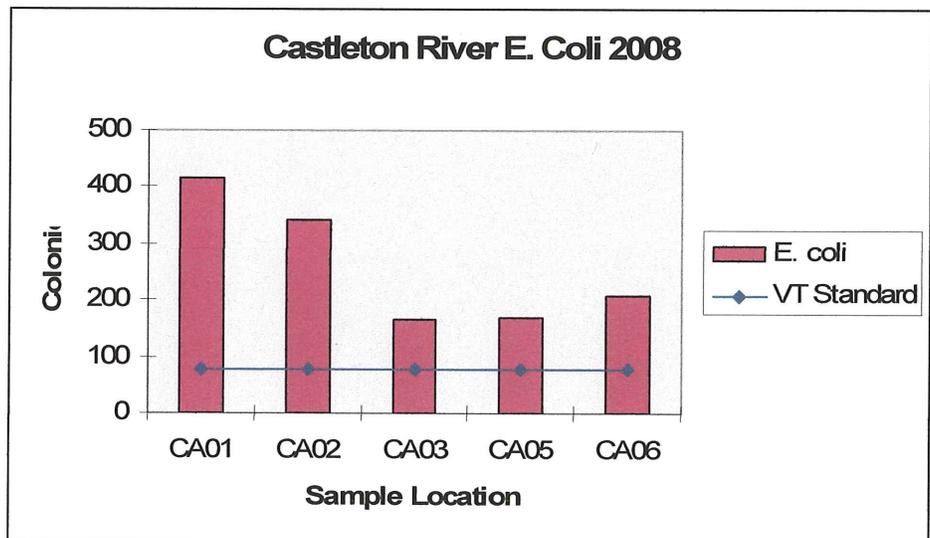
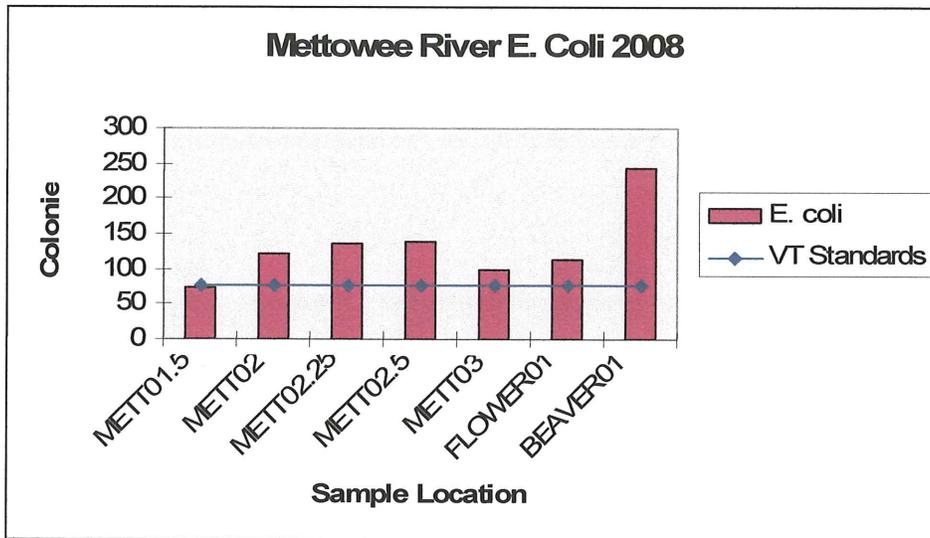
This year the majority of samples were above both the Vermont and the US EPA Water Quality Standard for coliform concentrations. Of the 149 samples collected this season, only 30 samples (20%) were below Vermont's *E. coli* Water Quality Standard. 76 samples (51%) were above the Vermont standard and 43 samples (29%) were above both the Vermont standard and the US EPA standard.

All of the sites monitored regularly exceeded both the Vermont and the US EPA Water Quality Standards for *E. coli* concentration.

Geometric mean *E. coli* concentrations are used as longer-term indicators of systemic contamination. Vermont considers waters impaired for swimming use where geometric mean *E. coli* concentrations exceed 77 *E. coli* colonies per 100ml for two or more years, based on five or more samples per year. Vermont considers the flow regime under which the samples were collected in determining impairment (Kamman, 2006). In 2006, the geometric mean (for all compiled data) was exceeded at all but three sites (PR02, PR06, and Mett1.5). In 2007, the geometric mean for all sites exceeded 77 *E. coli* colonies per 100 ml of water. Adding the data for 2007 to all of the other data collected and taking the geometric mean finds that only PR01 and Mett01 (only one year of data for this site) do not exceed the Vermont Standard. 2008 samples exceeded the state regulation in all but 4 sites (METT01.5, PR01, PR03 & PR05).

Graphs 3-5: *E. Coli* results for 2008





Total Phosphorus

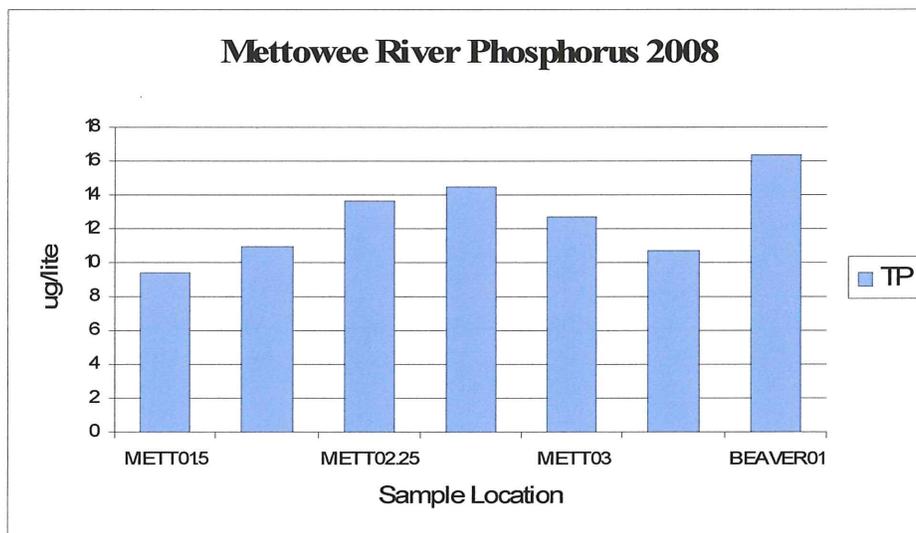
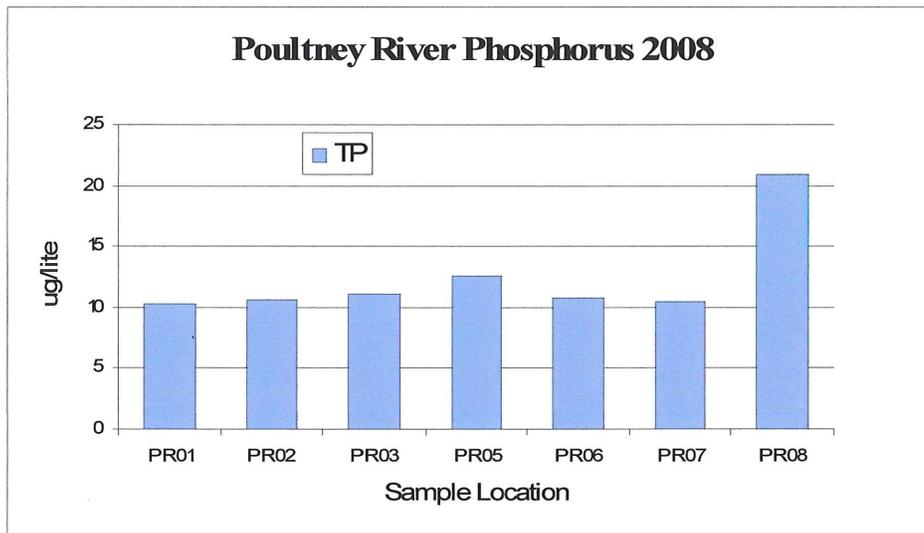
Table 2: Total Phosphorus results for the 2008 sampling season

Site	3/19/08	3/26/08	4/2/08	4/9/08	4/23/08	4/30/08	5/7/08	6/4/08	6/18/08	7/2/08	7/16/08	7/30/08	8/13/08	8/27/08
PR01	X	X	X	X	X	X	X	12.20	10.50	10.00	NO DATA	10.70	NO DATA	8.90
PR02	X	X	X	X	X	X	X	11.40	9.28	12.60	NO DATA	10.20	NO DATA	12.40
PR03	X	X	X	X	X	X	X	8.68	8.77	14.80	NO DATA	11.50	NO DATA	12.20
PR05	X	X	X	X	X	X	X	9.38	7.30	15.20	NO DATA	11.10	29.10	8.72
PR06	X	X	X	X	X	X	X	<5.0	8.11	13.30	NO DATA	8.82	26.20	7.97
PR07	X	X	X	X	X	X	X	5.42	7.09	13.10	NO DATA	9.00	23.20	8.26
PR08	X	X	X	X	X	X	X	13.00	21.10	26.40	NO DATA	16.40	40.50	16.60
METT01.5	X	X	X	X	X	X	X	6.19	6.50	11.70	NO DATA	9.78	15.20	8.94
METT02	X	X	X	X	X	X	X	6.10	7.04	13.80	NO DATA	10.60	20.60	9.14
METT02.25	15.40	6.60	43.70	13.90	8.44	14.00	8.37	8.24	8.10	14.20	NO DATA	11.50	19.60	11.50
METT02.5	9.38	6.73	58.50	8.35	8.53	16.80	10.30	6.01	6.95	14.00	NO DATA	12.30	25.10	11.60
METT03	9.11	7.67	33.70	9.54	7.67	17.60	9.17	7.33	8.45	14.80	NO DATA	12.90	22.80	10.10
FLOWER01	8.45	10.70	18.80	6.38	5.29	8.63	8.77	6.52	9.03	12.70	NO DATA	13.70	20.70	10.10
BEAVER01	X	X	X	X	X	X	X	14.60	15.00	15.60	NO DATA	17.30	20.10	15.60
CA01	X	X	X	X	X	X	X	33.50	32.60	31.60	NO DATA	28.40	23.50	24.50
CA02	X	X	X	X	X	X	X	36.20	40.70	30.60	NO DATA	28.70	23.60	20.80
CA03	X	X	X	X	X	X	X	16.90	29.60	33.90	NO DATA	22.50	23.30	13.30
CA05	X	X	X	X	X	X	X	22.90	33.10	32.30	NO DATA	25.20	29.20	13.80
CA06	X	X	X	X	X	X	X	21.60	26.30	35.50	NO DATA	24.00	27.40	16.20

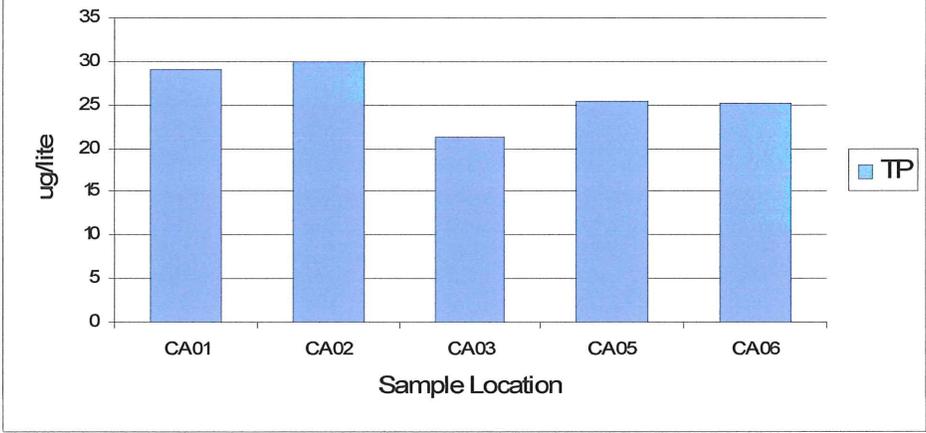
According to Vermont DEC's Neil Kamman, "There is no specific criterion for TP in streams, except for streams $\geq 2,500$ ft (nominally Class A {1}), where the criterion is 10ppb at low monthly median flow. Otherwise, the standard is that: "...loadings shall be limited so that they will not contribute to the acceleration of eutrophication or stimulation of the growth of aquatic biota in a manner that prevents the full support of uses." (Personal communication, December 2006; Vermont WQS, <http://www.nrb.state.vt.us/wrp/publications/wqs.pdf>)

The Vermont Water Quality Standards set 54 ppb as a goal for the South Lake B section of Lake Champlain (LCBP, http://www.lcbp.org/Atlas/HTML/is_pintro.htm). The PMWP has in the past used both 25 ppb and 10 ppb as goals for the rivers in our watershed. For the Poultney River and the Mettowee River which have cobble and gravel as bottom substrates, we generally see Total Phosphorus measurements near the 10 ppb goal. For the Castleton and Hubbardton Rivers, which have clay and silt as bottom substrates (phosphorus bonds with clay and sediment), we expect higher Total Phosphorus levels.

Graphs 6-8: Total phosphorus data for the Poultney, Mettowee and Castleton Rivers (averaged for all dates collected this year).



Castleton River Phosphorus 2008



Turbidity

Table 3: Turbidity results for the 2008 sampling season.

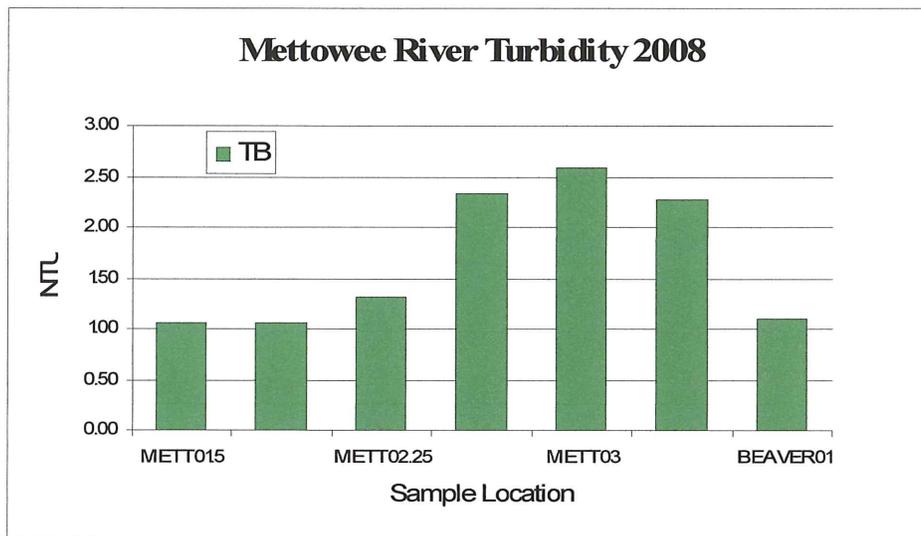
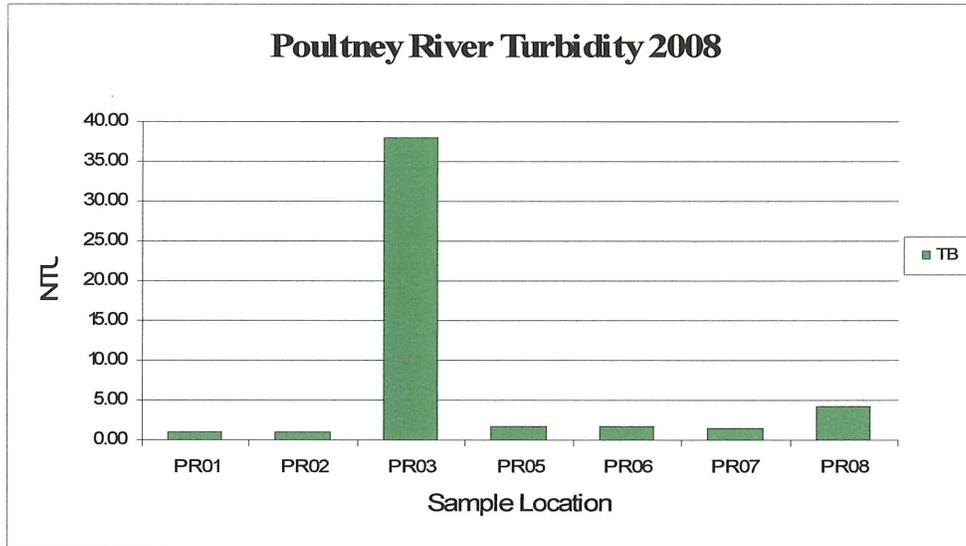
Site	3/19/08	3/26/08	4/2/08	4/9/08	4/23/08	4/30/08	5/7/08	6/4/08	6/18/08	7/2/08	7/16/08	7/30/08	8/13/08	8/27/08
PR01	X	X	X	X	X	X	X	0.59	0.75	0.82	2.82	0.59	NO DATA	0.27
PR02	X	X	X	X	X	X	X	0.48	0.57	2.27	0.71	0.76	NO DATA	0.54
PR03	X	X	X	X	X	X	X	0.31	0.28	1.71	0.51	0.76	NO DATA	0.73
PR05	X	X	X	X	X	X	X	0.38	0.53	2.37	0.65	0.83	6.53	0.69
PR06	X	X	X	X	X	X	X	0.41	0.70	2.43	0.59	0.70	6.65	0.61
PR07	X	X	X	X	X	X	X	0.45	0.50	1.99	0.57	0.71	5.76	0.38
PR08	X	X	X	X	X	X	X	1.62	6.46	4.06	1.71	2.20	11.50	1.74
METT01.5	X	X	X	X	X	X	X	0.45	0.57	2.06	0.64	1.10	1.81	0.77
METT02	X	X	X	X	X	X	X	0.96	0.37	2.15	0.54	0.69	2.25	0.39
METT02.25	0.86	2.48	X	2.69	1.98	1.29	1.42	0.49	0.53	2.12	0.84	0.84	1.84	0.34
METT02.5	2.50	2.59	10.20	2.52	2.98	3.70	1.77	0.77	0.59	1.20	0.41	1.00	1.68	0.80
METT03	3.42	1.47	10.60	4.17	1.48	3.16	1.61	0.62	0.56	2.05	0.89	1.28	4.30	0.65
FLOWER01	2.94	2.30	9.12	3.85	1.25	X	1.07	0.67	0.90	1.66	1.21	0.85	3.09	0.59
BEAVER01	X	X	X	X	X	X	X	1.11	0.95	0.98	X	1.14	1.19	1.24
CA01	X	X	X	X	X	X	X	2.46	1.28	1.30	3.44	1.27	0.83	0.75
CA02	X	X	X	X	X	X	X	2.96	2.12	1.75	1.95	1.82	1.43	0.89
CA03	X	X	X	X	X	X	X	1.22	2.05	4.49	1.13	1.28	1.85	0.58
CA05	X	X	X	X	X	X	X	2.17	2.97	3.34	1.38	2.66	3.33	0.96
CA06	X	X	X	X	X	X	X	1.84	4.86	3.39	1.70	2.24	3.69	3.71

Again, according to Vermont DEC's Water Quality Standards, turbidity results "for class A (1) and A (2) waters, are not to exceed 10 NTU. For Class B waters designated warm water reaches, they are not to exceed 25 NTU. For Class B waters in designated coldwater reaches, turbidity is not to exceed 10 NTU. (Kamman, personal communication, December 2006; Vermont WQS, <http://www.nrb.state.vt.us/wrp/publications/wqs.pdf>)"

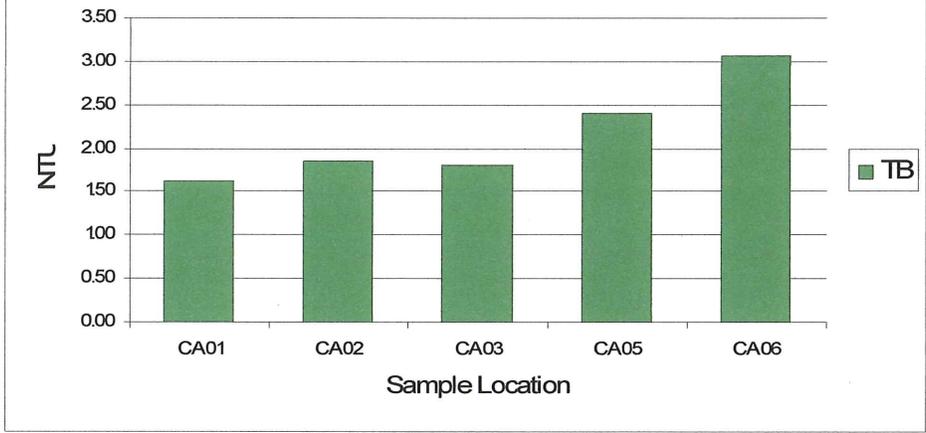
Based on the warmwater/coldwater fish habitat designations found in Vermont's Water Quality Standards (WQS), the only warmwater segments in the Poultney Mettowiee watershed include the Poultney River below Carvers Falls and "all waters west of 22A". The Castleton crosses 22A in Fair Haven, but no samples were collected in the section designated warmwater.

Similar to phosphorus results, the Poultney and Mettowie Rivers had extremely low turbidity levels. All of the turbidity results were within the Vermont DEC standards.

Graphs 9-11: Turbidity results for the 2008 sampling season.



Castleton River Turbidity 2008

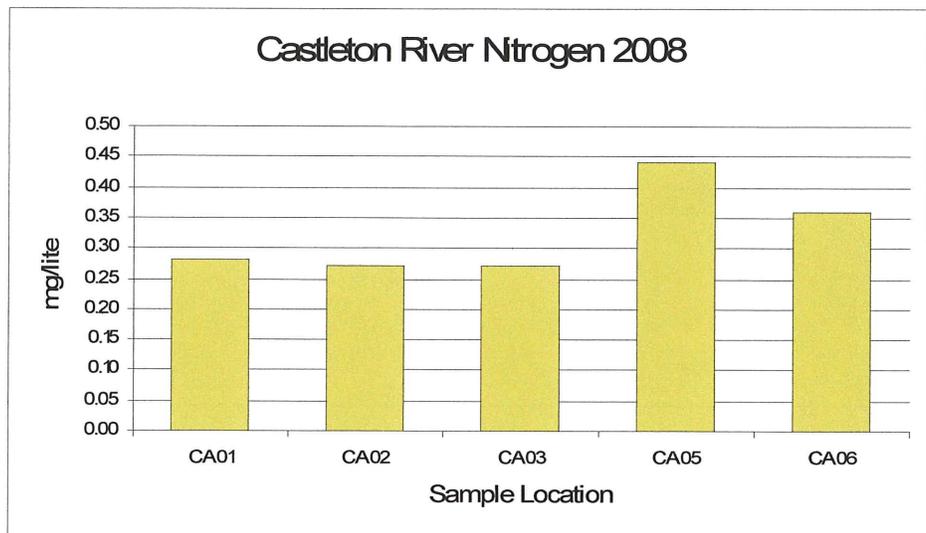
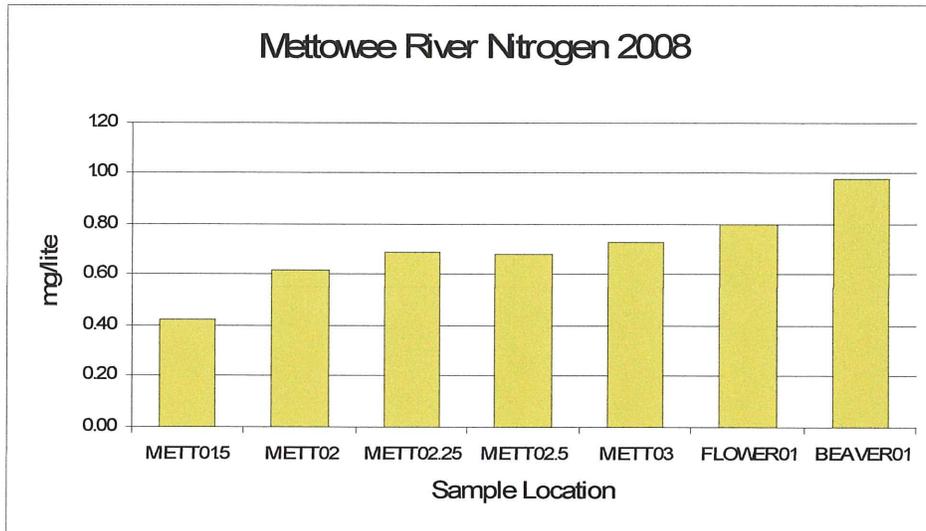
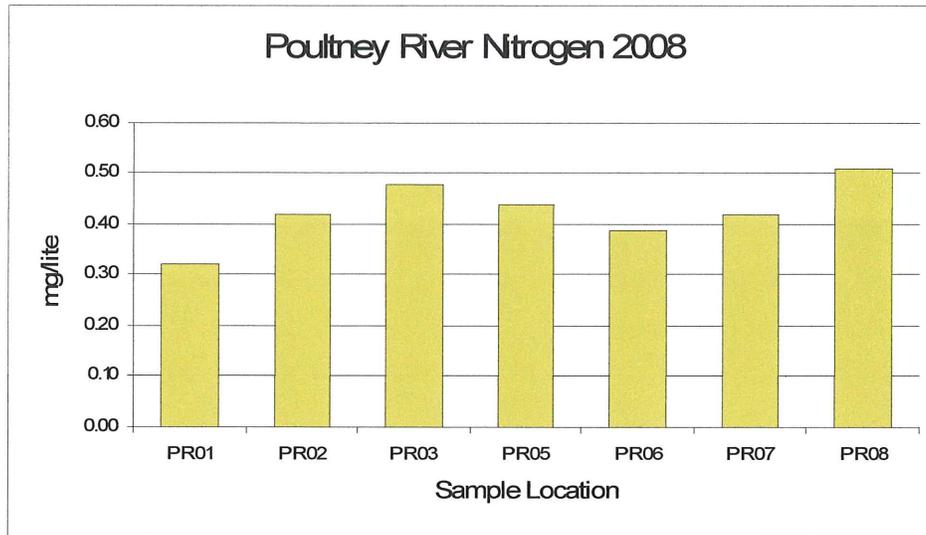


Nitrogen:

Table 4: Nitrogen results for the 2008 sampling season.

Site	3/19/08	3/26/08	4/2/08	4/9/08	4/23/08	4/30/08	5/7/08	6/4/08	6/18/08	7/2/08	7/16/08	7/30/08	8/13/08	8/27/08
PR01	X	X	X	X	X	X	X	0.48	0.36	0.25	NO DATA	0.28	NO DATA	0.22
PR02	X	X	X	X	X	X	X	0.43	0.37	0.38	NO DATA	0.48	NO DATA	0.39
PR03	X	X	X	X	X	X	X	0.40	0.20	0.42	NO DATA	0.53	NO DATA	0.50
PR05	X	X	X	X	X	X	X	0.37	0.33	0.43	NO DATA	0.45	0.50	0.43
PR06	X	X	X	X	X	X	X	0.31	0.33	0.37	NO DATA	0.43	0.39	0.39
PR07	X	X	X	X	X	X	X	0.50	0.42	0.39	NO DATA	0.44	0.39	0.41
PR08	X	X	X	X	X	X	X	0.63	0.55	0.48	NO DATA	0.46	0.48	0.49
METT01.5	X	X	X	X	X	X	X	0.51	0.46	0.41	NO DATA	0.40	0.37	0.39
METT02	X	X	X	X	X	X	X	0.74	0.73	0.57	NO DATA	0.56	0.45	0.61
METT02.25	0.71	0.70	0.64	0.65	0.71	0.57	0.64	0.99	0.80	0.61	NO DATA	0.66	0.49	0.73
METT02.5	0.69	0.70	0.63	0.63	0.70	0.56	0.61	0.78	0.81	0.64	NO DATA	0.68	0.50	0.75
METT03	0.82	0.84	0.67	0.69	0.73	0.56	0.62	0.89	0.81	0.67	NO DATA	0.67	0.56	0.86
FLOWER01	1.04	1.08	0.72	0.77	0.78	0.62	0.63	1.05	0.81	0.68	NO DATA	0.72	0.57	0.92
BEAVER01	X	X	X	X	X	X	X	1.05	0.90	0.82	NO DATA	0.85	0.87	1.40
CA01	X	X	X	X	X	X	X	0.29	0.34	0.31	NO DATA	0.31	0.23	0.20
CA02	X	X	X	X	X	X	X	0.35	0.31	0.31	NO DATA	0.29	0.18	0.18
CA03	X	X	X	X	X	X	X	0.31	0.31	0.31	NO DATA	0.28	0.20	0.19
CA05	X	X	X	X	X	X	X	0.69	0.47	0.39	NO DATA	0.42	0.31	0.32
CA06	X	X	X	X	X	X	X	0.46	0.34	0.39	NO DATA	0.31	0.29	0.34

Graphs 12-14: Nitrogen results for the 2008 sampling season.



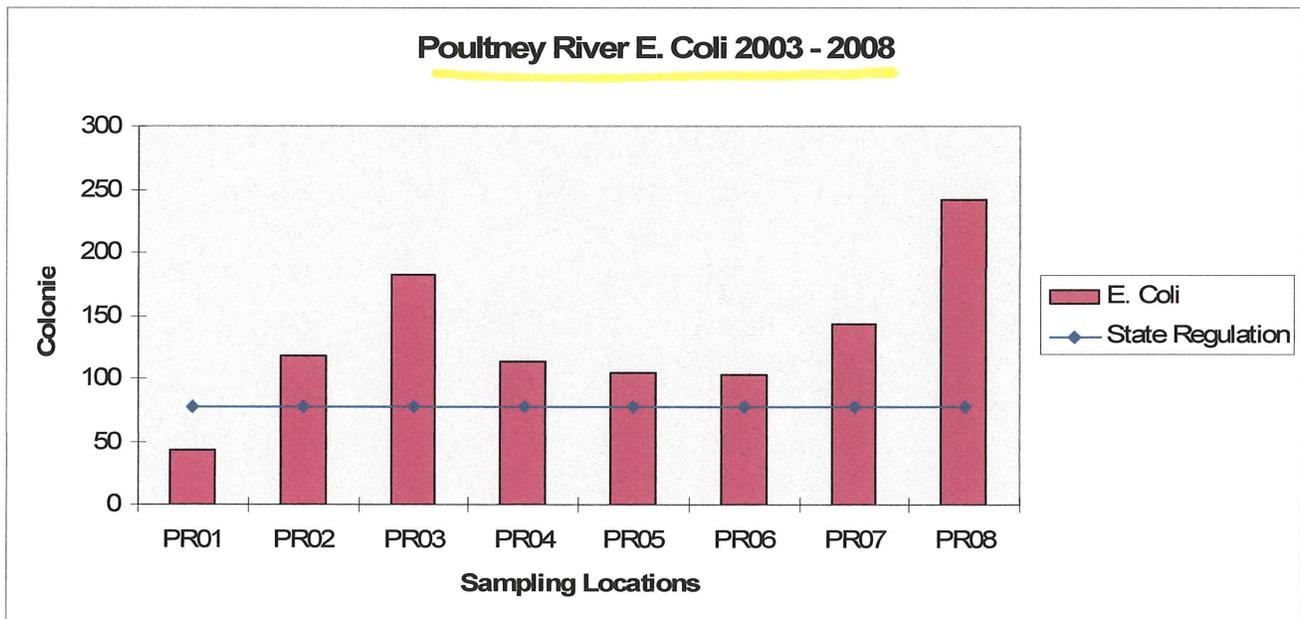
COMPILED DATA: AVERAGES FOR ALL DATA COLLECTED TO DATE

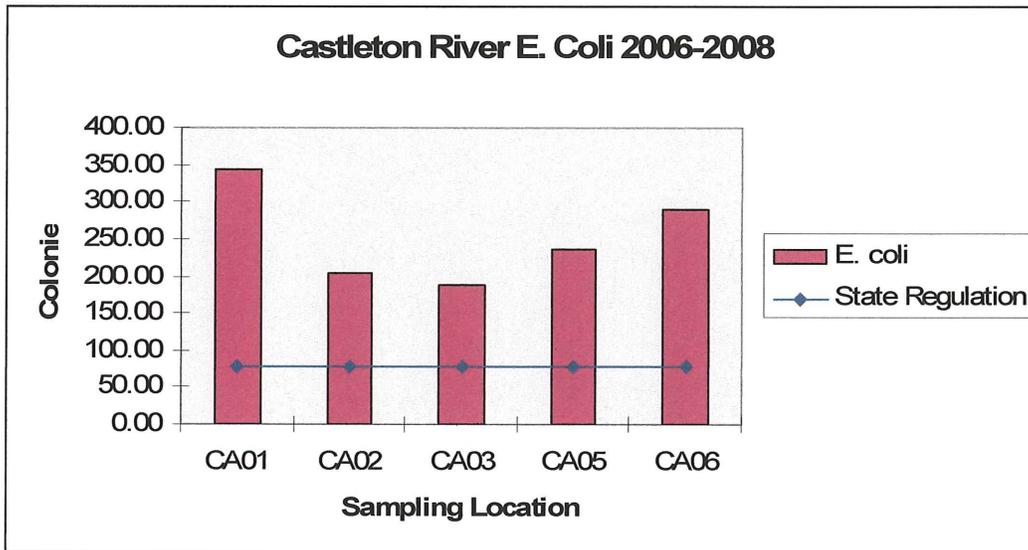
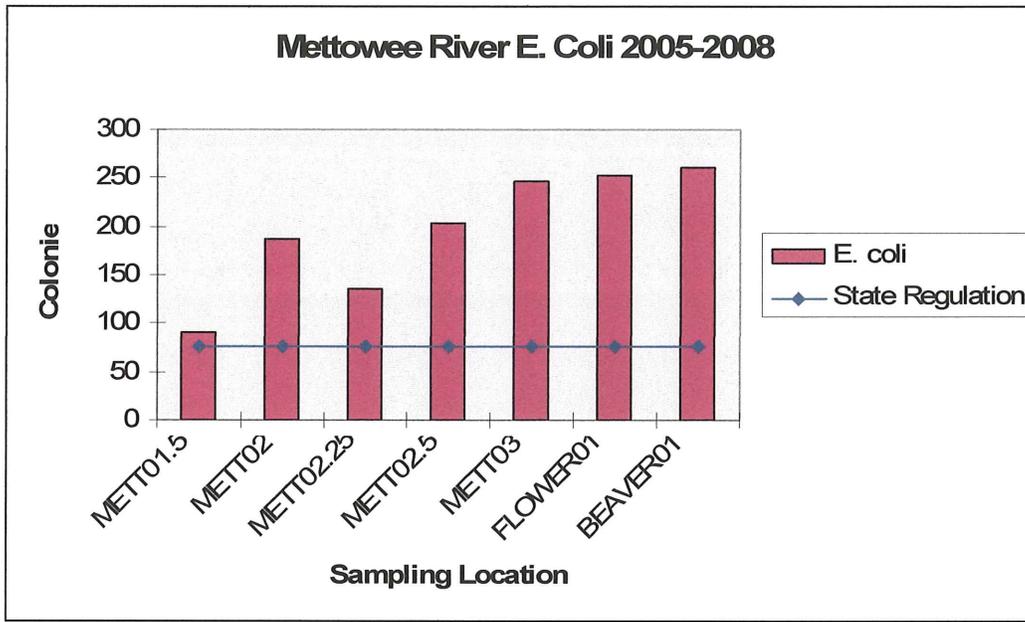
The following graphs include all of the data collected to date by the PMWP. The data has been averaged by site and ranges from one to six years worth of results. It is generally recognized that stream data becomes statistically significant when five or more years of data are available (Kamman, personal communication, 2004). These graphs, though only some sites contain five years worth of data, begin to show water quality differences between the sites. Each of the following graphs represents a stream continuum from upstream to downstream. Hopefully, this will help the reader to visualize the changes in water quality that are occurring spatially.

E. coli

The *E. coli* graphs show that many of the sites in the watershed are consistently over the State and Federal water quality standards. The lowest *E. coli* concentrations are found in the headwaters of the Poultney and Mettowee Rivers. The upstream site on the Castleton River (CA01) and the site on Beaver Brook are downstream of several wetlands and livestock pastures. *E. coli* bacteria at this site may result from either livestock in the stream or naturally-occurring animals, such as beaver, in the stream. Sites Flower01 and Mett02.5 may receive groundwater inputs from septic systems in Pawlet. The Poultney River has been sampled since 2003; therefore there is more data for that river.

Graphs 15-17: Compiled Geometric mean E. coli data for the Poultney, Mettowee, and Castleton Rivers.



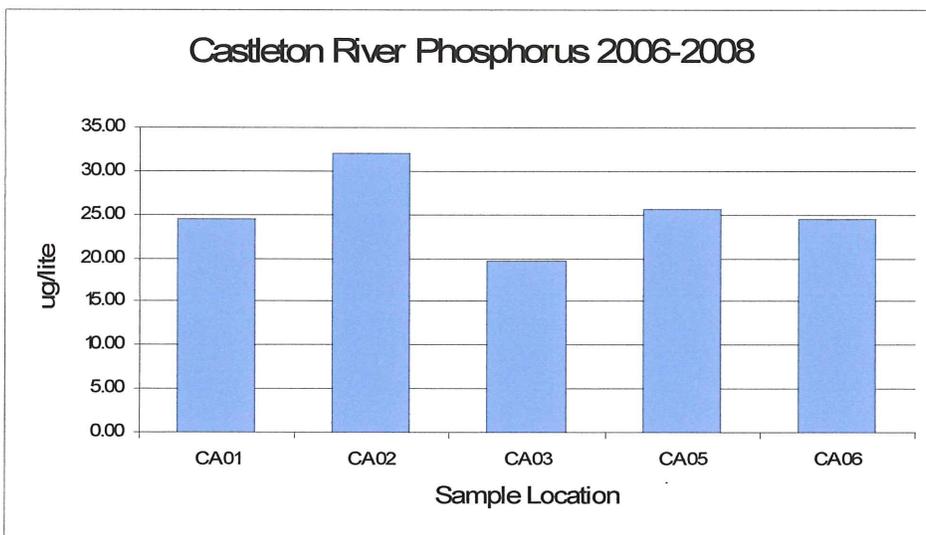
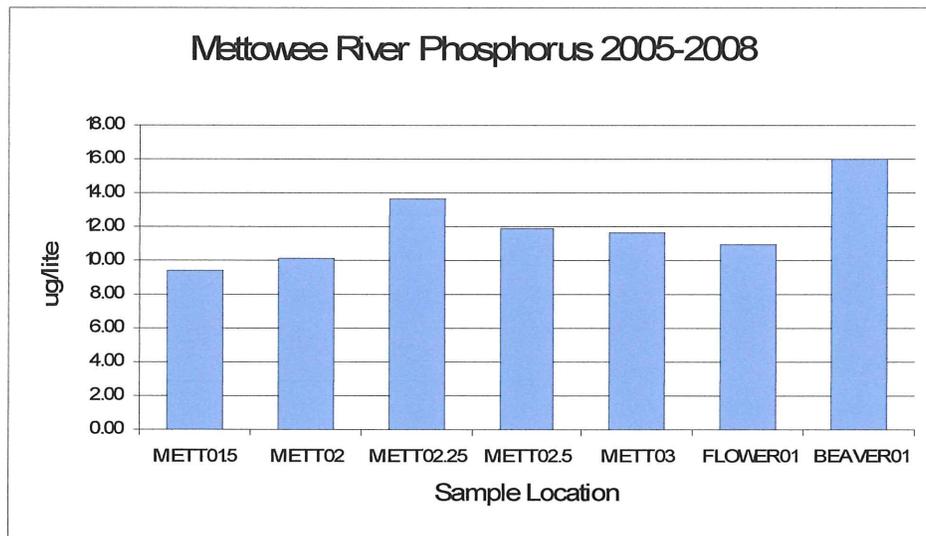
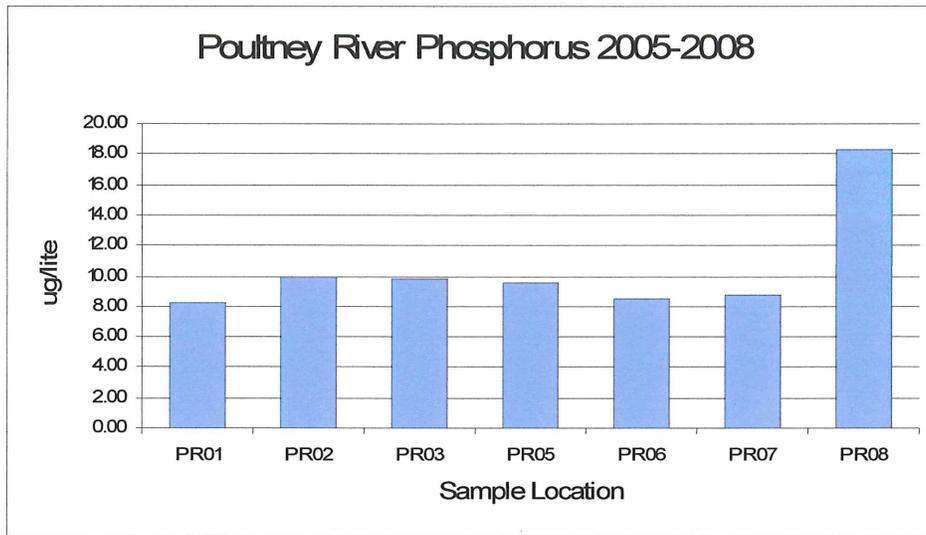


Phosphorus

The phosphorus measurements were variable along the length of the streams monitored. Again, the headwater Poultney and Mettowee sites (PR01 and Mett01) showed the lowest levels of phosphorus over the duration of the study period for each (five seasons for the Poultney and two for the Mettowee). This is to be expected, since as mentioned above, phosphorus binds to soil, and there is likely to be less sediment at the headwaters of a stream than downstream where more erosion and river movement occurs. Of the Poultney and Mettowee sites, the downstream Poultney site, PR08 (Green Rd) and Beaver Brook, had the highest phosphorus measurements over the duration of the study (around 17 and 19 ppb respectively).

This year the PMWP sampled the Castleton River for the third time. This stream show relatively high phosphorus results (as compared to the Poultney and Mettowee Rivers). The Castleton River sites averaged between 17 and 34 ug/liter of total phosphorus.

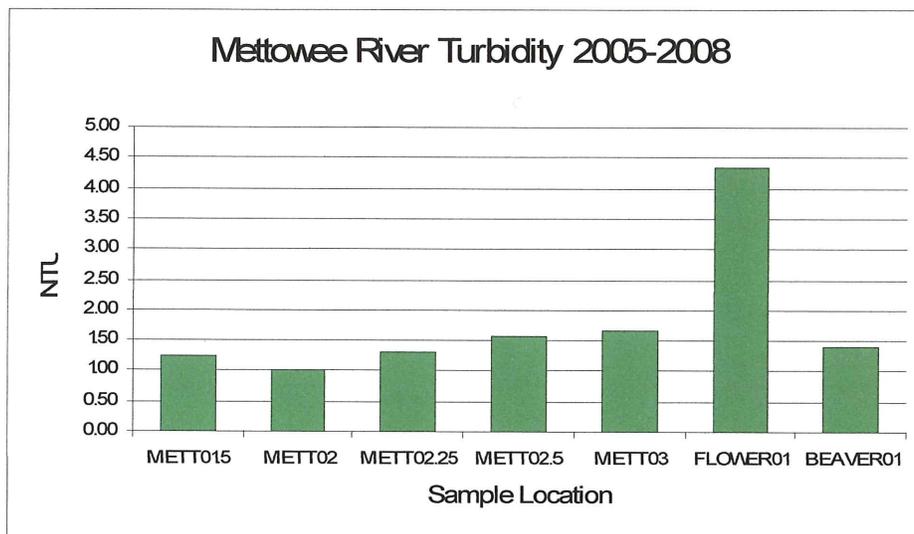
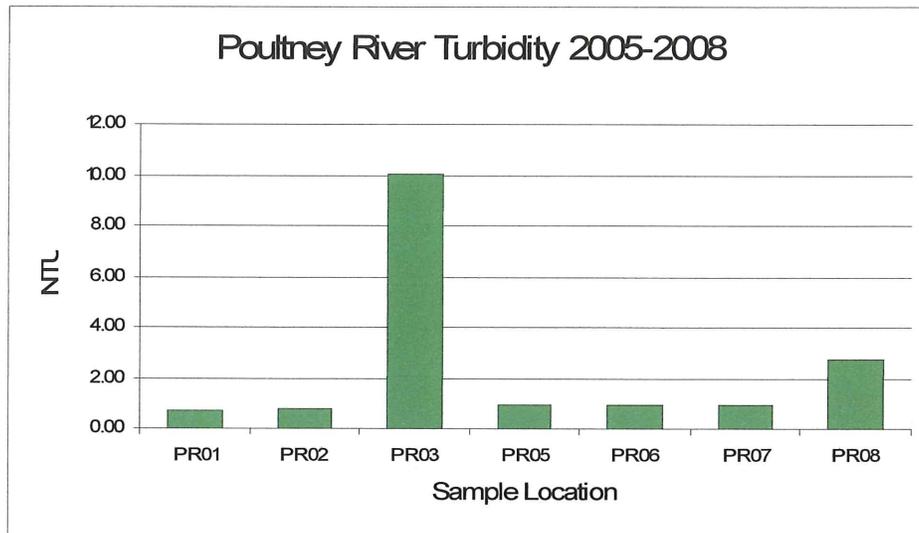
Graphs 14-17: Averaged Total Phosphorus data for the Poultney, Mettowiee, and Castleton River sites.

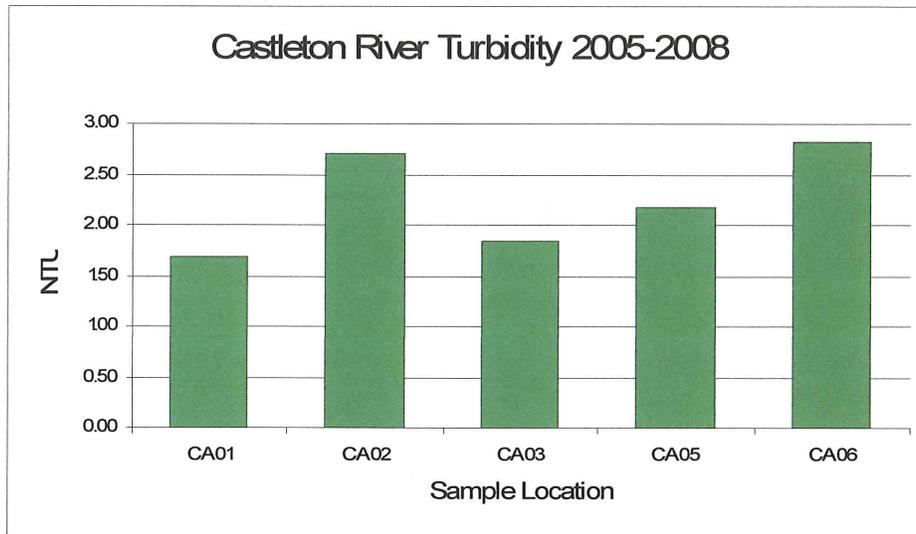


Turbidity Data

All of the averaged turbidity results are within coldwater standards for the Poultney, Mettowee and Castleton Rivers.

Graphs 18-20: Averaged Turbidity data for the Poultney, Mettowee, and Castleton River sites.



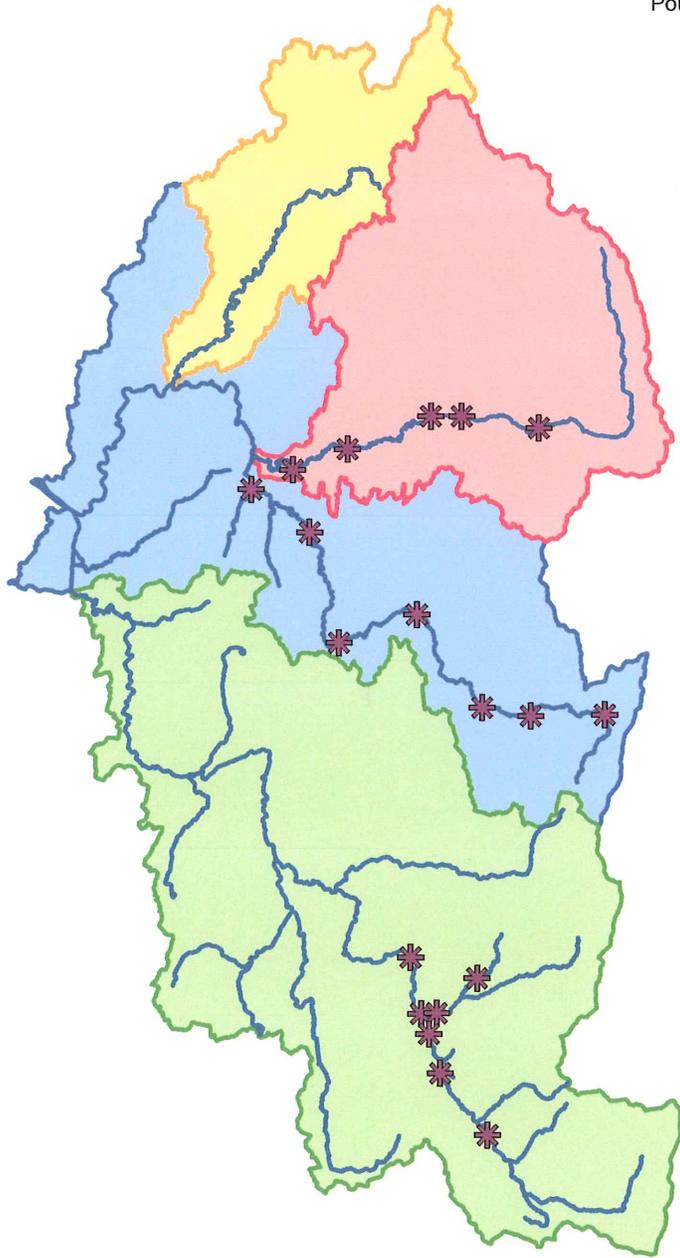


Nitrogen Data

2008 is the first year of sampling for nitrogen. Please refer to the graphs in the Nitrogen section to see the 2008 results. This data will provide a baseline for future comparisons.

Poultney Mettowee Water Quality Monitoring Project

Map created by Elaine Blodgett,
Poultney Mettowee Watershed Partnership,
February 2008



Legend

-  Monitoring Locations
-  Major Rivers
-  Mettowee Watershed
-  Castleton Watershed
-  Hubbardton Watershed
-  Poultney Watershed

