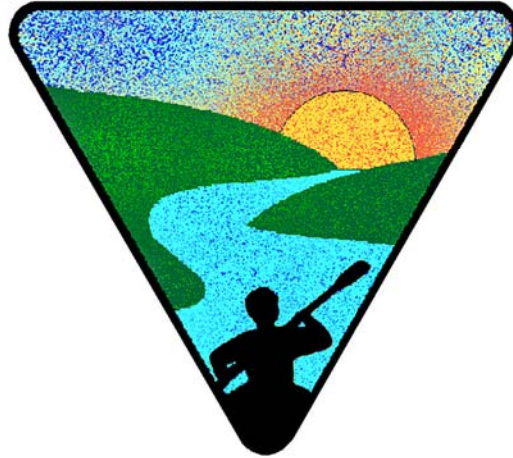


French River Connection



2010 Water Quality Monitoring Report

November 19, 2010

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1.0 INTRODUCTION

In 2005, The French River Connection was presented the opportunity by the Webster Lake Association to apply the TROLL 9000 water quality monitoring instrument that organization uses to monitor Webster Lake, to the French River. After a “pilot year” in 2005, we expanded our program in 2006 to include 15 sites and added a pilot nutrient monitoring program for several sites. We developed an ACCESS data base for maintaining our data and observations. Our first QAPP (Quality Assurance Program Plan) was approved by MASS DEP in August 2006.

In the “off-season” before 2007, The Last Green Valley was successful in obtaining a grant from MASS DEP to purchase a TROLL 9500 for use in the Massachusetts part of the Quinebaug-Shetucket National Heritage Corridor. This gave us much more flexibility in monitoring schedules, but it also placed the responsibility for calibrating and maintaining the instrument on us. In partnership with the Webster Lake Association, we expanded our campaign to 22 sites, reducing our schedule from twice to once per month. In addition to the colorimeters used for nutrient testing at some of the sites, we employed five temperature data loggers in the colder streams to determine if they were candidates for designation as cold water resources. Our QAPP was expanded to include all three instruments.

In 2008, we reduced our responsibility to 15 sites monitored once a month, leaving the Webster Lake Association responsible for any lake tributaries, except we continued our temperature data logging program in four of them. We did however extend the length of our program from March to November.

In 2009, we continued our TROLL and colorimeter monitoring programs unchanged, but scaled back our temperature data logging. While the loggers had been successful in identifying cold water resources, it was revealed that a report published in 2007 had determined there were no fish in them. Another important change for our program was the engagement of students from Shepherd Hill High School as monitors on two occasions. In November 2009, MASS DEP published the [French and Quinebaug River Watersheds 2004-2008 Water Quality Assessment Report](#), which includes recommendations based in part, in some instances, on our findings. We are pleased and proud to have made a contribution.

In 2010, our program was little changed from 2009. We deployed our temperature data loggers at four river locations, and continued to emphasize opportunities for student volunteers, utilizing them on three occasions. Our latest QAPP was approved on March 3, 2010 and applies through 2012. As you’ll see as you read this report, 2010 was a year of historic low flow, with negative implications for water quality throughout our area. Summary Findings are located in section 6.1.

Many people who care about rivers have contributed to our work, and we thank them all:

Water quality monitoring professionals Therese Beaudoin, Warren Kimball, and Richard F. Chase, of MASS DEP, and Jean Pillo of the Last Green Valley for their advice and encouragement.

Lois Bruinooge of The Last Green Valley for obtaining supplies for us through Last Green Valley funding which cut our costs significantly, maintaining contact with the TROLL manufacturer, and for her strong support of water quality monitoring within the organization.

And of course, our volunteers, without whom this program would be impossible.

Jean Hixson	April Thibaudeau	Elaine Parker
Nicole Giles	Judy Nawrocki	Sheila Veideman
Adam Carrier	Leslie Baker	Wendy Sposato
Andrew LaBonte	Pat Rosenthal	Robert Jacobsen
Karolina Jakobkiewicz	Ed Bazinet	Jim Beaudry
Mike Branniff	Tom Ryzewski	Paige Veideman
Haley Fletcher	Alicia Sheperd	

Thank you all.

Ken Parker
President, French River Connection

2.0 2010 WATER QUALITY MONITORING CAMPAIGN

In 2010, the French River Connection's monitoring campaign consisted of sampling 15 stations, 9 times each, monthly from March through November. The campaign was carried out using the TROLL 9500 water quality monitoring device owned by The Last Green Valley, Lamotte Smart 2 Colorimeters, and Onset HOB0 Pro v2 temperature data loggers. The program for each of the three instruments is described in a separate section. We followed the procedures described in a QAPP (Quality Assurance Program Plan) approved by the Massachusetts Department of Environmental Protection on March 3, 2010 .

2.1 Objectives

Demonstrate to the public that the French River is no longer an industrial sewer, but is worthy of protection and enjoyment.

Locate pollution sources and report our findings to local and state officials for appropriate action.

Gather data to use when commenting to local officials on decisions before them affecting the river.

Assist Nichols College in gathering flow data for regional hydrology studies.

Collect data for baseline, descriptive purposes.

By maintaining a monitoring program over many years, document trends in the health of the river.

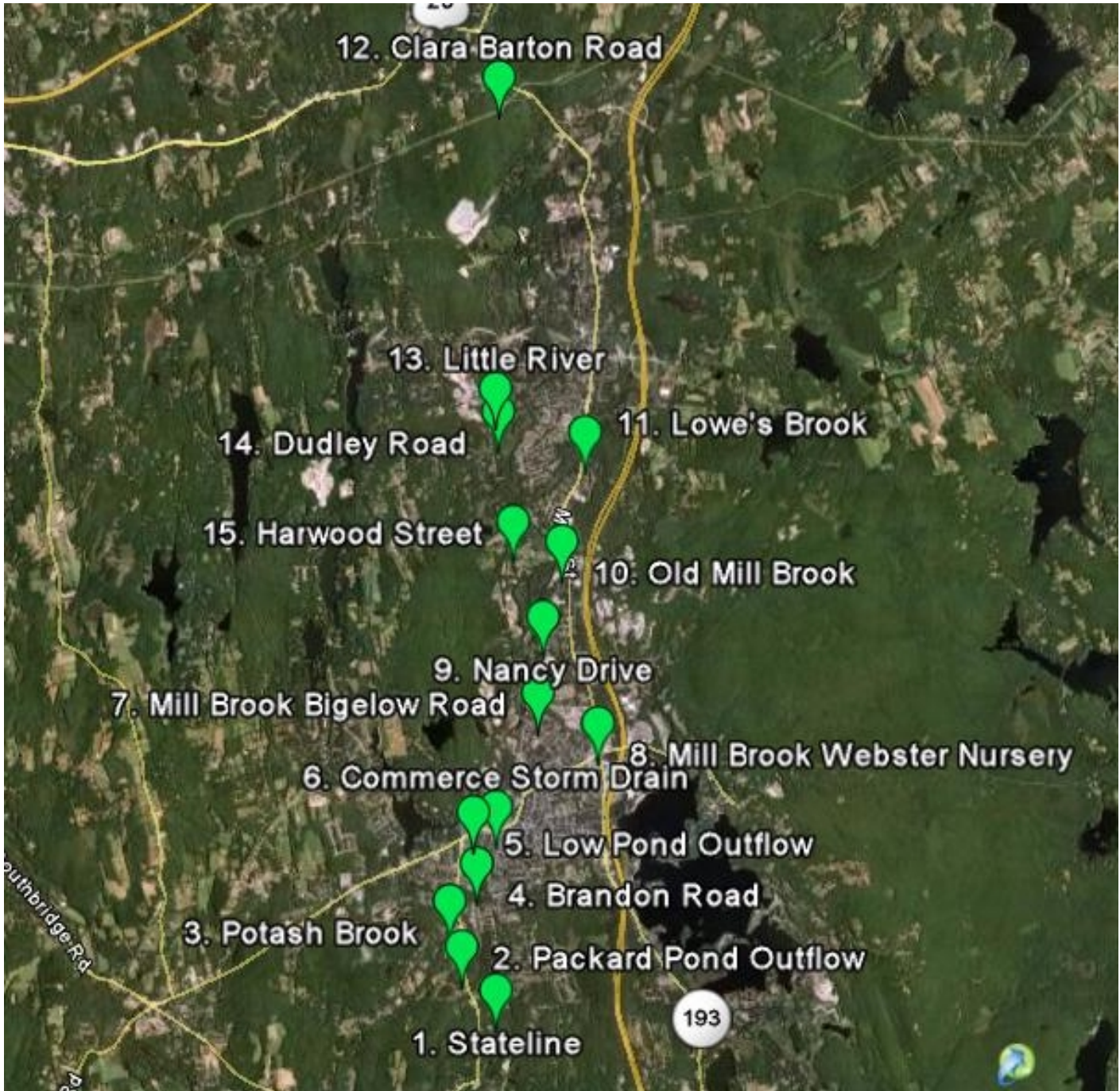
Engage community members in the monitoring program to interest them in the river as a community resource.

2.2 Methods

To gather our data, teams visited the sites each month from March through November. The application of instruments is shown below, followed by a map of the locations. Detailed procedures for each instrument used are found in the QAPP. All data are subjected to a quality assurance procedure found in the QAPP and are entered into an ACCESS data base.

Site Number	Site Name	TROLL	Staff Gauge	Colorimeter	Temperature logger
1	State line	X		X	
2	Packard Pond outflow	X		X	
3	Potash Brook	X	X	X	
4	Brandon Road	X		X	X
5	Low Pond Outflow	X		X	
6	Commerce Storm Drain	X			
7	Mill Brook Bigelow Road	X	X	X	
8	Mill Brook Webster Nursery	X			
9	Nancy Drive	X			
10	Old Mill Brook	X		X	
11	Lowe's Brook	X	X	X	
12	Clara Barton Road	X		X	X
13	Little River	X		X	
14	Dudley Road	X		X	X
15	Harwood Street	X		X	X

Sites and Methods



Site map

The reader may wish to follow the link below to an interactive map with site photos and summary results.

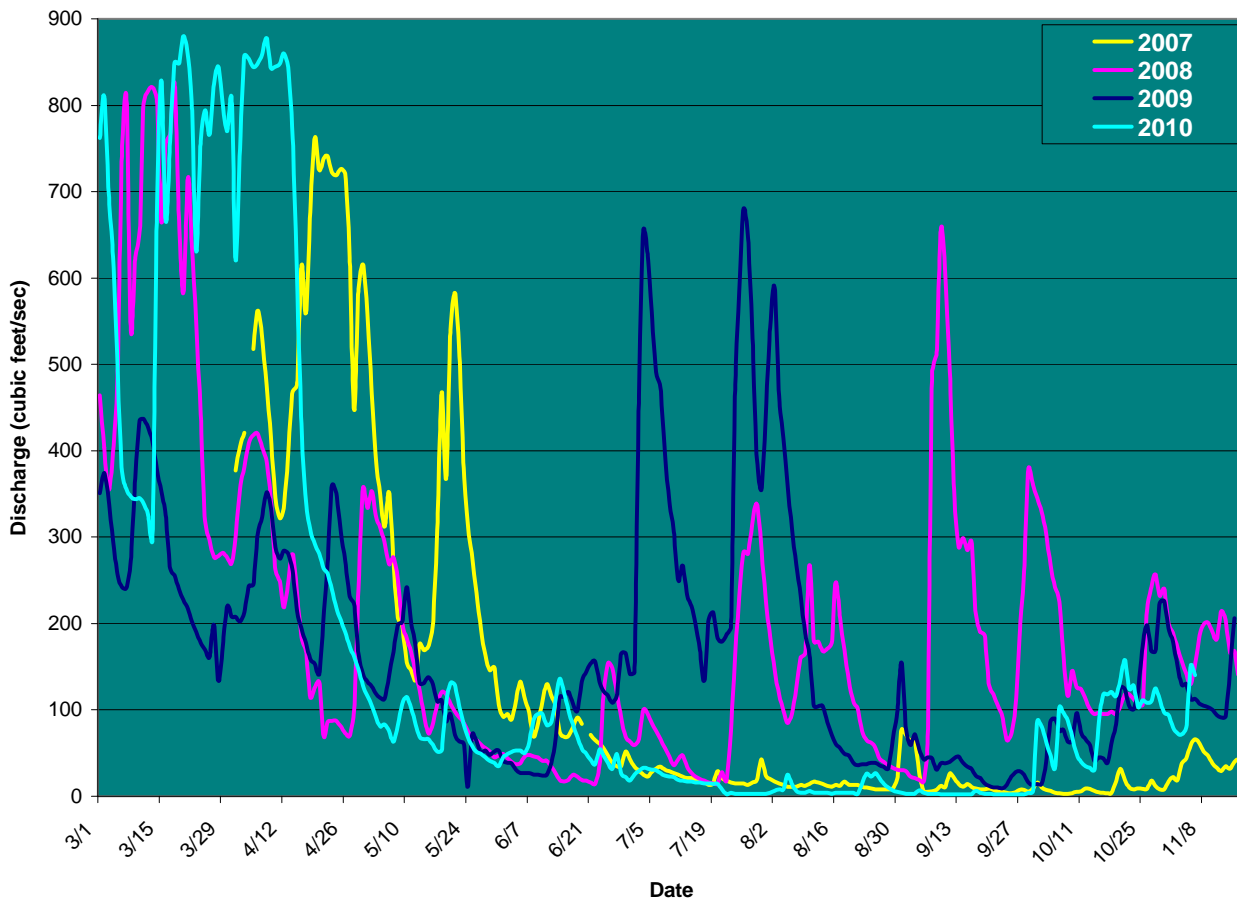
<http://maps.google.com/maps/ms?hl=en&ie=UTF8&msa=0&msid=113973321883276315420.000494167bb53a7e2fde0&t=h&z=11>

2.3 Environment

Water quality monitoring in 2010 was characterized by very low water from July through September, with most daily flows being the lowest ever recorded at the USGS Webster station. Below is a comparison of the average daily discharge at that station for each month we monitored, and a graph comparing daily data for 2007-2010

Month	2005 Discharge cubic ft./sec	2006 Discharge cubic ft./sec	2007 Discharge cubic ft./sec	2008 Discharge cubic ft./sec	2009 Discharge Cubic ft./sec	2010 Discharge Cubic ft./sec
March				559	276	654
April				230	246	525
May	235	259	290	151	112	78
Jun	67	467	80	50	88	30
Jul	55	124	23	103	362	15
Aug	16	48	15	121	157	9
Sep	20	40	15	216	30	3
Oct	562	125	9	169	98	91
Nov			41*	177*	124*	146*

* Through the last day of monitoring



2007-2010 Discharge rates

3.0 WATER CHEMISTRY MONITORING

2010 was our sixth year of monitoring using the In-Situ TROLL. Concentrating on building up data on sites we have been monitoring for several years, we added no new ones.

3.1 Method

Streams were chosen for monitoring based on such criteria as:

Water Volume: does the station represent a significant volume of water, flowing perennially or nearly so, and carrying a greater volume than neighboring streams which are otherwise similar?

Accessibility: can we reach the monitoring station without trespassing, or can access be arranged? Is the station safely reachable, and not too arduous?

Stream Appearance: does the stream appear to be healthy in terms of water quality, plant growth, animal life, and other observations?

Stream Route: Is the stream known or suspected to receive point or non-point-source pollution? Is it in the path of planned new development?

The instrument used was the TROLL 9500 owned by The Last Green Valley. It samples temperature, dissolved oxygen, pH, conductivity, and turbidity. In addition weather conditions and observations of the stream are noted.



TROLL and Rugged Reader

	Accuracy	Range
Temperature	± 0.1°C	-5°C – 50°C
pH	± 0.1 pH units	0 – 12 pH units
Dissolved Oxygen	± 0.1 mg/L	0 – 10 mg/L
	± 0.2 mg/L	10 – 20 mg/L
Conductivity	± 0.5% or 2 µS/cm	5 – 20,000 µS/cm
	± 0.5% + 2 µS/cm	150 – 112,000 µS/cm
Turbidity	± 5% or 2 NTU/FNU	0 – 2000 NTU/FNU
TROLL Specifications		

Monitoring with the TROLL was done each month from March through November. The TROLL was calibrated on the day before each monitoring event, and the TROLL response measured for drift immediately after each event. Calibration reports and post-testing results are maintained in the data base, as is volunteer experience levels and participation. On each monitoring day, teams of three or four people went to the field. Results are recorded on paper and returned to the Quality Manager for review and data entry. Quality assurance notes are added to the record as deemed appropriate. Analysis, including comparison with state water quality standards and development of a report card, is performed on data extracted from the ACCESS database.

3.2 Data Accuracy

One measure of the accuracy of our data is its repeatability. To this end, on each monitoring day a site is chosen at random for a repeat sampling and the two results are compared. The results are repeatable if the two measurements overlap in accordance with the accuracy specifications above. In the table below, if they fail to do so, they are coded yellow.

Date	Station	Temp (F)	QC Temp (F)	DO (mg/l)	QC DO (mg/l)	pH	QC pH	Cond (uS/cm)	QC Cond (uS/cm)	Turb (NTU's)	QC Turb (NTU's)
3/6	Clara Barton Road	35.49	35.56	13.23	13.28	6.87	6.85	95.0	94.7	3.1	2.0
4/3	Nancy Drive	51.89	52.07	6.54	6.70	6.52	6.53	448.1	453.9	.9	.9
5/8	Mill Brook Webster Nursery	56.02	56.02	9.07	9.07	6.80	6.79	199.0	203.9	63.8	54.9
6/5	Lowe's Brook	74.71	74.71	4.81	4.71	6.51	6.51	256.9	257.1	2.8	2.6
7/3	Mill Brook Webster Nursery	70.05	69.98	7.86	7.95	6.88	6.99	506.9	506.8	3.3	.8
8/4	Little River	73.32	73.40	6.42	6.53	6.60	6.58	195.4	195.9	1.3	1.3
9/4	Lowe's Brook	71.73	71.92	4.34	4.31	6.38	6.42	258.4	264.7	3.3	3.3
10/7	Brandon Road	56.23	56.24	9.45	9.50	7.05	7.08	186.9	186.9	1.6	1.6
11/6	Clara Barton Road	44.70	44.90	11.61	11.63	7.03	7.00	88.72	88.68	1.7	2.7

TROLL Sample Repeatability

On three occasions we failed, barely, to get the required repeatability in our conductivity measurements, but these were considered minor enough to not warrant additional measures. Turbidity measurements are never very stable. We have little experience in sampling turbidities at the high level noted on 5/8, which does not quite meet the criteria. The results on 7/3 do in fact meet the criteria but our experience should have dictated a second measurement regardless; we didn't do it. Overall, we consider these QC results gratifying.

Another test we do is for stability of the TROLL measurements over the time of the sampling event. A bucket of water is allowed to age overnight and then profiled just before we go out, and just after we return, approximately four hours later. We expect repeatability (except for temperature) just as for consecutive measures at one field site. Temperature, of course, can change. Results are shown below.

Date	DO % saturation	Turbidity NTUs	pH	Temp deg F	Specific Conductivity uSm/cm
3/6	104.5	0.0	6.81	63.91	245.73
	107.4	0.1	6.94	65.59	246.78
4/3	104.4	-0.1	6.85	68.00	251.30
	104.6	0.0	7.05	68.54	251.47
5/8	101.2	0.0	6.75	67.60	535.29
	101.0	0.1	6.92	67.50	536.93
6/4	99.7	0.4	6.84	74.35	301.79
	99.8	1.0	7.00	74.26	303.01
7/3	100.3	0.1	6.84	70.86	406.06
	99.9	0.2	6.94	70.76	406.62
8/4	98.9	0.2	7.09	76.22	242.10
	96.3	0.2	7.18	74.17	243.20
9/4	97.3	1.2	6.74	76.83	311.66
	97.3	1.2	7.04	75.06	313.55
10/7	89.9	0.1	6.78	68.29	348.07
	88.9	0.1	6.94	68.01	348.00
11/6	97.0	0.1	6.86	65.34	307.44

	98.6	0.2	6.95	66.22	309.05
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TROLL Calibration Post-Tests

In order to account for temperature difference, actual conductivity measurements are converted to specific conductivity, that is, corrected to 25 deg C. The criteria aren't met, narrowly, for dissolved oxygen on 3/6 and 8/4, and for pH on 9/4. On many occasions pH barely meets the criteria and is always higher at the second measurement. That was true in 2009 as well. Before next season we plan to conduct experiments to see if this is specifically the result of pretesting with the probe just removed from pH 4 buffer and post-testing with the probe having just been through four hours of "dipping". This might indicate that pH measurements increase slightly throughout a monitoring event.

Another accuracy consideration is calibration of the TROLL. This was our fourth year performing this function. This year, we addressed calibration frequency questions as we did in 2008 and 2009 since the QAPP requires, on MASS DEP's recommendation, calibration much more often than recommended by the manufacturer. It seems useful to preface calibration of each sensor with a measurement of the calibration solution. Presumably if it measures at the specified standard, then calibration is not necessary and in fact could introduce errors. It must be understood that there were other users who were not calibrating themselves, and one user who was calibrating sometimes, but not taking these pre-calibration measures. The data is shown below.

Calibration date	Days since previous	DO	Turbidity	Temp	pH	Specific conductivity
		100% +/-1% Sat	0+/-0.2 NTU		7.00+/-0.1	447+/- 3 uSm/cm
3/5	<10	102.7	-2.4	68.61	6.97	442.6
4/2	29	100.1	-0	69.85	7.02	448.8
5/7	27	99.3	.1	68.11	7.01	449.3
6/4	28	100.6	-1	76.86	7.14	446.8
7/2	16	100.1	-.2	70.04	7.05	439.2
9/3	14	99.0	-0.0	77.52	7.13	447.3
10/6	32	98.9	0	69.82	7.07	444.7
11/5	30	99.0	0.0	68.63	7.13	449.2

Pre-calibration Measurements

Conductivity measures are converted to specific conductivity, that is, adjusted to 25 deg C, for comparison with the standard.

The March calibration except for pH follows one previously done by US Environmental who conducted a maintenance action on the equipment. Noting their pH calibration report showed an improper calibration, we did it ourselves. We also noted their previous calibration of conductivity was done at 1000 uSm/cm, and that there was a spot of foreign material on the flow restrictor which may have contributed to a poor turbidity calibration. Considering this, results for 3/5 should be strongly discounted.

The results for July apply to a substitute TROLL. It is known that the previous calibration was done with a conductivity solution which had been open for a long time. We don't have any criteria for discarding open solution; this should be investigated.

No data is recorded for August. The TROLL had been sent out for maintenance and a Quik-Cal calibration may have been performed, which we consider unreliable. In addition, we know the previous conductivity calibration by another user was performed incorrectly.

What we do observe is that pH seems to drift upward. This is the parameter recommended for most frequent calibration by the manufacturer. Their documentation is inconsistent about it, but instances where every few weeks is recommended can be found.

Possible solutions for obtaining acceptable data when the instrument has not been calibrated the day before include widening the pH accuracy range, and specifying a discard date on open solutions.

3.3 Data and Observations

The following sections, one for each station where TROLL data was taken, contain the data for the station, a summary of observations and notations as necessary.

State Line, Webster N 42°02'27.5" W 71°53'02

Stateline(boundary): this is a measure of water quality, below the Webster WWTP, as the main stem leaves the state. This site is chosen because it is on the state line. It is reached by parking where the P&W active rail line crosses Perryville Road in Webster and walking diagonally downstream until the river is reached.



State Line									
Date	Time	Wet/Dry	Air Temp (F)	Staff Gauge	Water Temp (F)	DO (mg/l)	pH	Conductivity (uS/cm)	Turbidity (NTU's)
3/6/2010	8:36	Dry	35.2		36.35	12.75	6.65	112.7	2.6
4/3/2010	8:12	Wet	50.5		49.90	10.88	6.52	98.98	3.4
5/8/2010	8:15	Wet	56.6		61.93	8.95	7.08	192.4	2.5
6/5/2010	8:23	Wet	71.2		72.96	7.95	6.99	226.7	2.5
7/3/2010	8:08	Dry	68.7		70.39	8.31	7.07	263.0	1.5
8/4/2010	8:05	Dry	80.6		72.29	7.78	7.29	421.7	1.1
9/4/2010	8:21	Wet	68.3		73.59	7.03	7.13	514.5	0.9
10/7/2010	8:10	Wet	57.9		56.41	9.40	7.20	201.9	1.5
11/6/2010	8:13	Wet	44.8		45.37	10.75	7.03	127.8	1.7

State Line Observations

Water appearance	Clear with foam flecks as a result of passing over Perryville Dam, including a “glob” in November
Water odor	None noted
Flow/ level	Water levels were at 90% and flow swift in March and April, falling to 5% and slow flow in August and September before recovering in October and November to moderate levels
Plant growth	Duckweed patches (from above the dam) were observed in August and September
Other observations	New beaver activity was observed across the river in November
Comparison to 2009	August/September water levels and dissolved oxygen are the lowest observed since monitoring began. Temperature, pH, and turbidity are comparable to other years, with temperatures above 70F lasting longer. The conductivity in September is the highest recorded; it has not been above 400 uSm/cm since 2007.
Notes	

Packard Pond Outflow, Dudley N 42°01'1.0" W 71°53'25.5"

Packard Pond(impact): carries a significant volume of water and drains Ardlock Acres conservation area and an area behind the Dudley transfer station, which may be a source of pollution. Park at the junction of Carpenter Road and Route 12 in Dudley, and monitor on the east side of the culvert.



Packard Pond									
Date	Time	Wet/Dry	Air Temp (F)	Staff Gauge	Water Temp (F)	DO (mg/l)	pH	Conductivity (uS/cm)	Turbidity (NTU's)
3/6/2010	8:46	Dry	33.8		37.78	11.92	6.52	107.6	2.0
4/3/2010	8:30	Wet	50.9		52.73	10.14	6.52	110.9	1.8
5/8/2010	8:31	Wet	55.7		63.13	8.29	6.81	154.1	2.1
6/5/2010	8:36	Wet	85.5		74.65	7.21	6.68	143.8	1.5
7/3/2010	8:20	Dry	70.1		66.43	6.90	6.66	153.6	3.3
8/4/2010	8:25	Dry	82.7		65.16	6.70	6.66	171.3	15.0
9/4/2010	8:37	Wet	67.3		67.32	6.26	6.68	183.1	*
10/7/2010	8:23	Wet	54.5		57.08	7.69	6.65	106.9	1.7
11/6/2010	8:26	Wet	44.2		46.17	8.94	6.64	92.78	1.7

* no data, could not keep sensor out of mud

Packard Pond Outflow Observations

Water appearance	Generally clear with foam patches when flowing, but in August murky and covered with a sheen.
Water odor	None
Flow/ level	Flow is brisk to moderate in the spring and fall, but slow to still from July to September, when the channel was 10% or less full.
Plant growth	Iris, skunk cabbage, grass, and sedges along the edges
Other observations	Trash accumulating around the site. A two inch fish was seen in July
Comparison to 2009	No oil was seen in 2009, but was observed in earlier years. No fish had been seen here in recent years. In 2009, DO was never below 7.00 mg/l only once at 6.88. Dry weather turbidity as seen in August is unprecedented. Temperature, pH and conductivity are consistent with 2009.
Notes	None

Potash Brook, Dudley N 42°02'13.5" W 71°53'33.3"

Potash Brook(impact): carries a significant volume of water and drains an area west of Merino Pond which is partly residential and partly agricultural and may be a source of nutrient runoff. Turn off Route 12 onto New Boston Road and then right into the Dudley Pumping Station, and monitor on the south side of the bridge.



Potash Brook									
Date	Time	Wet/Dry	Air Temp (F)	Staff Gauge	Water Temp (F)	DO (mg/l)	pH	Conductivity (uS/cm)	Turbidity (NTU's)
3/6/2010	8:51	Dry	33.2	0.88	34.33	12.98	6.78	142.6	2.6
4/3/2010	8:35	Wet	54.5	1.30	47.26	10.45	6.55	129.1	1.6
5/8/2010	8:42	Wet	53.6	1.64	54.75	9.42	6.93	140.7	12.7
6/5/2010	8:42	Wet	73.9	0.52	67.12	7.84	6.94	175.5	2.8
7/3/2010	8:26	Dry	67.8	0.48	59.21	8.94	7.01	164.7	2.0
8/6/2009	8:32	Dry	*	*	*	*	*	*	*
9/12/2009	8:46	Wet	*	*	*	*	*	*	*
10/7/2010	8:30	Wet	54.6	0.62	54.88	9.14	6.81	112.1	2.0
11/6/2010	8:35	Wet	44.9	0.80	43.27	10.66	6.83	135.9	2.2

*No water

Potash Brook Observations

Water appearance	Water is generally clear, except for heavy rain in May.
Water odor	None
Flow/ level	The channel was 90% full in the spring but dry in August and September
Plant growth	Skunk cabbage was noted in April
Other observations	Water striders were noted in June and July
Comparison to 2009	In 2009, the brook flowed freely all year, but had dried up in 2007 and 2008, so going dry is not unprecedented. Data is generally consistent, except for the high turbidity resulting from a storm in May
Notes	None

Brandon Road, Dudley N 42°02'30.2" W 71°53'14.8"

Brandon Road (reference): At this location we can take data upstream of the Webster Wastewater Treatment Plant. Drive into the Ethan Allen Mill Complex north of the office and proceed directly to the river, just downstream from the Hill Street bridge



Brandon Road									
Date	Time	Wet/Dry	Air Temp (F)	Staff Gauge	Water Temp (F)	DO (mg/l)	pH	Conductivity (uS/cm)	Turbidity (NTU's)
3/6/2010	9:02	Dry	36.2		36.12	12.83	6.55	107.1	2.3
4/3/2010	8:45	Wet	52.3		49.55	10.74	6.48	91.5	1.8
5/8/2010	8:51	Wet	54.3		61.97	8.58	6.86	159.6	6.5
6/5/2010	8:51	Wet	73.0		73.41	7.58	6.85	206.3	2.0
7/3/2010	8:35	Dry	68.7		70.72	7.89	6.95	216.7	1.2
8/4/2010	8:36	Dry	82.0		72.77	7.33	7.03	258.6	1.6
9/4/2010	9:00	Wet	69.0		72.04	6.24	6.83	239.5	2.5
10/7/2010	8:39	Wet	53.6		56.23	9.45	7.05	186.9	1.6
11/6/2010	8:43	Wet	44.9		45.60	10.75	6.78	118.3	1.5

Brandon Road Observations

Water appearance	Clear, with a “glob” of foam passing in November
Water odor	None
Flow/ level	The channel is 90% or more full in the spring, falling to 5% in August and September and then recovering to 50% or more. Flow rate was observed to be slow only in August
Plant growth	None
Other observations	A woodpecker and geese were heard in April. Aquatic insects were seen in July and September.
Comparison to 2009	There was no new beaver activity this year. The DO value recorded in September was the lowest ever for this site. Values of conductivity are somewhat elevated; four occasions above 200 uSm/cm is unprecedented. Other parameters are consistent with 2009.
Notes	None

Low Pond Outflow, Dudley N 42°02'59.8" W 71°53'16.3"

Low Pond outflow(impact): carries a significant volume of water and drains a string of ponds including Low Pond, Merino Pond, and on to Pierpont Meadow Pond, around which there are significant residential developments which may be a source of runoff. Park on the north side of Stevens Linen in Dudley in the large parking lot and proceed to the right to the tailrace. Monitor where it emerges from under the building.



Low Pond Outflow									
Date	Time	Wet/Dry	Air Temp (F)	Staff Gauge	Water Temp (F)	DO (mg/l)	pH	Conductivity (uS/cm)	Turbidity (NTU's)
3/6/2010	9:14	Dry	39.8		38.47	12.67	6.83	58.0	1.7
4/3/2010	8:56	Wet	55.5		50.46	10.96	6.85	59.8	1.9
5/8/2010	9:02	Wet	55.0		61.40	9.16	6.94	85.9	3.1
6/5/2010	9:00	Wet	75.2		74.35	7.95	6.97	102.9	3.3
7/3/2010	8:43	Dry	71.2		63.04	8.53	7.02	114.9	2.7
8/4/2010	8:48	Dry	82.4		66.05	6.87	6.82	147.4	2.8
9/4/2010	9:17	Wet	72.1		65.98	6.28	6.67	145.5	2.8
10/7/2010	8:58	Wet	53.7		57.00	9.17	7.04	97.1	3.2
11/6/2010	8:55	Wet	43.8		47.04	10.80	6.91	77.3	1.8

Low Pond Outflow Observations

Water appearance	Clear
Water odor	None
Flow/ level	In April the flow was described as a raging torrent. Although water continued to move swiftly, the level was very low, and did not recover in the fall, necessitating descent into the channel even in November
Plant growth	None
Other observations	Various items of trash are accumulating in the channel, which was cleaned in 2008
Comparison to 2009	During no year has the water level been so low for so long. In 2009 DO was never below 8 mg/l. pH is somewhat lower this year. In 2009 it was below 7 only twice. Other parameters are consistent with 2009 and previous years.
Notes	The low water level required a volunteer to descend into the channel from July on. This is only for the agile and most volunteers should not do it.

Commerce Parking Lot Storm Drain, Webster N 42°03'01.4" W 71°53'00.6"

Commerce parking lot storm drain(impact):
 This continually running storm drain in downtown Webster has exuded an odor detectable at times and nearby rocks have exhibited an orange deposit. In 2005 high coliform counts were found on the only occasion measured. This is a possible point source of pollution. Enter the public parking lot at Tracy Court and go to the southwest corner. Monitor the storm drain outflow.



Commerce Parking Lot Storm Drain									
Date	Time	Wet/Dry	Air Temp (F)	Staff Gauge	Water Temp (F)	DO (mg/l)	pH	Conductivity (uS/cm)	Turbidity (NTU's)
3/6/2010	9:20	Dry	41.8		40.67	12.10	7.20	264.8	1.5
4/3/2010	9:06	Wet	60.8		47.16	10.77	6.89	289.1	1.3
5/8/2010	9:12	Wet	55.5		55.85	9.61	6.85	125.5	58.5
6/5/2010	9:11	Wet	79.8		64.85	7.75	7.22	302.7	3.2
7/3/2010	8:53	Dry	78.4		63.16	9.30	7.25	302.8	2.5
8/4/2010	9:01	Dry	85.2		66.66	8.59	7.43	267.7	2.2
9/4/2010	9:24	Wet	71.1		66.71	8.73	7.50	273.6	2.2
10/7/2010	9:10	Wet	55.0		60.18	9.51	7.35	290.3	2.0
11/6/2010	9:03	Wet	46.9		53.11	10.44	7.26	276.8	2.0

Commerce Parking Lot Storm Drain Observations

Water appearance	The water was clear except for May during heavy rain, when it was murky and foamy
Water odor	An oily smell was quite evident in May
Flow/ level	The channel was essentially flooded by the River in March and April, and flowing moderately during the rain event in May. After that, levels were low and flow very slow. Levels recovered to 50% full in October and November
Plant growth	None
Other observations	Scattered trash is visible on most occasions. Plows continue to push snow with sand and salt up to the edge and in some cases into the culvert. A 12" fish was seen in June and a bluegill and smaller fish in September.
Comparison to 2009	For the second year in a row, there has been no sign of the orange deposits which were prevalent in 2005. Parameters are consistent with 2009, with the exception of the May storm event.
Notes	None

Mill Brook at Bigelow Road, Webster N 42°04'00.8" W 71°52'31.9"

Mill Brook at Bigelow Road(impact): As the outflow from Webster Lake, carries a significant volume of water. This station is downstream from a closed stump grinding operation, which operated on raw material of unknown origin and character, and added chemicals to its product, and may have affected the chemistry of Mill Brook. Park near the bridge over Mill Brook on Bigelow Road, and monitor on the east side of the bridge.



Mill Brook Bigelow Road									
Date	Time	Wet/Dry	Air Temp (F)	Staff Gauge	Water Temp (F)	DO (mg/l)	pH	Conductivity (uS/cm)	Turbidity (NTU's)
3/6/2010	9:35	Dry	44.2	2.18	38.81	12.74	6.39	101.5	1.0
4/3/2010	9:15	Wet	62.4	2.06	53.10	10.41	6.39	113.3	1.0
5/8/2010	9:22	Wet	54.8	0.94	54.84	6.36	6.38	417.8	5.9
6/5/2010	9:22	Wet	87.6	1.06	74.34	6.56	6.42	282.0	1.9
7/3/2010	9:00	Dry	78.6	0.48	61.19	7.36	6.72	473.5	1.7
8/4/2010	9:12	Dry	88.7	0.70	67.85	4.50	6.42	654.1	14.1
9/4/2010	9:38	Wet	74.5	0.74	69.11	3.76	6.40	701.2	1.9
10/7/2010	9:21	Wet	56.8	0.98	56.17	5.13	6.38	227.4	7.9
11/6/2010	9:16	Wet	47.3	0.78	46.36	8.16	6.71	343.7	2.7

Mill Brook at Bigelow Road Observations

Water appearance	Usually clear, but characterized as dark during the May rain event and murky in August. Patches of floating oil were noted in June and October
Water odor	None
Flow/ level	A beaver dam started just upstream of the bridge in August and restricted flow throughout the remainder of the season. It was about two feet tall in November. The channel status had gotten down to 5% full in July.
Plant growth	Algae was noted as early as March and was prevalent by May, to the left out of the current. It remained into October. Many plants grow here, including cattails, lily pads, loosestrife, milfoil, and other submerged and emergent plants
Other observations	There is a lot of scattered trash accumulating. In June, two bluegill were seen, and a bullfrog was heard. Dragonflies and water striders were also noted.
Comparison to 2009	Dissolved oxygen levels are the lowest ever seen, both in terms of level and duration. pH values are lower than in 2009, but low pH values have been a feature of this site since monitoring began. Conductivity is much higher than in 2009, and the August value of over 700 uSm/cm is a record, although values above 500 uSm/cm have been recorded before, in 2008. High dry weather turbidity in August has not been observed previously. No fish were seen in 2009, but they had been seen in previous years. Beaver dams have been built before, but usually downstream of the site
Notes	None

Mill Brook at Webster Nursery, Webster N 42°03'45.0" W 71°51'50.3"

Mill Brook at Webster Nursery(reference): measures the quality of water leaving Webster Lake, and serves as a reference point above the stump grinding operation. Park in the Webster Nursery parking lot and monitor on the west side of the bridge.



Mill Brook Webster Nursery									
Date	Time	Wet/Dry	Air Temp (F)	Staff Gauge	Water Temp (F)	DO (mg/l)	pH	Conductivity (uS/cm)	Turbidity (NTU's)
3/6/2010	9:45	Dry	43.5		38.73	12.95	6.29	97.2	1.4
4/3/2010	9:25	Wet	67.6		53.14	10.90	6.49	105.6	2.2
5/8/2010	9:30	Wet	54.6		56.02	9.07	6.80	199.0	63.8
6/5/2010	9:30	Wet	82.7		77.27	8.13	6.97	261.9	1.3
7/3/2010	9:10	Dry	79.7		70.05	7.86	6.88	506.9	3.3
8/4/2010	9:27	Dry	87.8		69.15	8.61	6.81	888.3	2.0
9/4/2010	9:48	Wet	74.8		70.89	7.84	6.83	659.6	17.6
10/7/2010	9:31	Wet	56.4		58.80	8.02	7.09	929.8	1.1
11/6/2010	9:20	Wet	50.0		48.55	10.00	6.85	494.8	2.8

Mill Brook at Webster Nursery Observations

Water appearance	The water is mostly clear, but there were fine whitish patches visible on the surface in March and April. During the May rain event the water was dark and oily. Small oily patches were seen in October and a large patch (25 square feet) was present in November. Some oil could also be observed upstream across the road.
Water odor	None
Flow/ level	After being 90% full and swift in April, level and flow rapidly fell to 5% or below and never recovered.
Plant growth	By June, milfoil, submerged grass, and algae were apparent. Surface brown algae clumps and submerged mats of algae could be seen through October. Grass began to grow on the exposed bottom.
Other observations	Fish were seen in June and July, and a dead one in October. Dragonflies were seen on two occasions. Trash is accumulating around the site. The bottom is covered with road sand
Comparison to 2009	In a departure from most sites, DO is comparable to 2009. pH is also comparable. Conductivity is much higher, with October's figure being the highest we have ever recorded at any site. The duration of the high conductivity period is unprecedented at this site. High turbidity occurred during the May rain event and also under dry conditions in September. Very low flow in November occurred in 2009 as well, as did considerable algae growth, and some oily patches, but nothing like the slick seen in November
Notes	The general aesthetic quality of this site seems to be deteriorating. Cranston Print Works has ceased operations and it may be possible that some source of water quality degradation is no longer being monitored or casually observed.

Nancy Drive, Webster N 42°04'41.2" W 71°52'28.0"

Nancy Drive(impact): an unnamed stream on the east side of the river in Webster near the Oxford line, which receives water from an industrial park and a casual junkyard, possibly carrying pollutants of all types. High conductivity levels have been measured here in the past. Take Nancy Drive from Route 12 and park at the end. Walk to the left by the house to a wooden bridge, and monitor downstream.



Nancy Drive									
Date	Time	Wet/Dry	Air Temp (F)	Staff Gauge	Water Temp (F)	DO (mg/l)	pH	Conductivity (uS/cm)	Turbidity (NTU's)
3/6/2010	9:55	Dry	48.6		38.16	9.14	6.55	530.0	1.9
4/3/2010	9:37	Wet	62.9		51.89	6.54	6.52	448.1	0.9
5/8/2010	9:50	Wet	55.5		57.64	4.45	6.66	492.1	7.4
6/5/2010	9:38	Wet	86.5		71.39	2.25	6.51	605.9	3.2
7/3/2010	9:26	Dry	77.1		65.72	5.13	6.77	627.5	4.8
8/6/2009	9:48	Dry	*	*	*	*	*	*	*
9/4/2010	10:07	Wet	71.7		72.27	1.47	6.56	543.0	4.0
10/7/2010	9:42	Wet	58.6		55.05	3.41	6.50	348.1	2.0
11/6/2010	9:32	Wet	49.2		43.58	5.34	6.65	336.0	2.3

* Insufficient water to submerge TROLL

Nancy Drive Observations

Water appearance	Clear
Water odor	None noted
Flow/ level	Water was always flowing at least moderately swiftly, but in August it was too shallow to submerge the TROLL. The water level in October of 50% full was surprisingly high
Plant growth	Algae on rocks was noted in April
Other observations	Frogs were seen in September. Trash, including a tire, is visible downstream.
Comparison to 2009	Alarming DO and conductivity levels are consistent with past years. Other parameters are consistent as well.
Notes	None

Old Mill Brook, Oxford N 42°05'19.1" W 71°52'15.1"

Old Mill Brook(impact): carries a significant volume of water and flows through two industrial parks, which may be sources of pollution. Park on Route 12 under the railroad overpass and Old Mill Brook is on the west side. Monitor where it emerges from the culvert under Route 12.



Old Mill Brook									
Date	Time	Wet/Dry	Air Temp (F)	Staff Gauge	Water Temp (F)	DO (mg/l)	pH	Conductivity (uS/cm)	Turbidity (NTU's)
3/6/2010	10:01	Dry	43.5		34.22	13.09	6.68	148.3	1.0
4/3/2010	9:55	Wet	58.6		51.58	10.52	6.73	140.8	0.8
5/8/2010	9:57	Wet	56.6		54.74	9.63	6.77	184.4	106.9
6/5/2010	9:46	Wet	77.0		61.91	7.39	6.51	590.8	3.3
7/3/2010	9:32	Dry	81.8		59.59	3.97	6.22	462.6	12.2
8/4/2010	9:42	Dry	83.0		71.28	6.09	6.56	249.6	2.2
9/4/2010	10:18	Wet	72.5		69.13	5.34	6.43	214.9	10.0
10/7/2010	9:52	Wet	57.5		54.42	9.30	6.66	195.0	1.2
11/6/2010	9:36	Wet	47.3		44.22	10.74	6.80	173.2	1.1

Old Mill Brook Observations

Water appearance	Varies from very clear to murky and filmed over. It was murky at the May rain event, and exhibited a surface film in July and September
Water odor	None
Flow/ level	The water is always barely moving here because its at the same height as the river. The channel is 20% full or more, even with very low water elsewhere
Plant growth	None
Other observations	10" fish were seen in June and August. There is some trash scattered about
Comparison to 2009	The DO reading of 3.97 mg/l in July is the lowest recorded at this site. In 2009 DO barely got below 8 mg/l. pH is a little lower in 2010. Conductivity in June is higher than any recorded in 2009, but that year featured several months of elevated values. In addition to very high turbidity during the May rain event, there are two other instances of elevated turbidity, which did not occur in 2009.
Notes	None

Lowe's Brook, Oxford N 42°06'14.7" W 71°51'58.8"

Lowe's Brook(impact): The largest brook that we measure flowing into the French River, except for the Little River, drains Lowe Pond, above which significant commercial development is taking place, which may be resulting in runoff now from development, and in the future from operation. Park at the small convenience store on the east side where Lowe's Brook crosses Route 12. Monitor from the bridge over the small diagonally running road (State Street) behind the store.



Lowe's Brook									
Date	Time	Wet/Dry	Air Temp (F)	Staff Gauge	Water Temp (F)	DO (mg/l)	pH	Conductivity (uS/cm)	Turbidity (NTU's)
3/6/2010	10:13	Dry	43.8	1.16	37.86	12.47	6.57	115.7	2.3
4/3/2010	10:00	Wet	57.7	2.22	53.90	10.02	6.50	110.9	2.1
5/8/2010	10:05	Wet	55.2	1.76	61.39	6.91	6.66	218.3	6.6
6/5/2010	9:55	Wet	78.9	1.72	74.71	4.81	6.51	256.9	2.8
7/3/2010	9:38	Dry	75.5	1.56	69.46	5.54	6.55	273.1	4.5
8/4/2010	9:53	Dry	83.0	1.50	70.99	5.14	6.39	299.7	3.6
9/4/2010	10:24	Wet	73.5	1.60	71.73	4.34	6.38	258.4	3.3
10/7/2010	10:01	Wet	55.9	1.36	57.22	8.71	6.86	250.9	2.5
11/6/2010	9:40	Wet	47.6	1.18	45.85	9.80	6.74	242.4	2.9

Lowe's Brook Observations

Water appearance	Water was characterized as murky in May, June, and July, clear otherwise. Except in May, this is not consistent with turbidity readings, which is not uncommon for this site.
Water odor	None noted
Flow/ level	Flow rates were moderate to slow. The channel status never got below 20%
Plant growth	Duckweed patches were noted in September
Other observations	There is a lot of trash at the site, even though a clean-up apparently was conducted between the April and May sampling events. In June and July, water striders were seen. On one occasion a bullfrog was heard, and a mouse could be seen on the bridge. A 3" fish was seen in July.
Comparison to 2009	DO levels are much lower than in 2009. Levels below 5 mg/l had not been seen before. pH is generally slightly lower than in 2009. Conductivity is higher; only twice in 2009 was it above 200 uSm/cm.
Notes	None

Clara Barton Road, Oxford N 42°09'14.2" W 71°52'57.3"

Clara Barton Road (reference): This site is upstream of gravel pit operations in the area. It is the furthest upstream site that we will be monitoring and gives us a baseline for all down stream monitoring. Take Clara Barton Road off Route 12 in North Oxford and park at the stone bridge. Make your way down to the water upstream of the bridge and monitor from the rock outcropping.



Clara Barton Road									
Date	Time	Wet/Dry	Air Temp (F)	Staff Gauge	Water Temp (F)	DO (mg/l)	pH	Conductivity (uS/cm)	Turbidity (NTU's)
3/6/2010	10:30	Dry	47.2		35.49	13.23	6.87	95.0	3.1
4/3/2010	10:15	Wet	66.0		51.20	10.96	6.77	87.5	2.6
5/8/2010	10:19	Wet	54.8		59.83	9.11	6.99	141.3	4.4
6/5/2010	10:17	Wet	75.5		74.08	7.83	7.01	177.4	2.4
7/3/2010	9:55	Dry	72.8		68.98	8.54	7.21	184.6	2.6
8/4/2010	10:12	Dry	81.0		74.05	8.03	7.17	203.0	1.8
9/4/2010	11:05	Wet	74.8		73.88	7.51	7.08	261.3	1.8
10/7/2010	10:20	Wet	58.6		56.64	9.86	7.23	142.5	3.2
11/6/2010	9:59	Wet	45.1		44.70	11.61	7.03	88.7	1.7

Clara Barton Observations

Water appearance	Always clear
Water odor	None
Flow/ level	Flow is swift during March, April, October and November, with a channel status of 70% or greater. Flow is moderate otherwise, with channel status going down to 10% in August
Plant growth	None
Other observations	Aquatic insects were noted from June through September. Six 2" fish were seen in September
Comparison to 2009	The duration of peak water temperatures are very noticeable at this site, with the August temperatures being comparable, but 12F warmer in September 2010. DO is lower in 2010; it was never below 8.55 mg/l in 2009, and never before below 8. Conductivity is slightly higher in 2010. Instances of conductivity this high were seen in 2007 and 2008. No fish were seen in 2009.
Notes	None

Little River, Oxford N 42°06'34.1" W 71°53'00.3"

The Little River (impact): this site is the largest inflow of water into the French River; it is the outflow from Buffumville Lake. Between Buffumville Lake and its confluence with the French River there are several industrial areas right on the river. We are monitoring here to see if there are any adverse effects from these sites. Where Dudley Road crosses over the French River there is a public parking lot at the Leovich Landing boat launch site. Park here and walked down the old Boston & Albany railbed about ¼ mile and monitor the Little River when reached



Little River									
Date	Time	Wet/Dry	Air Temp (F)	Staff Gauge	Water Temp (F)	DO (mg/l)	pH	Conductivity (uS/cm)	Turbidity (NTU's)
3/6/2010	11:06	Dry	46.3		36.79	12.81	6.43	112.2	3.1
4/3/2010	10:35	Wet	66.3		48.47	11.18	6.45	79.5	1.7
5/8/2010	10:30	Wet	54.0		60.79	7.85	6.52	117.4	4.5
6/5/2010	10:37	Wet	87.6		75.54	6.92	6.59	153.6	2.1
7/3/2010	10:12	Dry	78.2		70.38	9.65	7.14	175.8	1.0
8/4/2010	10:34	Dry	82.0		73.32	6.42	6.60	195.4	1.3
9/4/2010	11:30	Wet	72.5		71.20	3.84	6.42	236.9	1.9
10/7/2010	10:39	Wet	57.5		57.03	7.85	6.61	132.6	1.6
11/6/2010	10:26	Wet	50.7		46.67	9.85	6.68	100.8	1.2

Little River Observations

Water appearance	Clear except characterized as cloudy in September. Turbidity readings do not confirm this
Water odor	None
Flow/ level	Unlike other sites, channel status is lowest in May and June, down to 15%. It's 50-70% during August-November. Flow is slow to moderate
Plant growth	Submerged grass is noted in varying amounts from June on, with algae caught on it in July
Other observations	The beaver dam located upstream in previous years was damaged in March and completely gone by May. There continues to be beaver activity, and live beavers were seen in March and June. Mallards were also seen in March. There are many flying insects, including dragon flies, horseflies, and mosquitoes. A turtle was seen in September.
Comparison to 2009	The DO value in September is an all time low for the site. The lowest value in 2009 was 6.99 mg/l. pH values are somewhat lower in 2010. Conductivity values in August and September are higher than in 2009. Turbidity values are comparable.
Notes	none

Dudley Road, Oxford N 42°06'25.5" W 71°52'58.4"

Dudley Road (reference): This site is above Lowe's Brook and is monitored as a baseline to see how much influence Lowe's Brook has on the French River. Park in the same location as for Little River and monitor off the bridge.



Dudley Road									
Date	Time	Wet/Dry	Air Temp (F)	Staff Gauge	Water Temp (F)	DO (mg/l)	pH	Conductivity (uS/cm)	Turbidity (NTU's)
3/6/2010	11:16	Dry	47.6		36.91	12.35	6.42	109.2	2.5
4/3/2010	10:45	Wet	72.5		47.91	11.23	6.42	82.8	2.4
5/8/2010	10:49	Wet	54.0		60.55	7.57	6.59	134.0	4.8
6/5/2010	10:48	Wet	84.3		75.02	7.26	6.67	181.7	2.0
7/3/2010	10:24	Dry	79.8		69.20	7.30	6.66	205.5	1.6
8/4/2010	10:54	Dry	82.0		73.07	5.32	6.56	218.9	1.3
9/4/2010	11:44	Wet	78.8		72.91	4.25	6.43	247.8	1.8
10/7/2010	10:51	Wet	56.3		56.19	7.74	6.60	153.5	1.8
11/6/2010	10:34	Wet	44.9		45.58	9.60	6.58	98.2	1.7

Dudley Road Observations

Water appearance	Clear except May and August when it was characterized as murky, the latter with a light oily sheen
Water odor	None noted
Flow/ level	The flow was slow or moderate, except for April when it was termed swift and the channel was 100% full. During the summer months it got down to 20%
Plant growth	During the summer many submerged and emergent plants were noted, including milfoil, and grasses
Other observations	In March an aquatic mammal was seen far downstream. Bluegill and nests were seen in June and July. Aquatic insects and dragonflies were observed on several occasions
Comparison to 2009	The DO level of 4.25 is the lowest seen at this site, and the period of low DO is longer than in 2009. pH values are slightly lower. Conductivity measurements are higher in the 2010 summer months, and turbidity is comparable. Conductivity this high was last seen in 2007. Bluegill were not seen in 2009, but had been observed in previous years
Notes	None

Harwood Street , Oxford N 42°05'28.6" W 71°52'48.7"

Harwood Street (reference): This site is below Lowe's Brook and combined with Dudley Road should give us a clear picture of any impact Lowe's has on the French. Monitoring here also gives us a good flow measurement above North Village dam to compare with flow below as measured by the USGS gauge in Webster. There is a pull off next to the bridge where Harwood Street crosses over the French River. Park here and monitor off the bridge



Harwood Street									
Date	Time	Wet/Dry	Air Temp (F)	Staff Gauge	Water Temp (F)	DO (mg/l)	pH	Conductivity (uS/cm)	Turbidity (NTU's)
3/6/2010	11:24	Dry	50.2		36.49	12.13	6.42	109.6	2.5
4/3/2010	10:55	Wet	65.4		48.57	10.14	6.36	81.4	2.2
5/8/2010	11:03	Wet	54.0		59.83	7.27	6.60	150.8	6.6
6/5/2010	10:57	Wet	82.0		73.62	6.22	6.59	194.8	2.6
7/3/2010	10:35	Dry	78.0		67.53	7.17	6.90	208.6	2.1
8/4/2010	11:06	Dry	84.0		72.45	6.21	6.67	227.4	1.4
9/4/2010	11:59	Wet	77.1		71.52	4.25	6.58	226.1	2.3
10/7/2010	11:00	Wet	59.0		55.87	7.38	6.66	175.3	2.0
11/6/2010	10:56	Wet	44.5		45.00	9.09	6.55	106.6	1.9

Harwood Street Observations

Water appearance	Always clear
Water odor	None
Flow/ level	Flow was swift in March and April when levels were high, and slow or moderate thereafter. Channel status got down to 10% in August
Plant growth	Submerged grasses were observed in June through October, with algae in August
Other observations	Three small fish were seen in August, with dragonflies and aquatic insects observed on several occasions
Comparison to 2008	The DO reading of 4.25 mg/l is the lowest ever seen at this site. pH is lower during March and April and generally comparable to 2009 otherwise. Conductivity is higher during the summer months. It was never above 183 uSm/cm in 2009, and was higher only in 2007. Turbidity readings are comparable, except slightly elevated during the May rain event.
Notes	None

3.4 Analysis

In this section we compare our findings to MASS DEP Water Quality Standards. In the case of Turbidity we have added our definition for inclusion on the list, and made other notations concerning the problem scope for Oil and Grease, and Aesthetics. Then we look at the five river sites in terms of comparisons with 2007-2009.

3.4.1 Comparison to Water Quality Standards

Dissolved Oxygen	<u>Class BWWF: ≥ 5.0 mg/L unless background conditions are lower</u>
Mill Brook Bigelow Road	Failed on 2 of 9 occasions
Nancy Drive	Failed on 4 of 8 occasions
Old Mill Brook	Failed on 1 of 9 occasions
Lowe's Brook	Failed on 2 of 9 occasions
Little River	Failed on 1 of 9 occasions
Dudley Road	Failed on 1 of 9 occasions
Harwood Street	Failed on 1 of 9 occasions
Temperature (maximum mean monthly)	<u>Class BWWF: $\leq 83^{\circ}\text{F}$ (28.3°C) and $\Delta 3^{\circ}\text{F}$ (1.7°C) in lakes, $\Delta 5^{\circ}\text{F}$ (2.8°C) in rivers Class BCWF: Shall not exceed 68°F (20°C) based on the mean of the daily maximum temperature over a seven day period unless naturally occurring.</u>
Clara Barton Road	No failures were found during monthly TROLL monitoring. However, with temperature data loggers, we found the temperature at Clara Barton Road exceeded 83°F from 7/2 to 7/12
Dudley Road	With temperature data loggers, temperature exceeded 83°F from 7/4 to 7/7
pH	<u>Class BWWF: 6.5 – 8.3 SU and $\Delta 0.5$ outside the background range.</u>
Brandon Road	Failed low on 1 of 9 occasions
Mill Brook Bigelow Road	Failed low on 7 of 9 occasions
Mill Brook Webster Nursery	Failed low on 2 of 9 occasions
Old Mill Brook	Failed low on 2 of 9 occasions
Lowe's Brook	Failed low on 2 of 9 occasions
Little River	Failed low on 3 of 9 occasions
Dudley Road	Failed low on 3 of 9 occasions
Harwood Street	Failed low on 2 of 9 occasions
E Coli Bacteria (not measured)	<u>Class B: geometric mean shall not exceed 126 colonies per 100ml, typically based on a minimum of 5 samples. No single sample shall exceed 235 colonies per 100ml</u>
Solids (not noted separately from aesthetics)	<u>All Classes: These waters shall be free from floating, suspended, and settleable solids in concentrations or combinations that would impair any use assigned to each class, that would cause aesthetically objectionable conditions, or that would impair the benthic biota or degrade the chemical composition of the bottom.</u>
Color and Turbidity (If based on a qualitative notation, Turbidity must be greater than 4 NTU)	<u>All Classes: These waters shall be free from color and turbidity in concentrations or combinations that are aesthetically objectionable or would impair any use.</u>
Packard Pond	In August, murky and covered with a sheen, turbidity of 15.0
Potash Brook	Turbidity of 12.7 during May rain event
Commerce parking Lot	Murky with foam and turbidity of 58.5 during May rain event
Mill Brook Bigelow Road	Characterized as dark in May, turbidity of 14.1 in August
Mill Brook Webster Nursery	Dark and oily in May, with turbidity of 63.8. Turbidity was 17.6 in September
Old Mill Brook	Turbidity of 106.9 in May. Murky with film in July and September with turbidity of 12.2 and 10.0 respectively

Oil & Grease (in all cases, small oil patches were noted)	<u>Class B</u> : Waters shall be free from oil and grease, petrochemicals that produce a visible film on the surface of the water, impart an oily taste to the water or an oily or other undesirable taste to the edible portions of aquatic life, coat the banks or bottom of the water course or are deleterious or become toxic to aquatic life.
Packard Pond	Exhibited a sheen in August
Mill Brook Bigelow Road	Patches of floating oil were seen in June and October
Mill Brook Webster Nursery	Fine whitish floating patches were observed in March and April, and the water was oily in May. An oily patch was seen in October and a large slick in November.
Dudley Road	Exhibited a slight sheen in August
Taste and Odor	<u>Class B</u> : None in such concentrations or combinations that are aesthetically objectionable, that would impair any use assigned to each class, or that would cause tainting or undesirable flavors in the edible portions of aquatic life.
Commerce Parking Lot	An oily smell was quite evident during the May rain event
Aesthetics (not including mention of roadside trash at many sites)	<u>All Classes</u> : All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.
Low Pond Outflow	Trash (wood, foam blocks, etc) are being thrown into the channel, which was cleaned in 2008.
Commerce Parking Lot	Snow and sand continue to be pushed onto the banks and into the culvert
Toxic Pollutants (not determined)	<u>All Classes</u> : All surface waters shall be free from pollutants in concentrations or combinations that are toxic to humans, aquatic life or wildlife... The division shall use the recommended limit published by EPA pursuant to 33 USC 1251, 304(a) as the allowable receiving water concentrations for the affected waters unless a site-specific limit is established.
Nutrients (discussed in Section 4)	Shall not exceed the site-specific limits necessary to control accelerated or cultural eutrophication.

This year there are many more failures to meet dissolved oxygen standards, presumably due to the very low flows and elevated temperatures which characterized the season. There are more locations with at least one failure, and in general the lows are the lowest we have seen since monitoring began. Although not so striking in terms of the values measured, there are also more widespread failures to meet pH standards, some of these occurring during the high flow months of March and April.

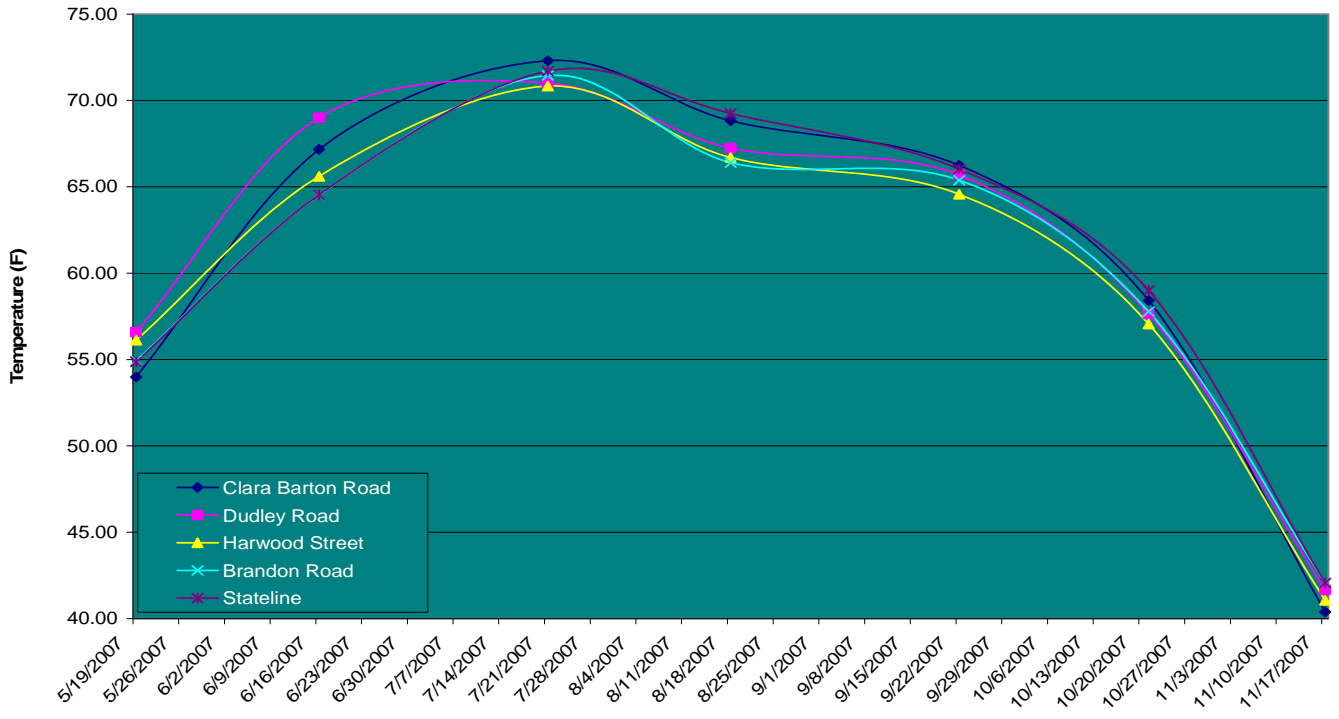
There were two situations resulting in notations concerning turbidity. In May, we monitored in a more stormy situation than we ever had before. Turbidity was slightly elevated (6 NTUs) in many locations but not noticeable visually. However, as indicated above, several sites were quite murky. The other situation occurred in the summer under low flow conditions, with double-digit turbidity not associated with heavy rain.

The most alarming observation of floating oil was in November at Webster Nursery. Small patches are not uncommon, but this was at least 25 square feet.

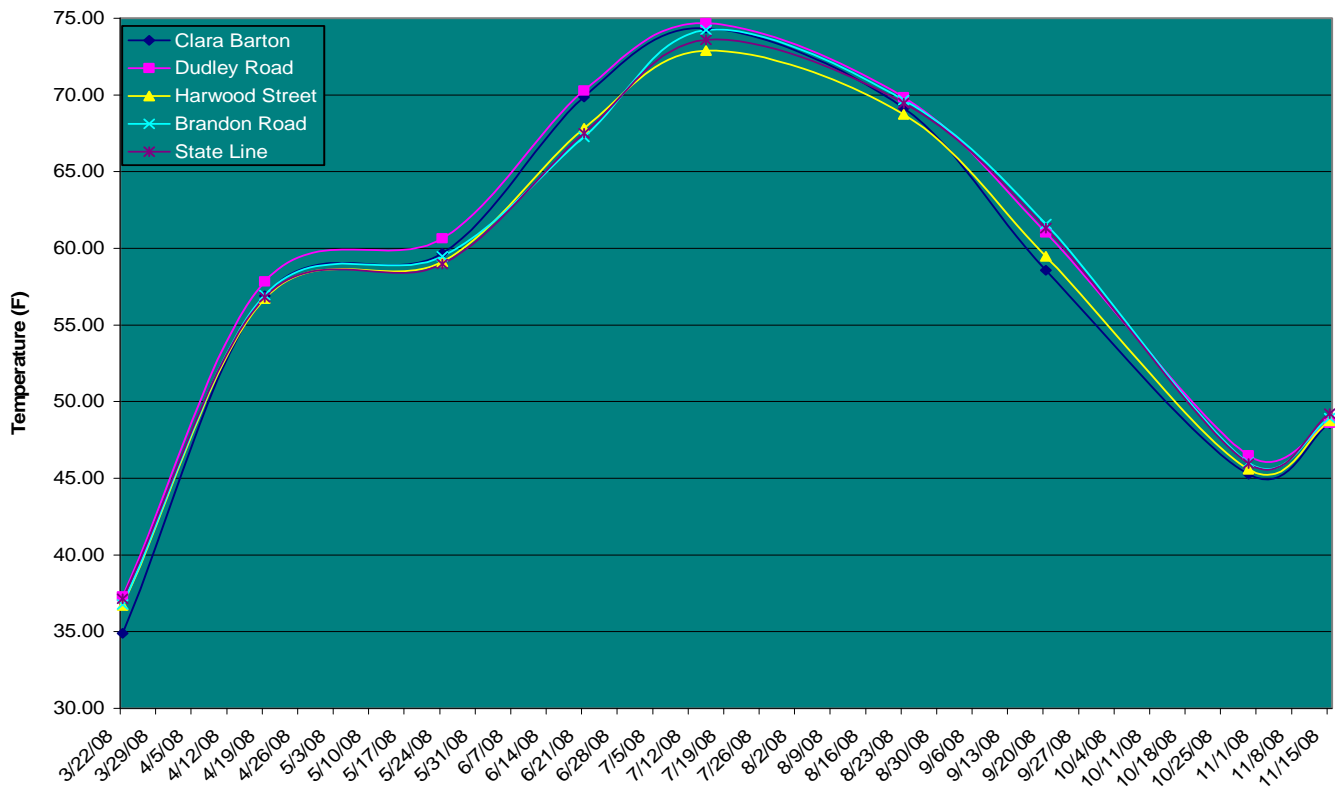
3.4.2 French River Profile

The following graphs and charts show, for each measured parameter, how they vary from the most upstream site on the main stem at Clara Barton Road to the most downstream at the State Line, over the monitoring season.

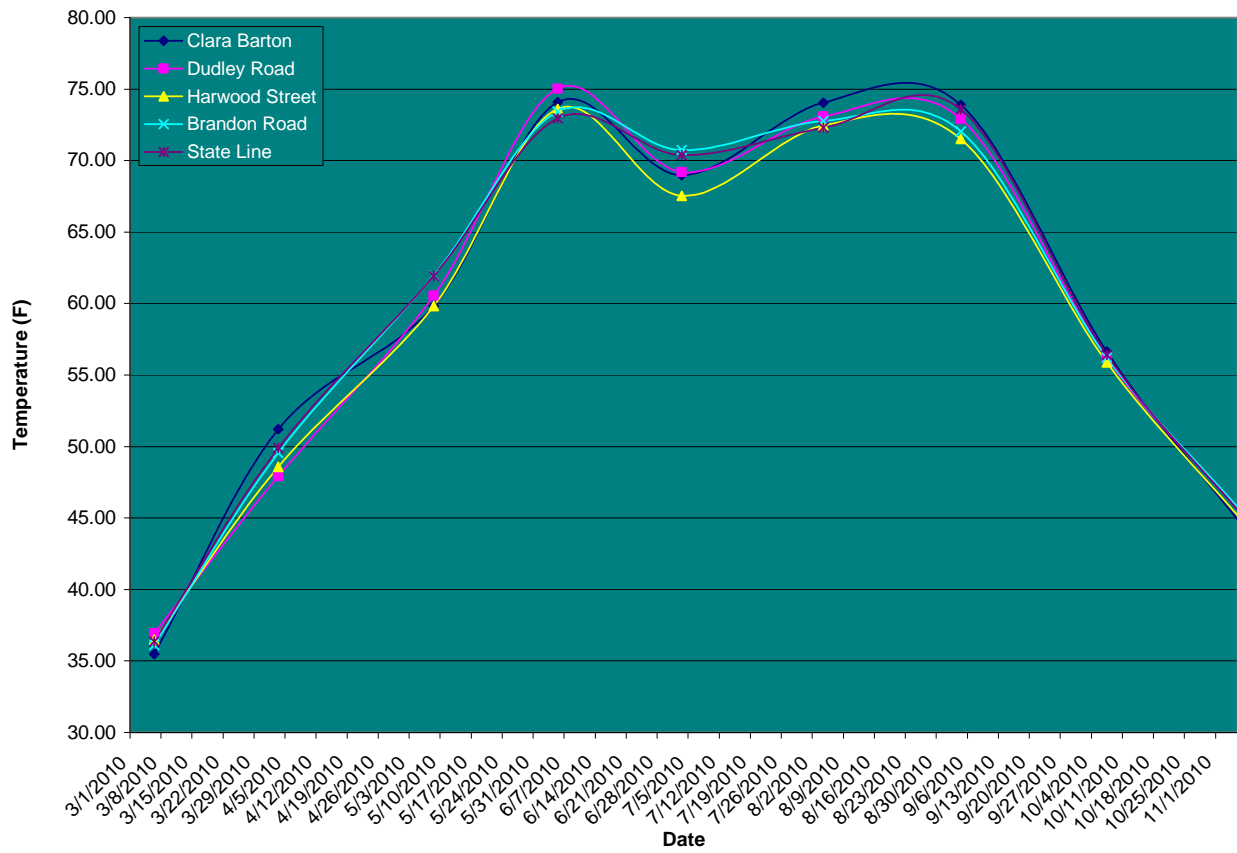
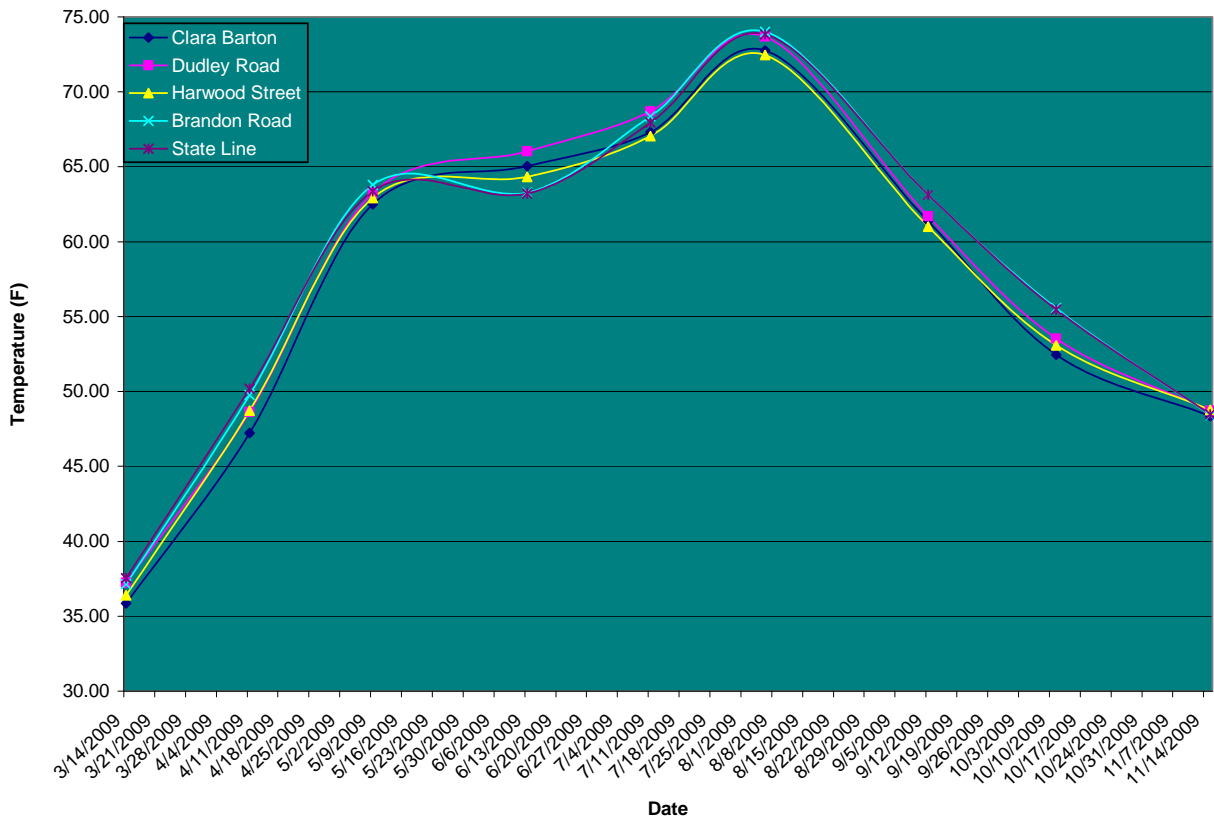
Temperature at French River Stations



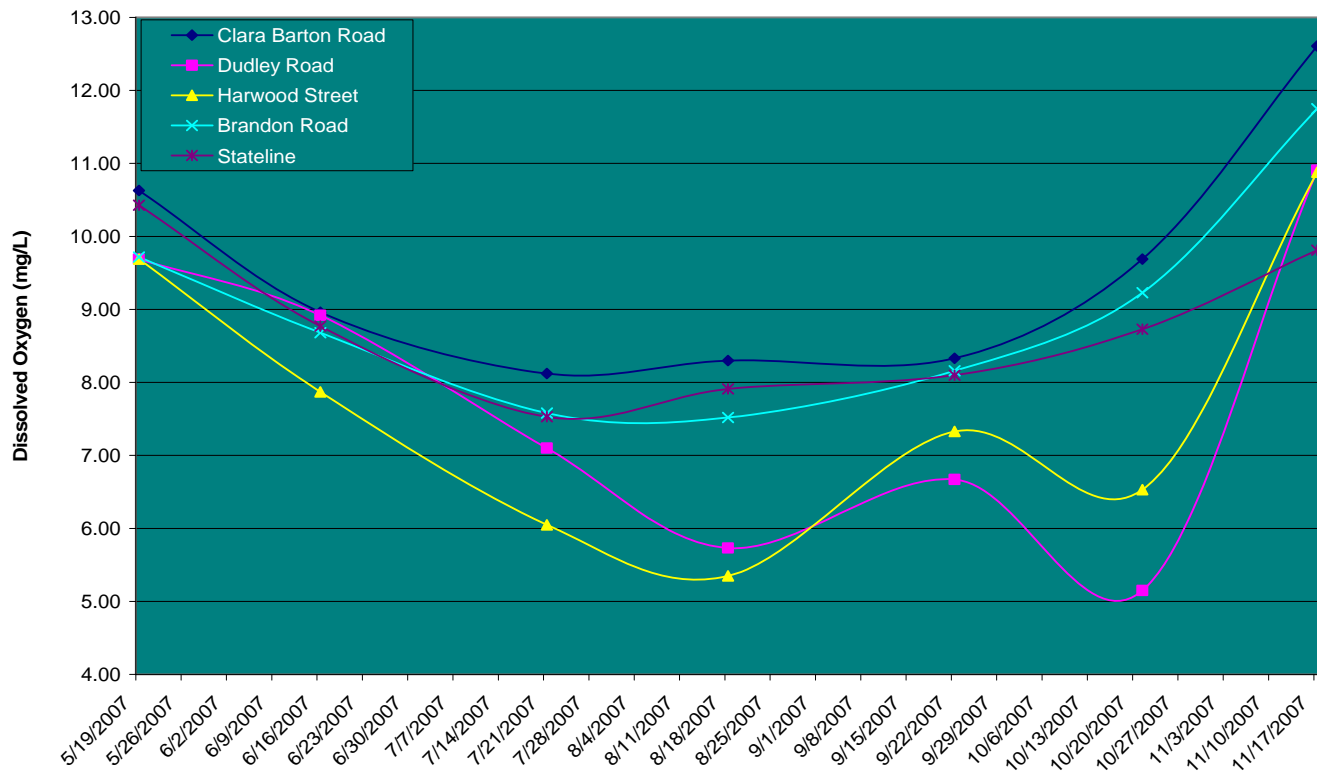
2007



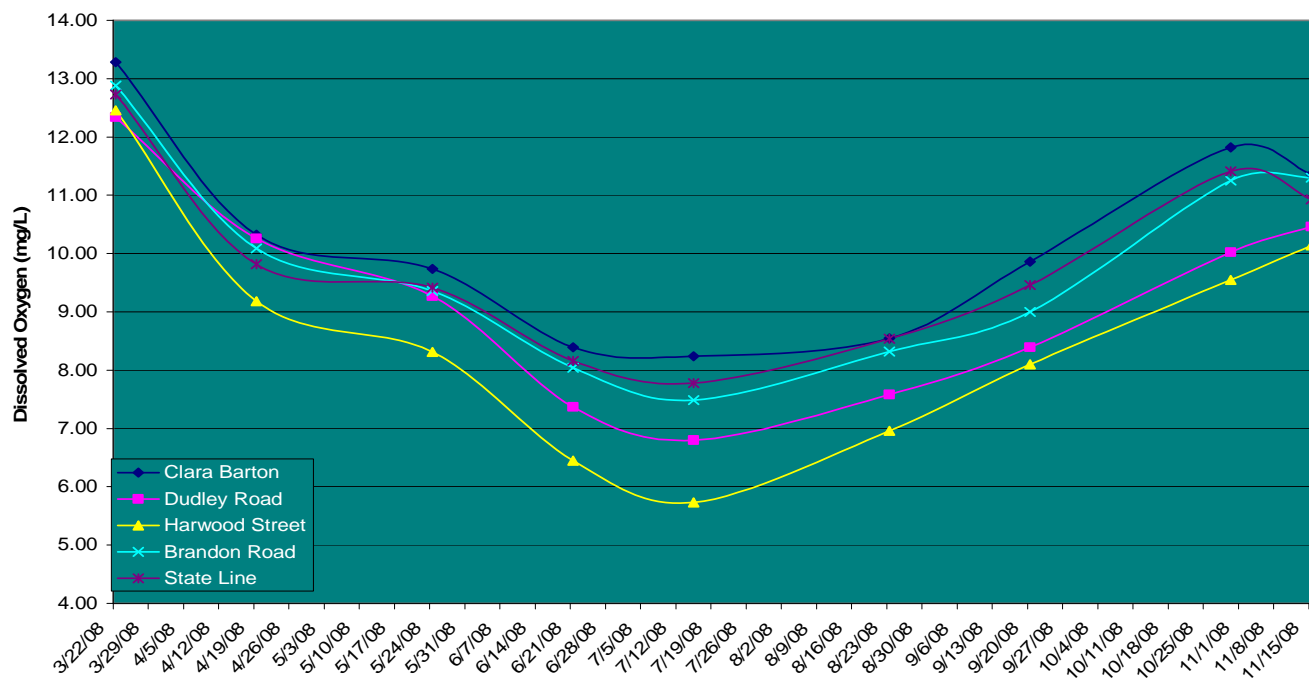
2008



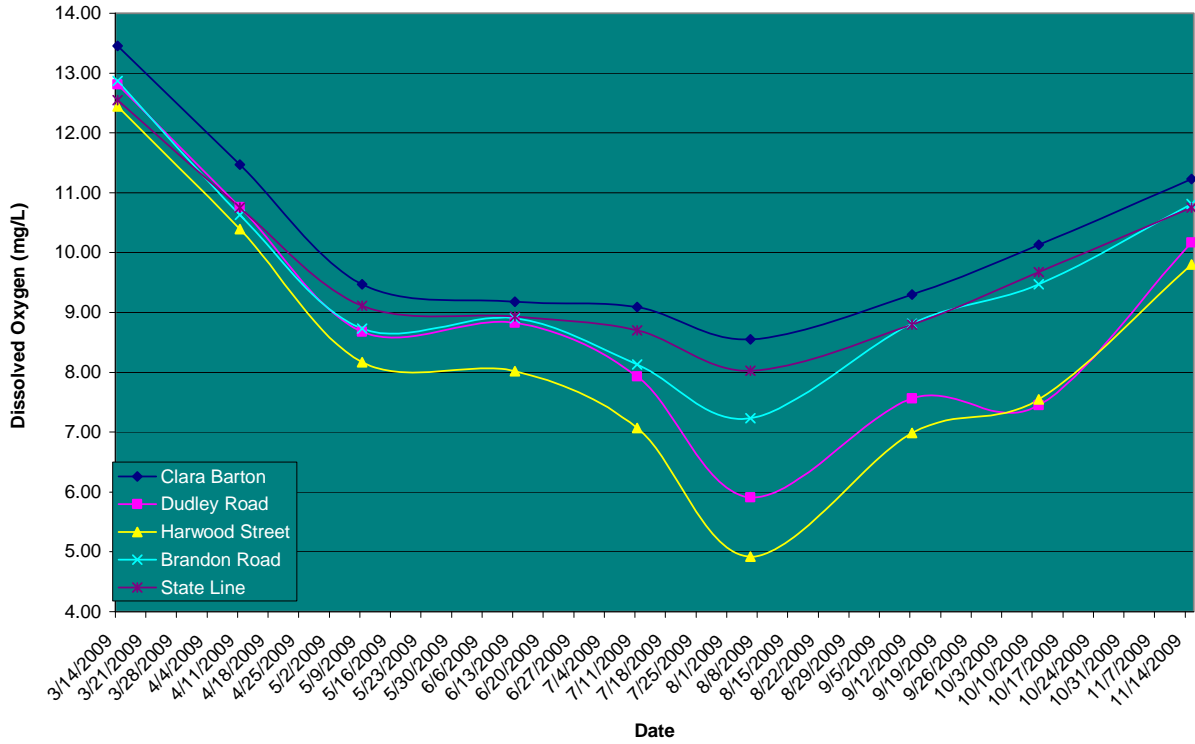
DO at French River Stations



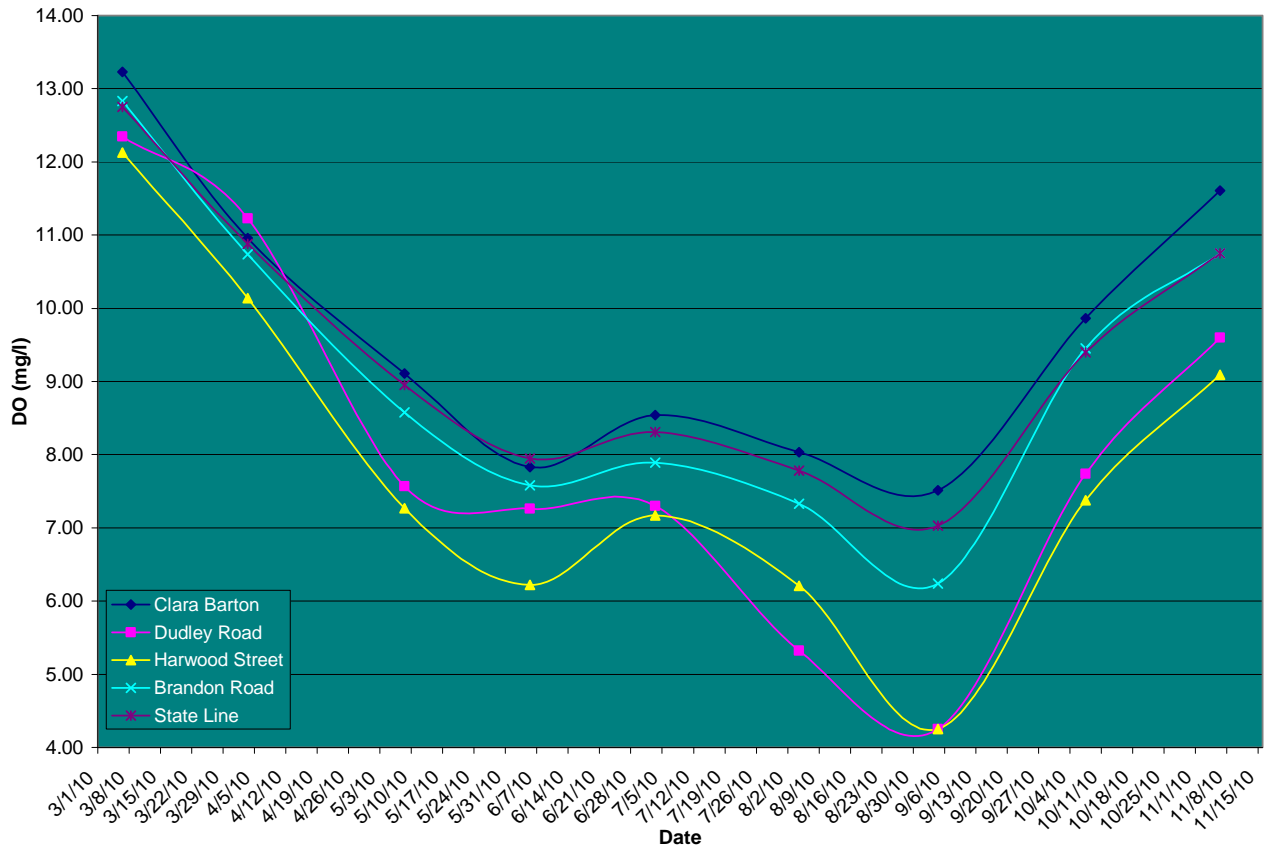
2007



2008

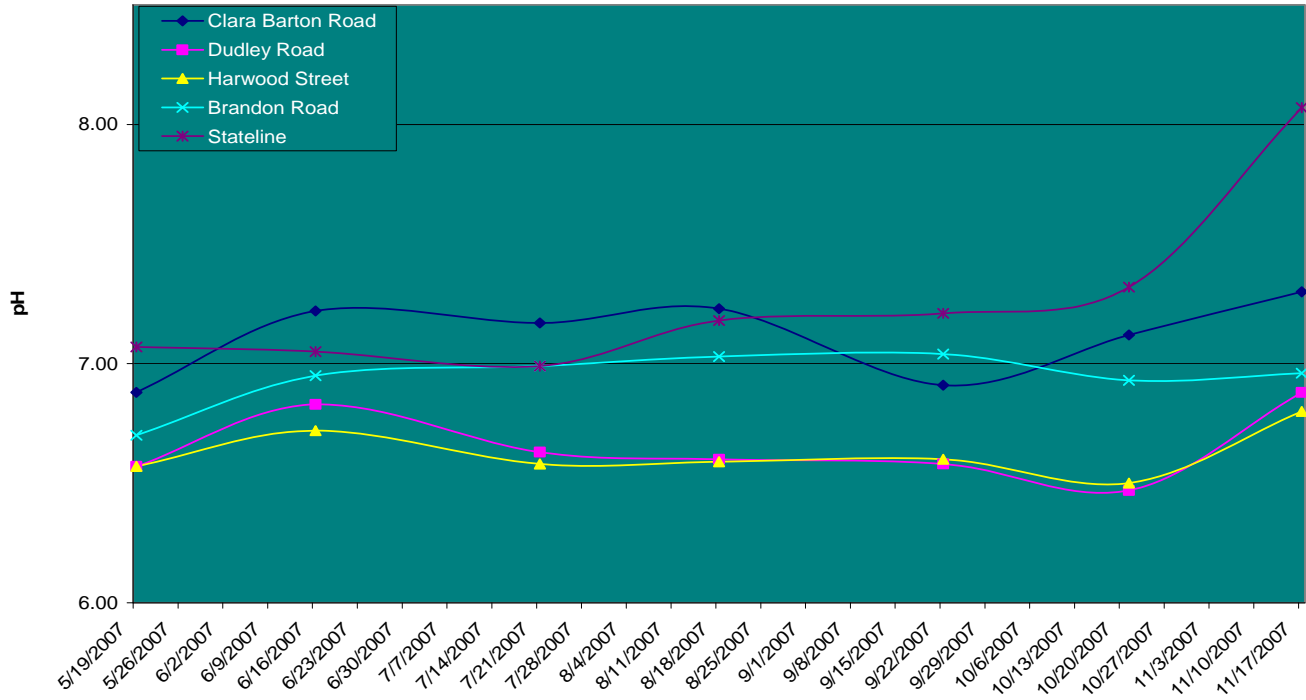


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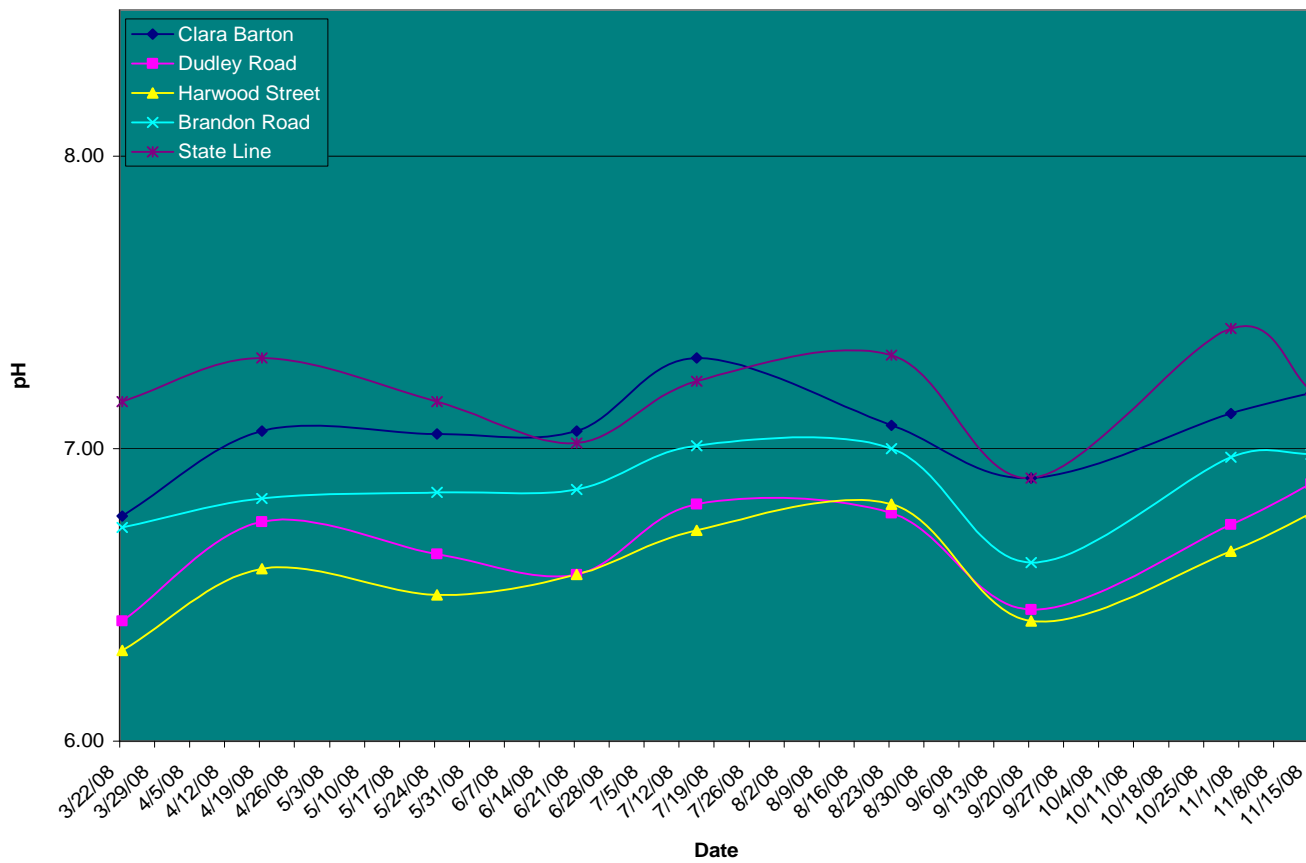


2010

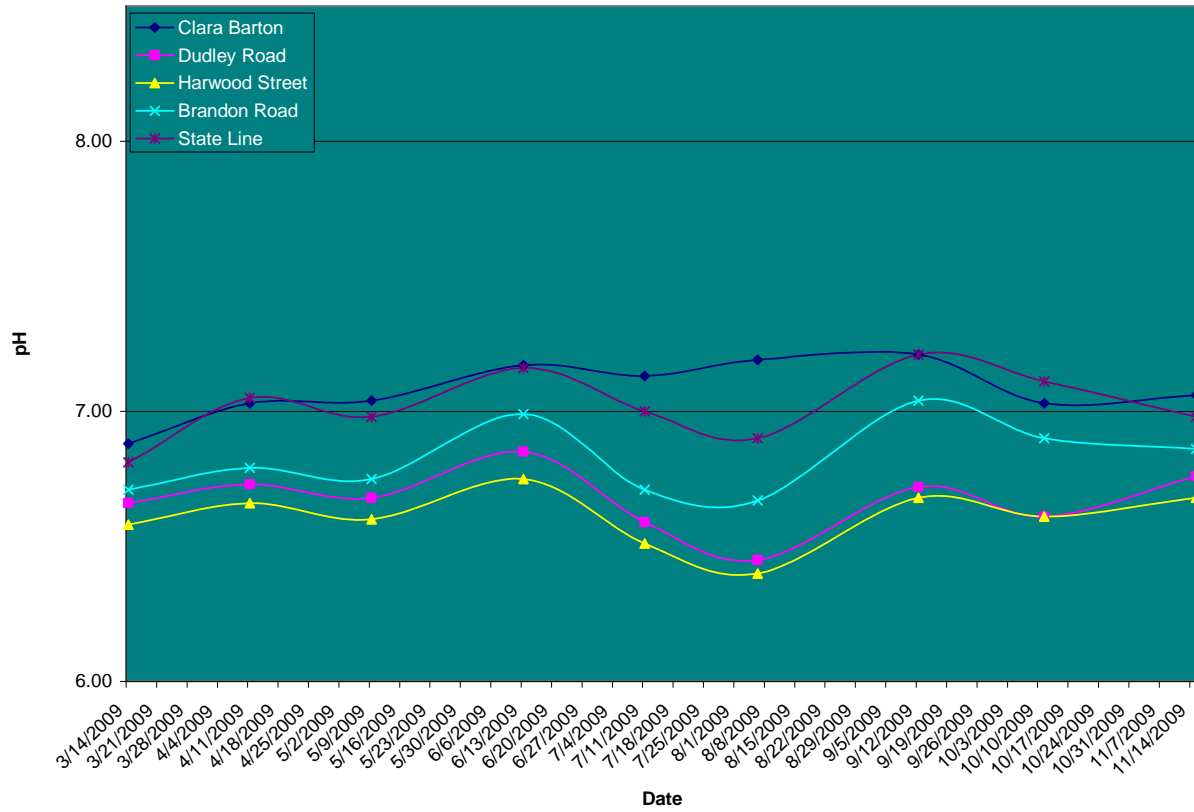
pH at French River Stations



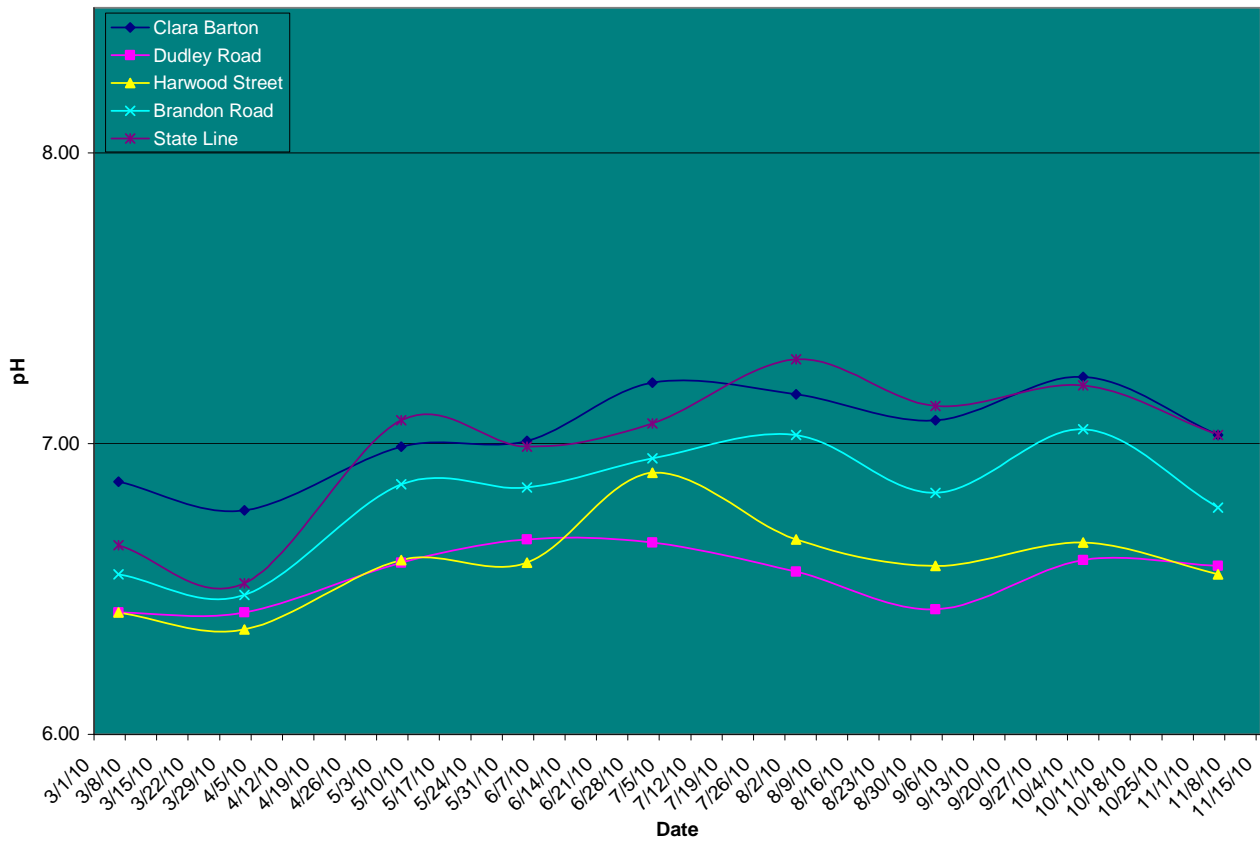
2007



2008

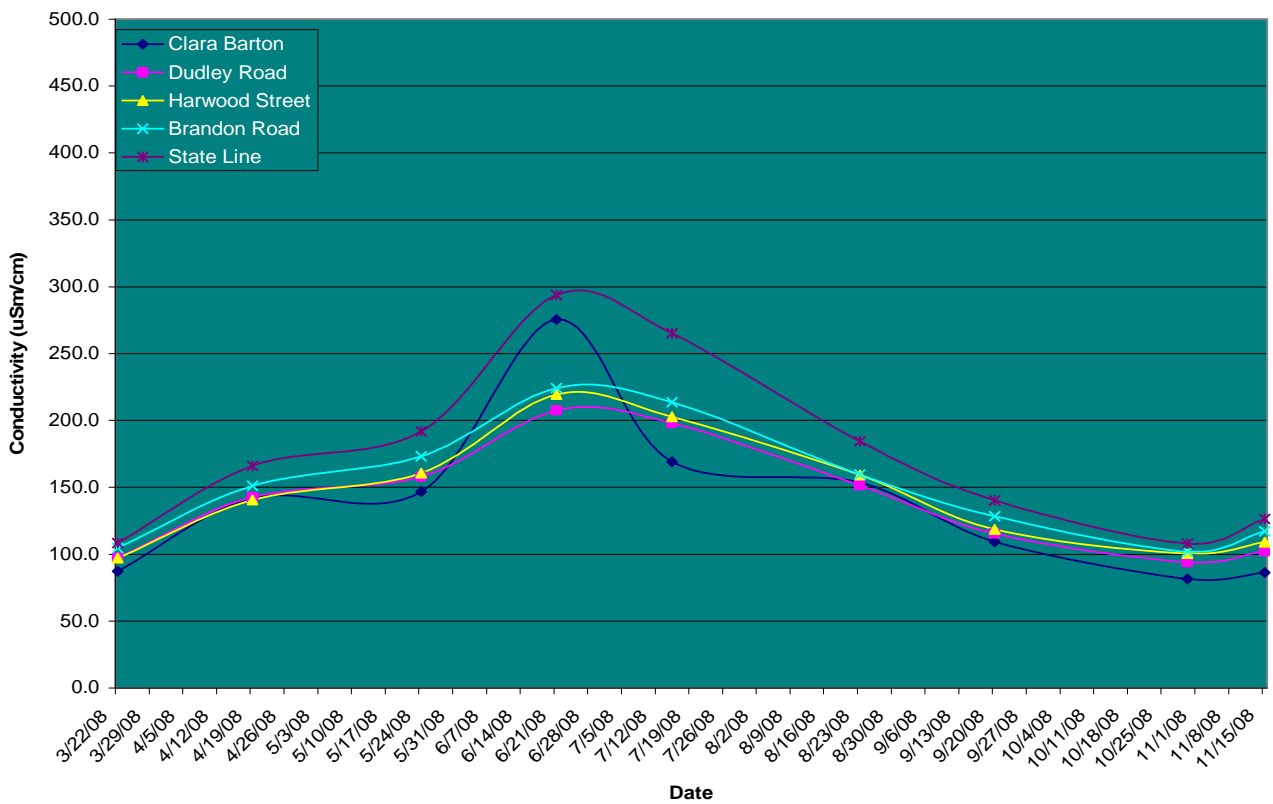
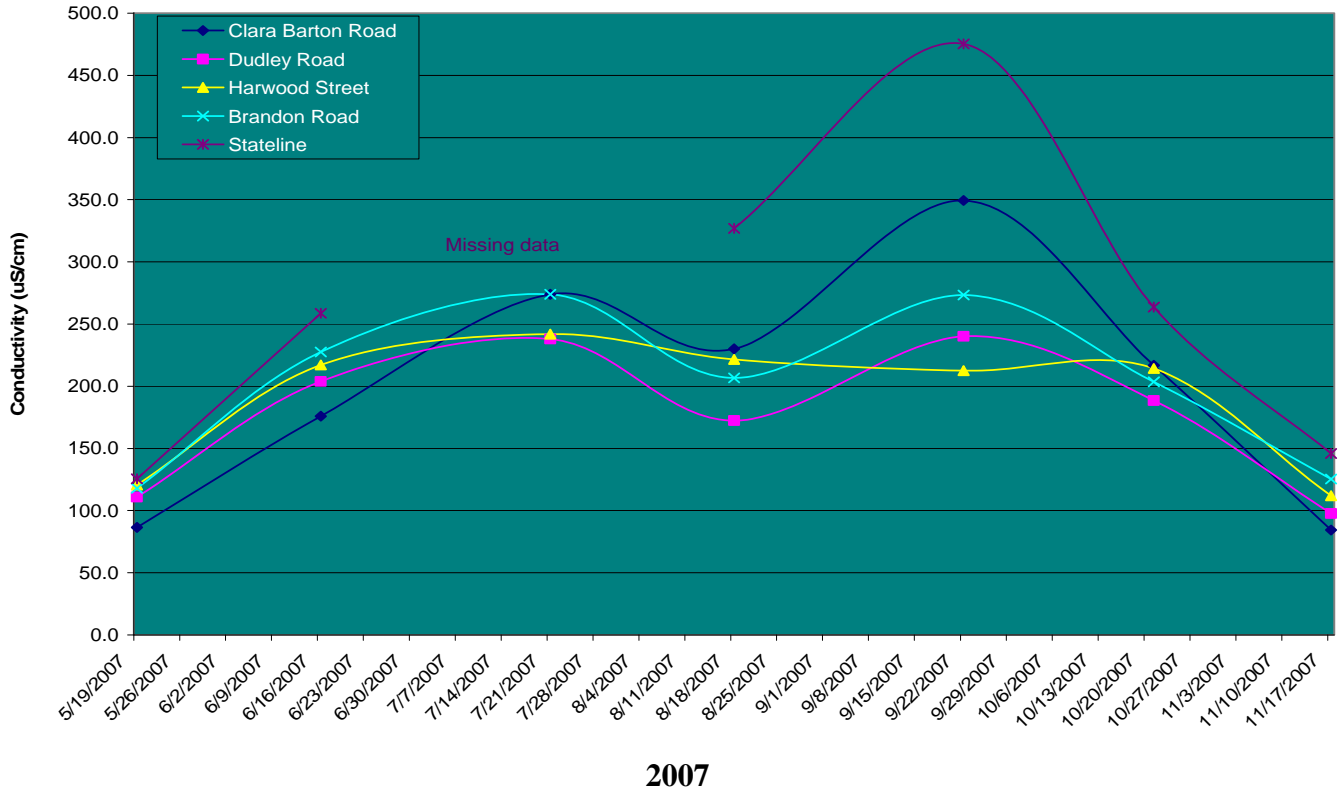


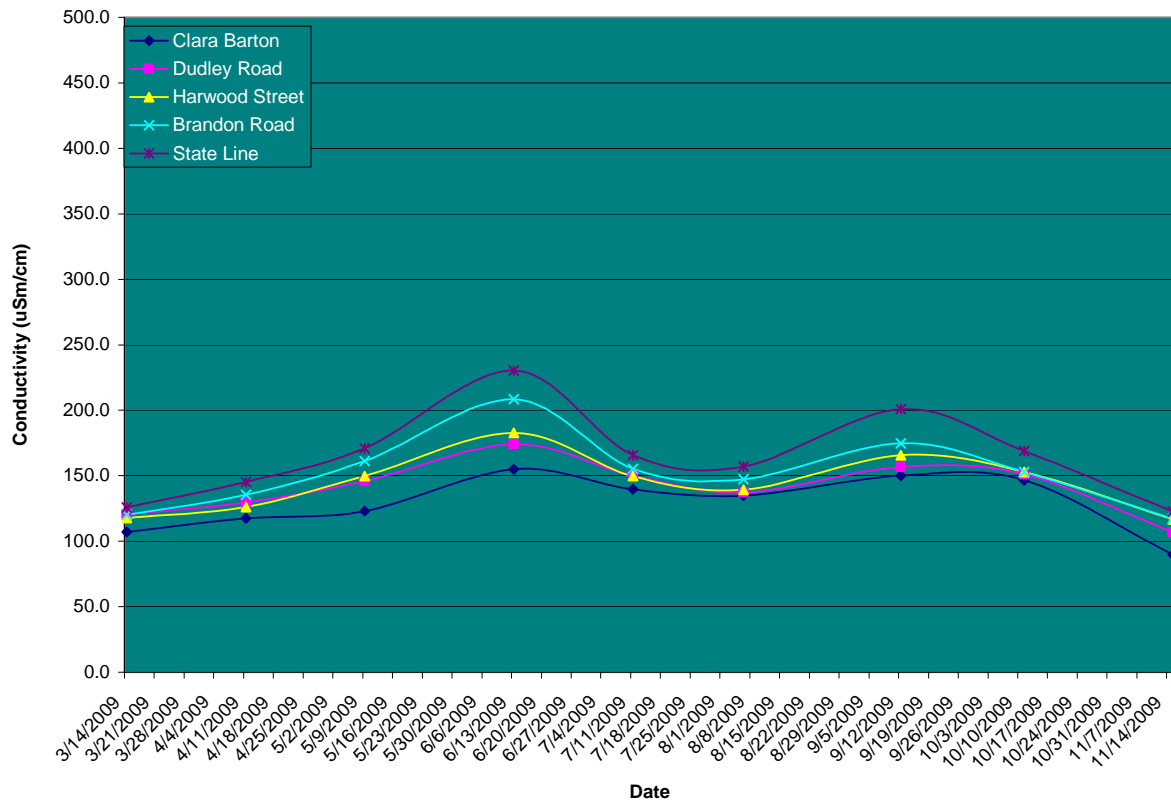
2009



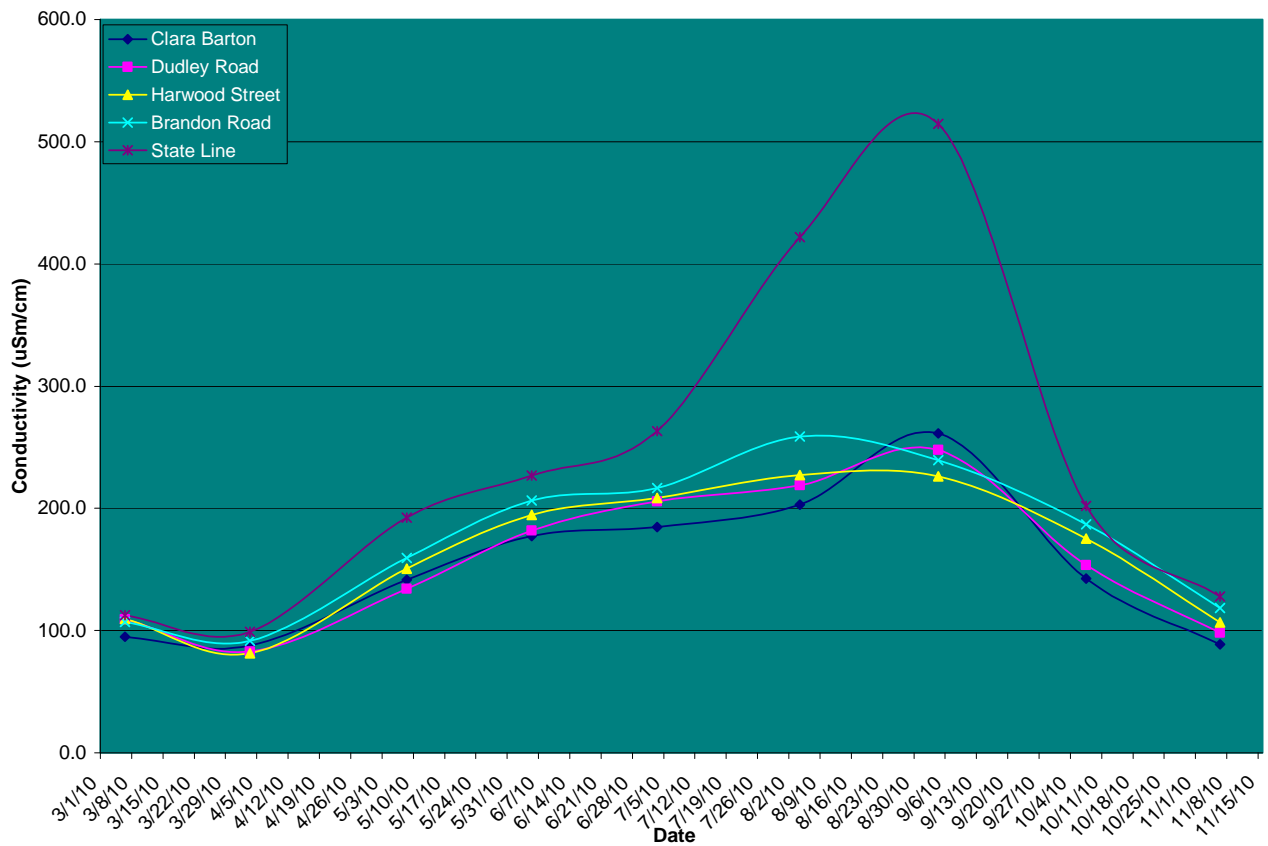
2010

Conductivity at French River Stations



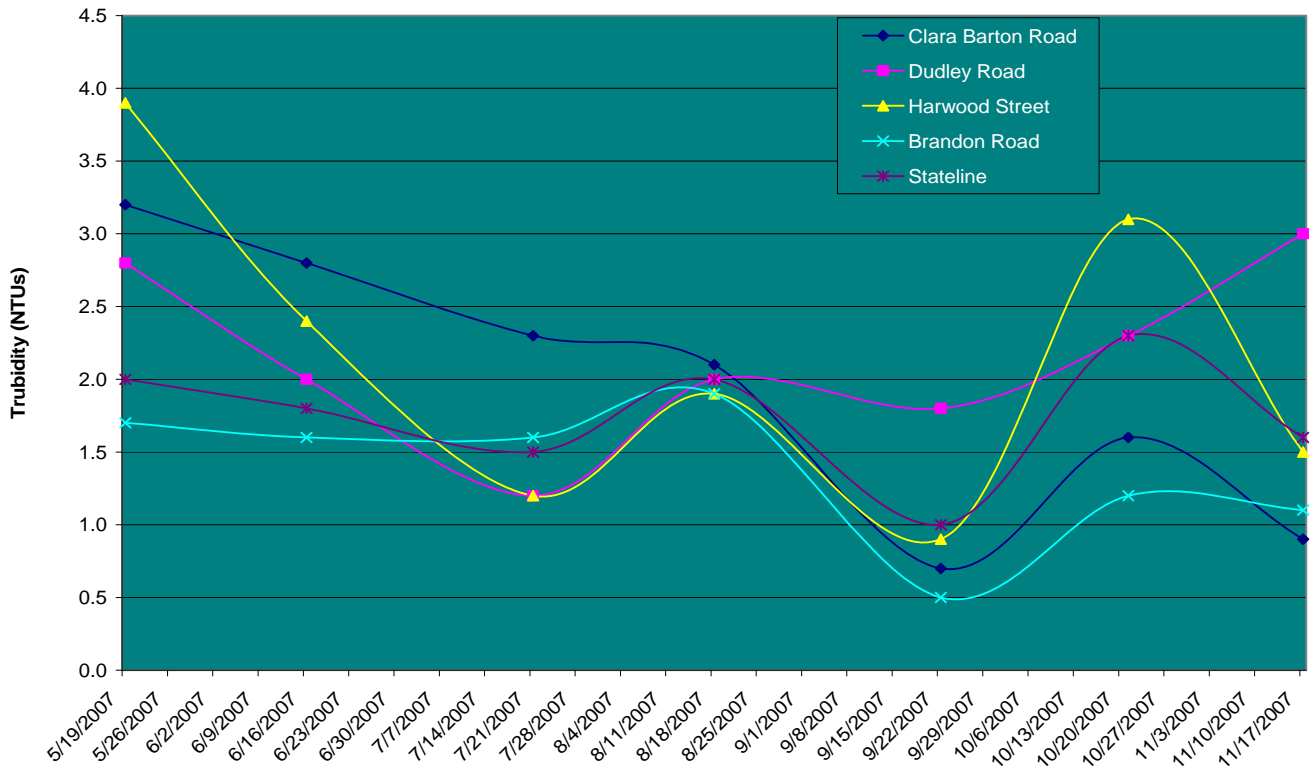


2009

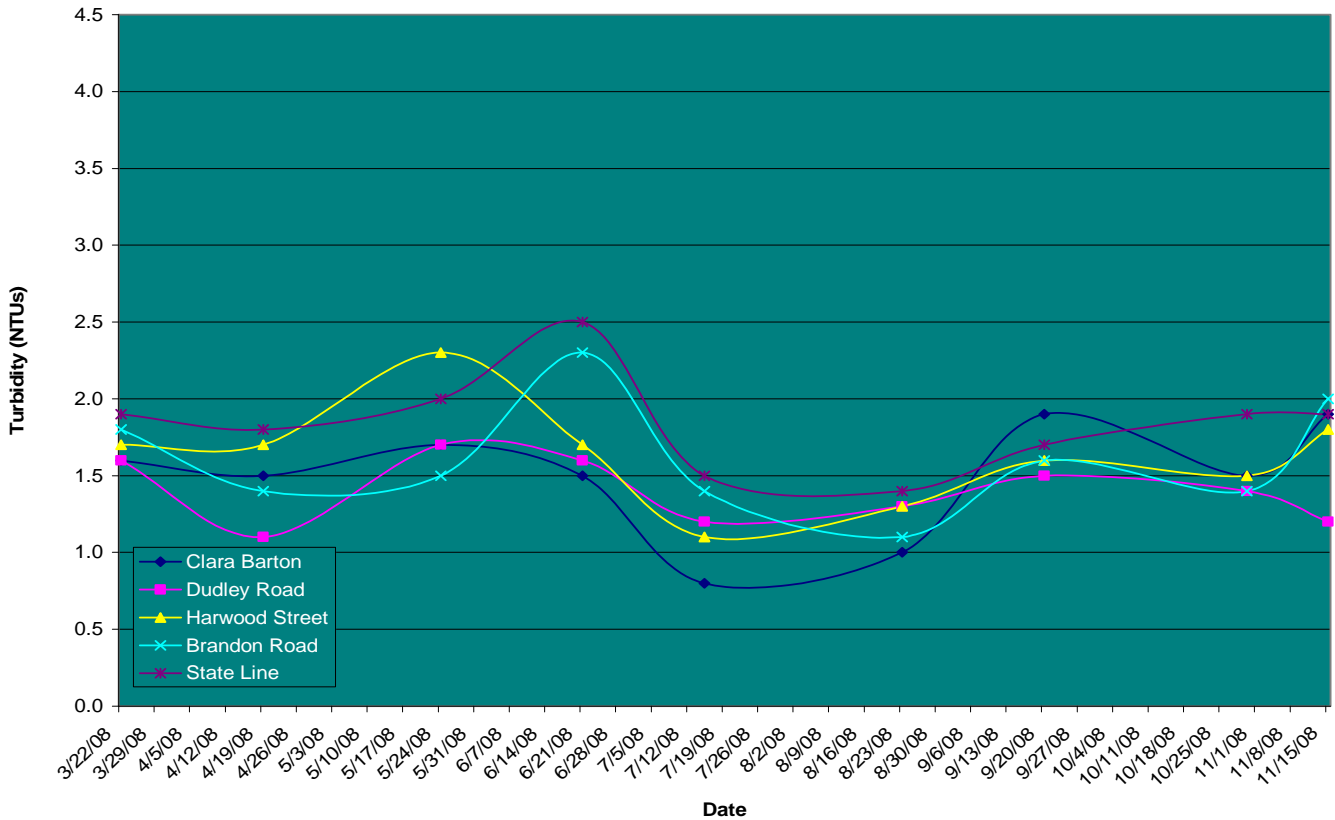


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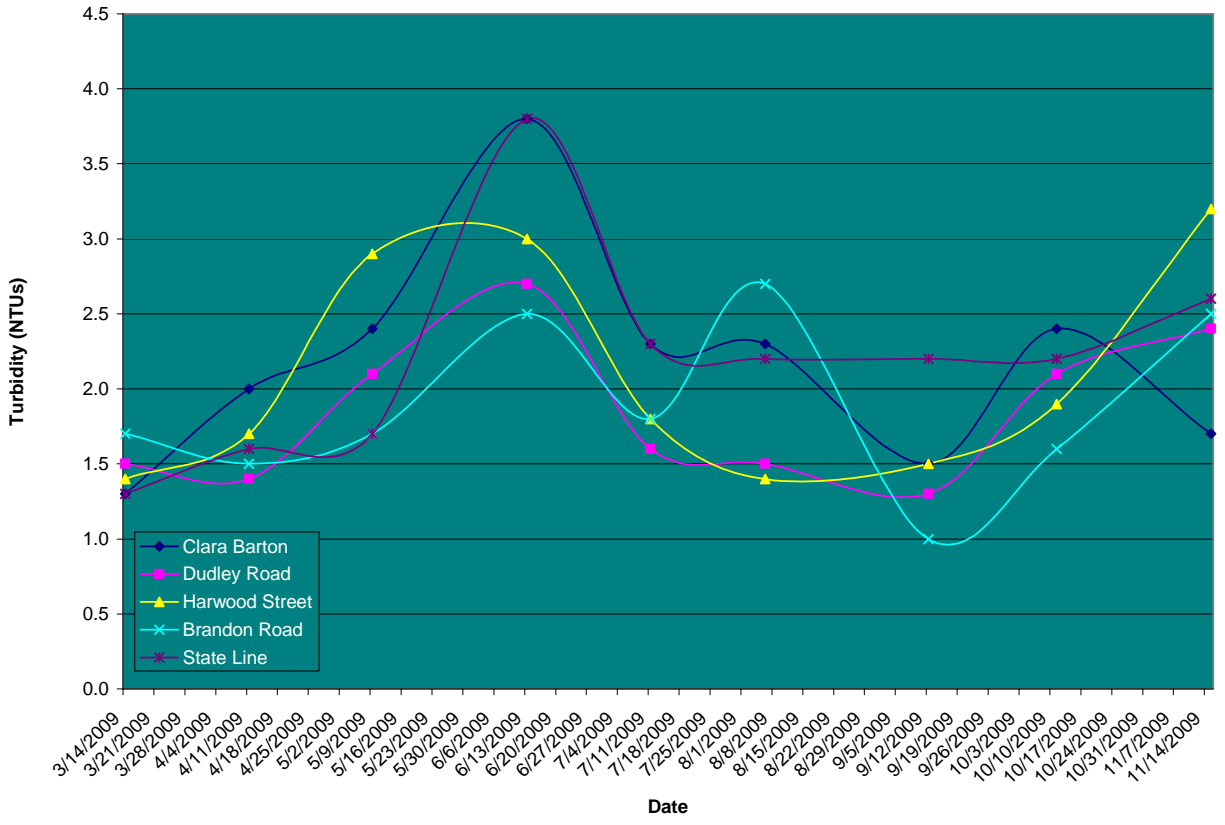
Turbidity at French River Stations



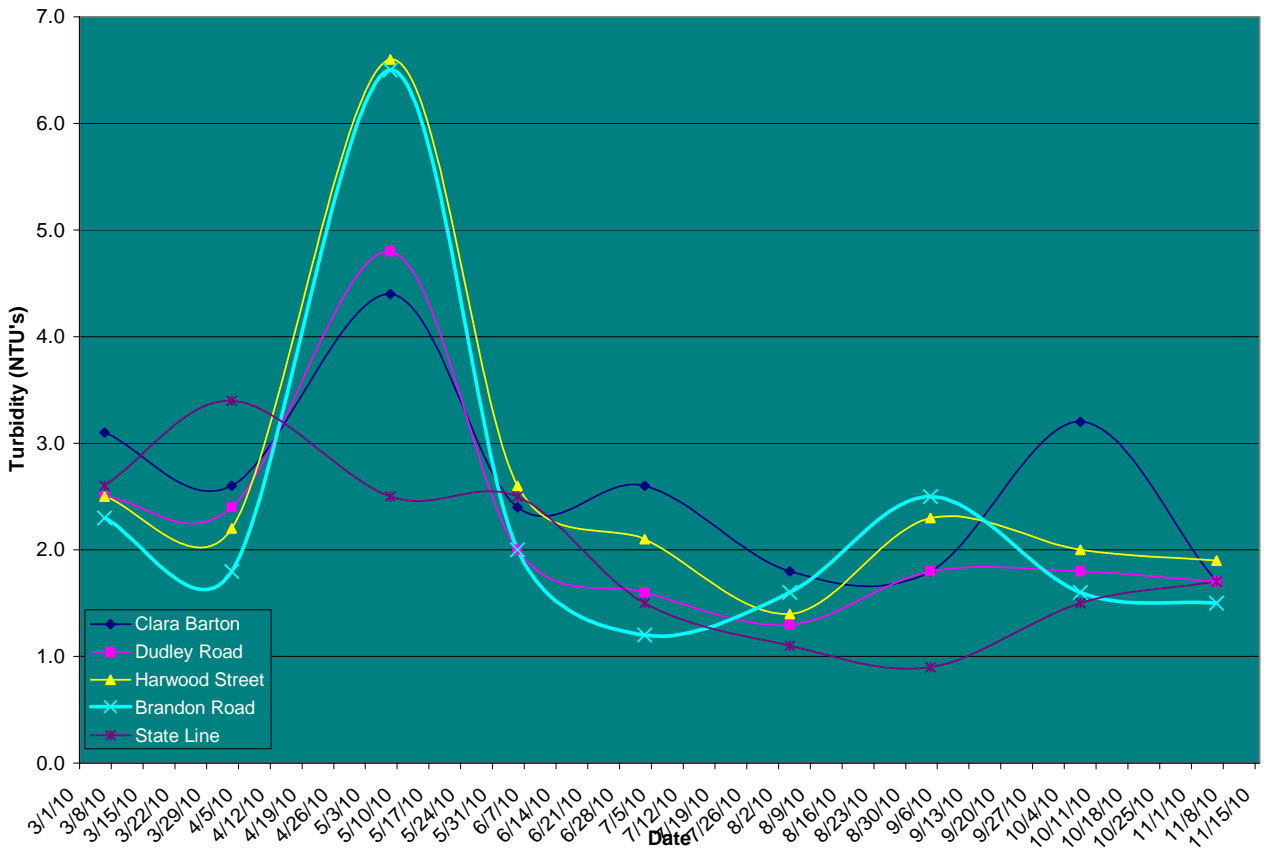
2007



2008



2009



2010

3.4.3 Mill Brook

In 2005 through 2009 pH was consistently lower at Mill Brook Bigelow Road than upstream at Mill Brook Webster Nursery; there is only one exception.

pH on Mill Brook

Date	Mill Brook at Webster Nursery	Mill Brook at Bigelow Road
3/6/2010	6.29	6.39
4/3/2010	6.49	6.39
5/8/2010	6.80	6.38
6/5/2010	6.97	6.42
7/3/2010	6.88	6.72
8/4/2010	6.81	6.42
9/4/2010	6.83	6.40
10/7/2010	7.09	6.38
11/6/2010	6.85	6.71

In 2010, this observation remains true, with the exception of March, which was the 2009 finding as well.

In the past, we have generally found more instances of high conductivity at Bigelow Road than at Webster Nursery. The elevated conductivity at Webster Nursery this year is striking, but referring to 2007, another year of low flow, we also find high conductivity.

3.5 Interpretation

In stark contrast to 2009, flows were very low this year; indeed for most days between mid July and late September, the USGS Webster gauge recorded record lows for the day. This followed some very high flows during the spring. We have to go back to 2007 to find another very low flow year.

High water temperatures are comparable to other years, but the period of highest temperatures is considerably longer, with September temperatures in the neighborhood of 10F above other years. Temperatures also reached 70F earlier than in previous years.

Patterns of decreased levels of dissolved oxygen are similar to other years, but with lower, and longer duration lows. This would be expected with extremely low flows and the extended period of high water temperatures. Lows noted this year are the lowest since are program began.

The pH graphs are similar to other years, but slightly lower overall, and especially low at the beginning of the season.

Unlike some of the tributary brooks, conductivity in the main stem is not remarkably high given the low flows, with the exception of the spike at the state line site, which also occurred in the low flow year of 2007.

Turbidity is generally so low that its difficult to characterize any differences year to year in the main stem, unlike some high turbidity found in some tributary brooks. Higher turbidity was evident in most main stem locations during a rainstorm in May, but still under 7 NTUs

The Commerce Parking Lot site, which in 2005 was characterized by extensive orange deposits, has exhibited less and less of this, and it was not noted at all in 2009 or 2010. However, snow and sand continue to be plowed into the culvert.

Nancy Drive continues to exhibit the lowest dissolved oxygen we monitor, and for the longest duration.

Mill Brook continues to exhibit consistent changes in pH between Webster Nursery and Bigelow Road, even with the stump grinding facility now closed for three years. Oil is noted at the Webster Nursery site in increasing amounts, and this site has displaced Nancy Drive as the site of highest conductivity.

4.0 NUTRIENT MONITORING

In 2006 we initiated a pilot nutrient monitoring at several locations using a Lamotte Smart 2 Colorimeter. In 2007, this was expanded to a full season of 12 sites, and conducted under an approved QAPP. In 2009 and 2010 we did not monitor in November.

4.1 Method

The French River Connection employed two colorimeters to measure levels of Nitrate-Nitrogen and Orthophosphate. Samples are collected at the sites indicated in Section 2 by a volunteer (not the same as the TROLL team) and brought back home for analysis by the same volunteer. In most cases, samples were gathered on different days than the TROLL data, which can result in a different determination with regard to whether the data is considered “wet” or “dry”, and makes the application of staff gauge data taken with the TROLL data unusable for determination of nutrient loads.

Times of gathering the samples are recorded on a data sheet which doubles as a chain of custody form. Orthophosphate and Nitrate-Nitrogen levels are recorded on the same form, along with the time. These data sheets are delivered to the Quality Manager for examination and entry into the Access database. His notes regarding the quality of the samples are entered as well. For reporting, data is extracted from the data base, and Orthophosphate converted to Phosphorus.



Lamotte Smart 2 Colorimeter

Light Source	LED/filter setup at 430nm, 520nm, 570nm, 630nm
Wavelength Accuracy	+/- 2nm
Method Range	0.00-3.00 ppm Nitrate nitrogen, Cadmium reduction method 0.00-3.00 ppm Orthophosphate, Ascorbic acid reduction method
Method Detection Limit	.1 Nitrate Nitrogen Low Range .05 Orthophosphate Low Range
Resolution	.01 ppm
Accuracy	2% full scale (+/- .06ppm)
Calibration	Factory set
Expected range of results based on 2006-2009 programs	Nitrate Nitrogen: 0-1.00 ppm* Orthophosphate: 0-.40 ppm

Colorimeter Specifications

*values up to 6ppm have been observed at the Stateline site under very low flow conditions.

4.2 Data Accuracy

Date	Nitrate (ppm)	Nitrate (ppm) QC	Phosphate (ppm)	Phosphate (ppm) QC
3/29/2010	0.40	0.42	0.05	0.03
4/27/2010	0.23	0.20	0.00	0.00
5/27/2010	0.29	0.29	0.02	0.04
6/29/2010	1.98	1.88	0.15	0.16
7/29/2010	0.43	0.41	0.08	0.07
8/31/2010	0.73	0.70	0.11	0.13
9/29/2010	0.00	0.01	0.00	0.00
10/28/2010	0.07	0.06	0.00	0.00

A duplicate QC sample is taken at one of the twelve locations. With a method accuracy of +/- .06ppm, we expect the values of the QC samples and their corresponding measurements to be within .12ppm of each other. A comparison is shown at left. This criterion is always met.

Although some of the samples and their QC measurements are at variance by a significant percentage, they are very near (or in some cases below) the method detection limit, and the values are of the same order of magnitude as the accuracy.

Colorimeter Sample Repeatability

4.3 Data and Observations

The Nutrient Data is shown in the table below. Orthophosphate values are converted to Phosphorus. Main stem stations are labeled in bright yellow, and French River tributaries in light yellow.

In August, data collection was stopped after Low Pond outflow due to vehicle trouble. There was no flow in July, August, or September at Potash Brook and none in September at the Packard Pond outflow.

Station	Date	Wet/Dry	NO3-N	PO4-P
Clara Barton Road	3/29/2010	Dry	0.27	0.00
	4/27/2010	Dry	0.28	0.00
	5/27/2010	Dry	0.32	0.05
	6/29/2010	Dry	0.25	0.04
	7/29/2010	Dry	0.18	0.03
	9/29/2010	Wet	0.25	0.02
	10/28/2010	Dry	0.16	0.01
Little River	3/29/2010	Dry	0.22	0.01
	4/27/2010	Dry	0.19	0.01
	5/27/2010	Dry	0.22	0.01
	6/29/2010	Dry	0.21	0.01
	7/29/2010	Dry	0.06	0.00
	9/29/2010	Wet	0.31	0.01
	10/28/2010	Dry	0.19	0.03
Dudley Road	3/29/2010	Dry	0.27	0.00
	4/27/2010	Dry	0.35	0.01
	5/27/2010	Dry	0.26	0.02
	6/29/2010	Dry	0.29	0.00
	7/29/2010	Dry	0.23	0.00
	9/29/2010	Wet	0.28	0.00
	10/28/2010	Dry	0.12	0.00
Lowe's Brook	3/29/2010	Dry	0.33	0.05
	4/27/2010	Dry	0.37	0.04
	5/27/2010	Dry	0.11	0.01
	6/29/2010	Dry	0.14	0.02
	7/29/2010	Dry	0.09	0.02
	9/29/2010	Wet	0.05	0.00
	10/28/2010	Dry	0.15	0.03
Harwood Street	3/29/2010	Dry	0.36	0.00
	4/27/2010	Dry	0.51	0.01
	5/27/2010	Dry	0.47	0.01
	6/29/2010	Dry	0.56	0.01
	7/29/2010	Dry	0.41	0.00
	9/29/2010	Wet	0.47	0.03
	10/28/2010	Dry	0.14	0.00
Old Mill Brook	3/29/2010	Dry	0.25	0.01
	4/27/2010	Dry	0.23	0.02
	5/27/2010	Dry	0.33	0.04
	6/29/2010	Dry	0.48	0.02
	7/29/2010	Dry	0.23	0.02
	9/29/2010	Wet	0.00	0.00
	10/28/2010	Dry	0.07	0.00
Mill Brook Bigelow Road	3/29/2010	Dry	0.25	0.03
	4/27/2010	Dry	0.15	0.02
	5/27/2010	Dry	0.83	0.02

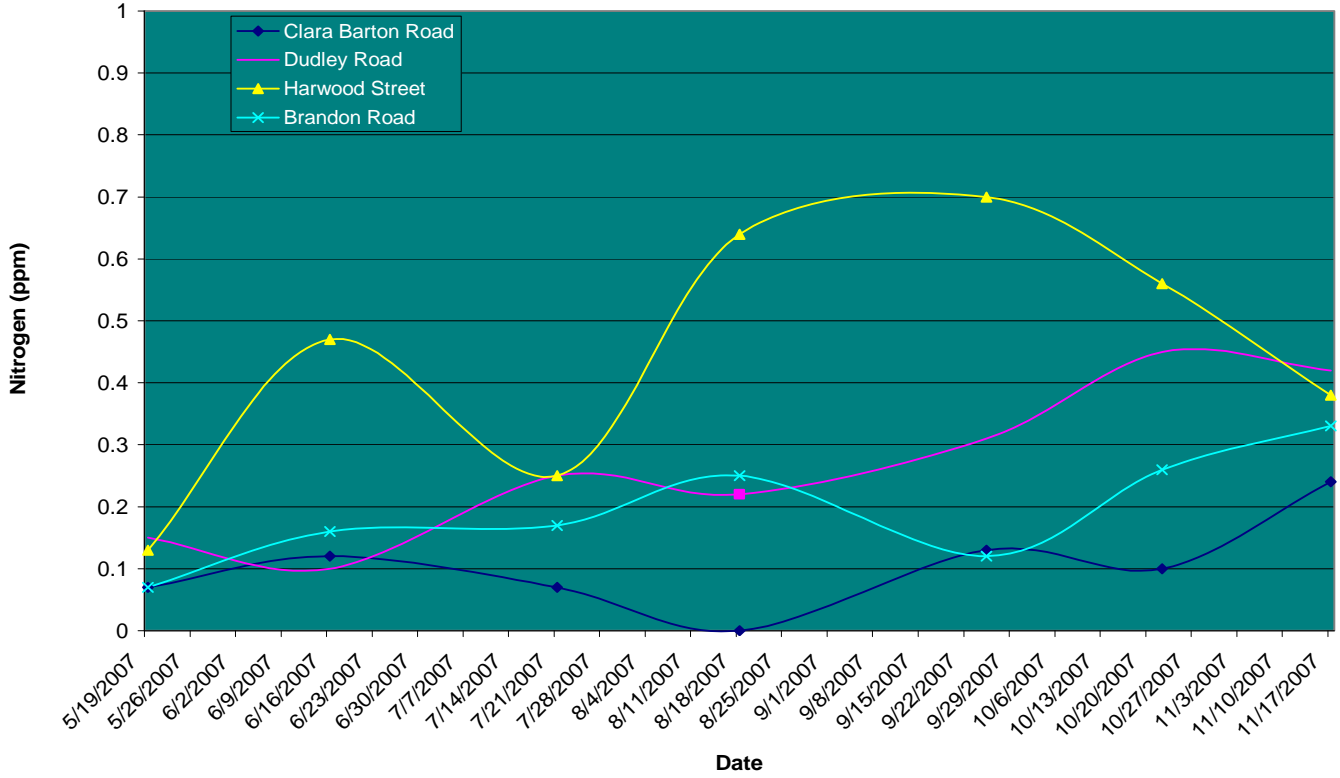
	6/29/2010	Dry	0.29	0.02
	7/29/2010	Dry	0.43	0.03
	9/29/2010	Wet	0.28	0.00
	10/28/2010	Dry	0.18	0.00
Low Pond Outflow	3/29/2010	Dry	0.44	0.01
	4/27/2010	Dry	0.23	0.00
	5/27/2010	Dry	0.29	0.01
	6/29/2010	Dry	0.51	0.01
	7/29/2010	Dry	0.66	0.03
	8/31/2010	Dry	0.73	0.04
	9/29/2010	Wet	0.26	0.02
	10/28/2010	Dry	0.40	0.02
Brandon Road	3/29/2010	Dry	0.37	0.01
	4/27/2010	Dry	0.37	0.02
	5/27/2010	Dry	0.35	0.00
	6/29/2010	Dry	0.38	0.02
	7/29/2010	Dry	0.63	0.17
	8/31/2010	Dry	0.36	0.00
	9/29/2010	Wet	0.22	0.00
	10/28/2010	Dry	0.16	0.01
Potash Brook	3/29/2010	Dry	0.40	0.02
	4/27/2010	Dry	0.45	0.04
	5/27/2010	Dry	0.85	0.02
	6/29/2010	Dry	0.75	0.02
	10/28/2010	Dry	0.06	0.00
Packard Pond	3/29/2010	Dry	0.40	0.00
	4/27/2010	Dry	0.33	0.06
	5/27/2010	Dry	0.14	0.00
	6/29/2010	Dry	0.12	0.02
	7/29/2010	Dry	0.08	0.03
	8/31/2010	Dry	0.14	0.03
	10/28/2010	Dry	0.05	0.01
Stateline	3/29/2010	Dry	0.36	0.01
	4/27/2010	Dry	0.58	0.02
	5/27/2010	Dry	1.00	0.01
	6/29/2010	Dry	1.98	0.05
	7/29/2010	Dry	3.00	0.20
	8/31/2010	Dry	2.91	0.10
	9/29/2010	Wet	3.00	0.13
	10/28/2010	Dry	0.16	0.01

4.4 Analysis and Interpretation

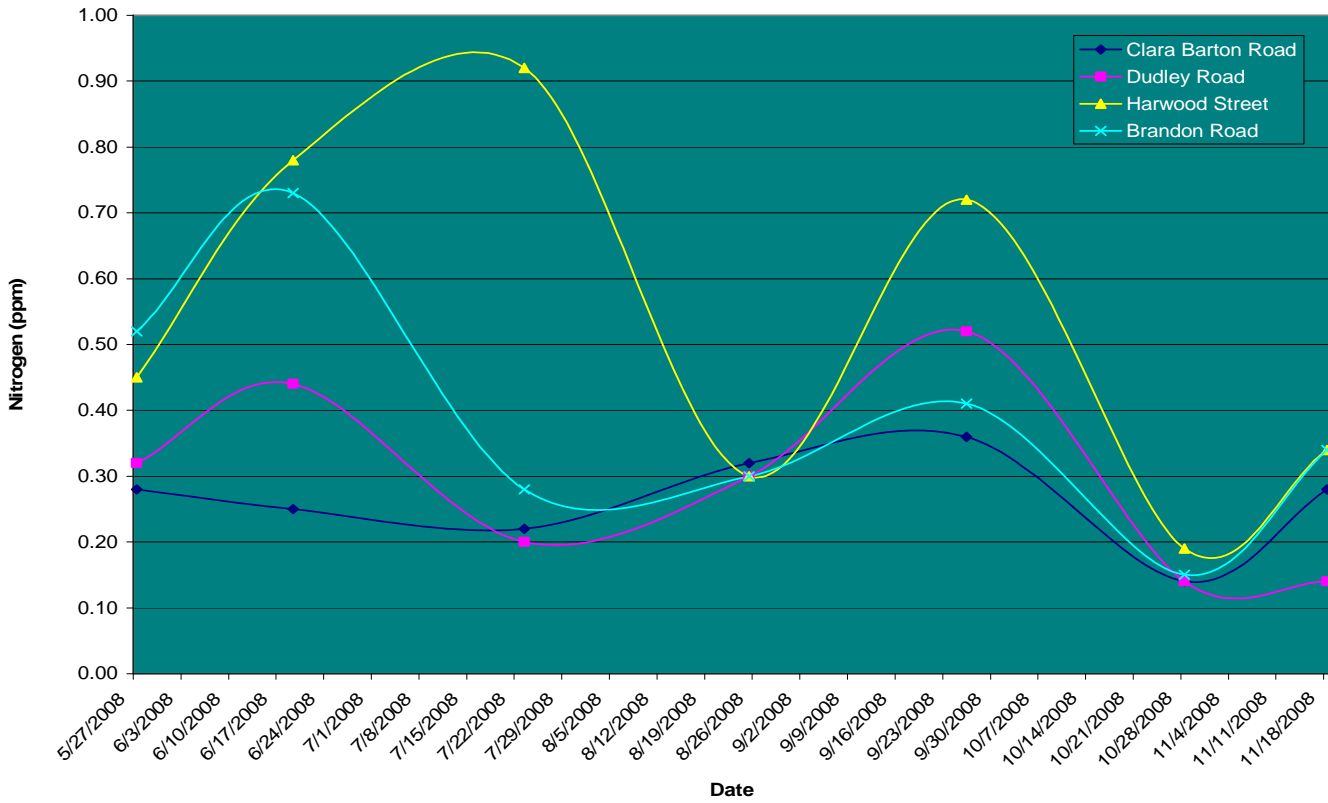
Mass DEP has no quantitative standards for nutrients, stating only that levels “Shall not exceed the site-specific limits necessary to control accelerated or cultural eutrophication.” There are four instances this year of phosphate at or above .10ppm; three at the Stateline site and one at Brandon Road. There were four at the Stateline site in the low flow year of 2007 but none in 2008 or 2009. Values of Nitrate-Nitrogen above 1 ppm occurred five times at the Stateline; this has occurred in other years as well. The values above 3.00 exceed the limit of our method, so July and September were higher than that. In 2009, there was also one instance of Nitrate-Nitrogen above 1ppm at Potash Brook and one at Harwood Street, the only times that has been seen other than at the Stateline, and not repeated this year.

The graphs below shows the concentrations at the river stations (except for the Stateline site which will be discussed separately) for nitrogen and phosphorus for 2007-2010.

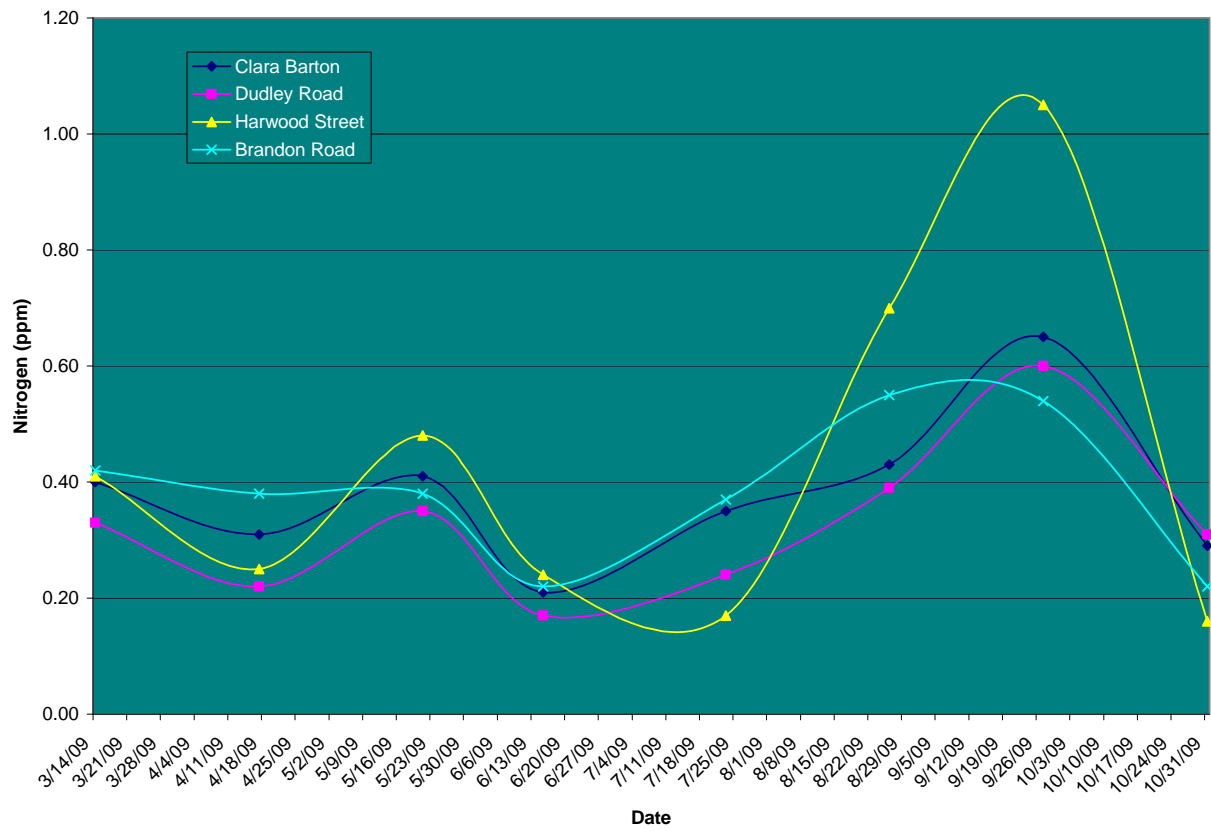
Nitrogen at French River Stations



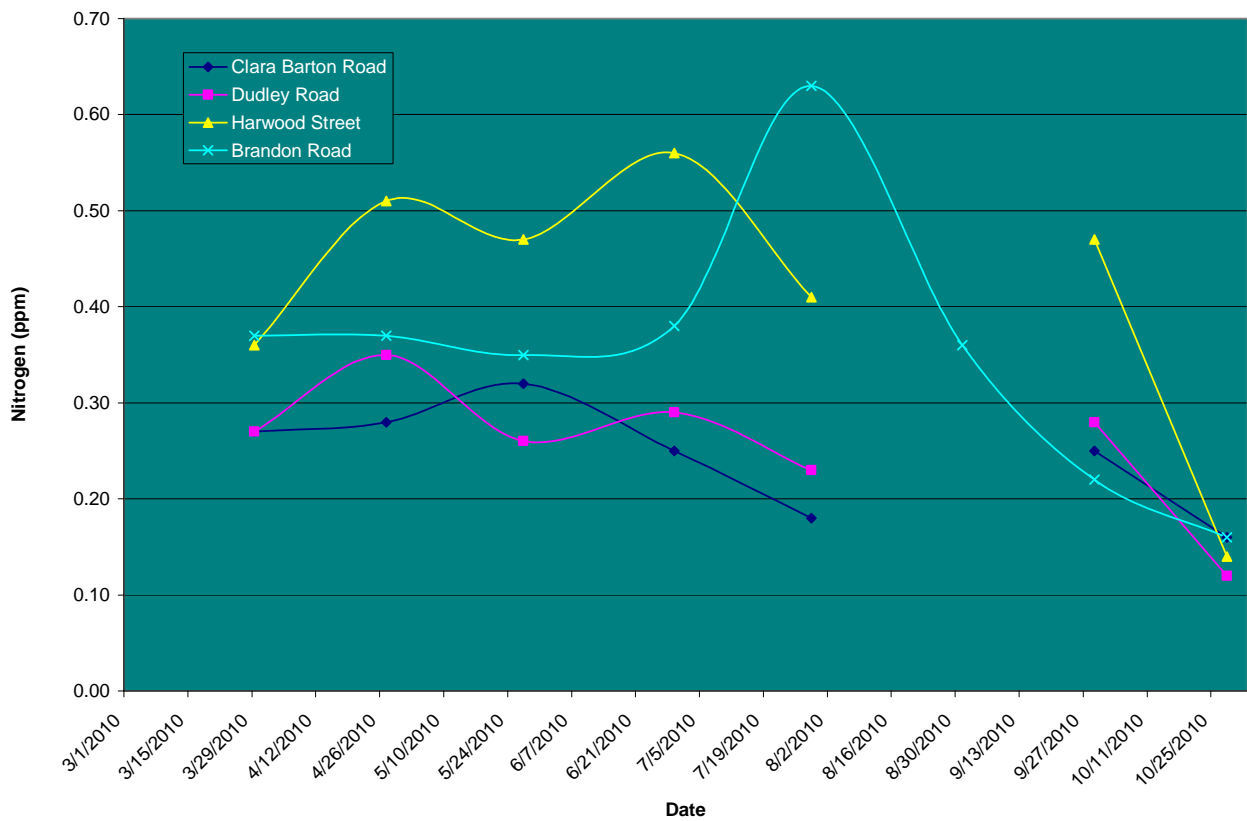
2007



2008

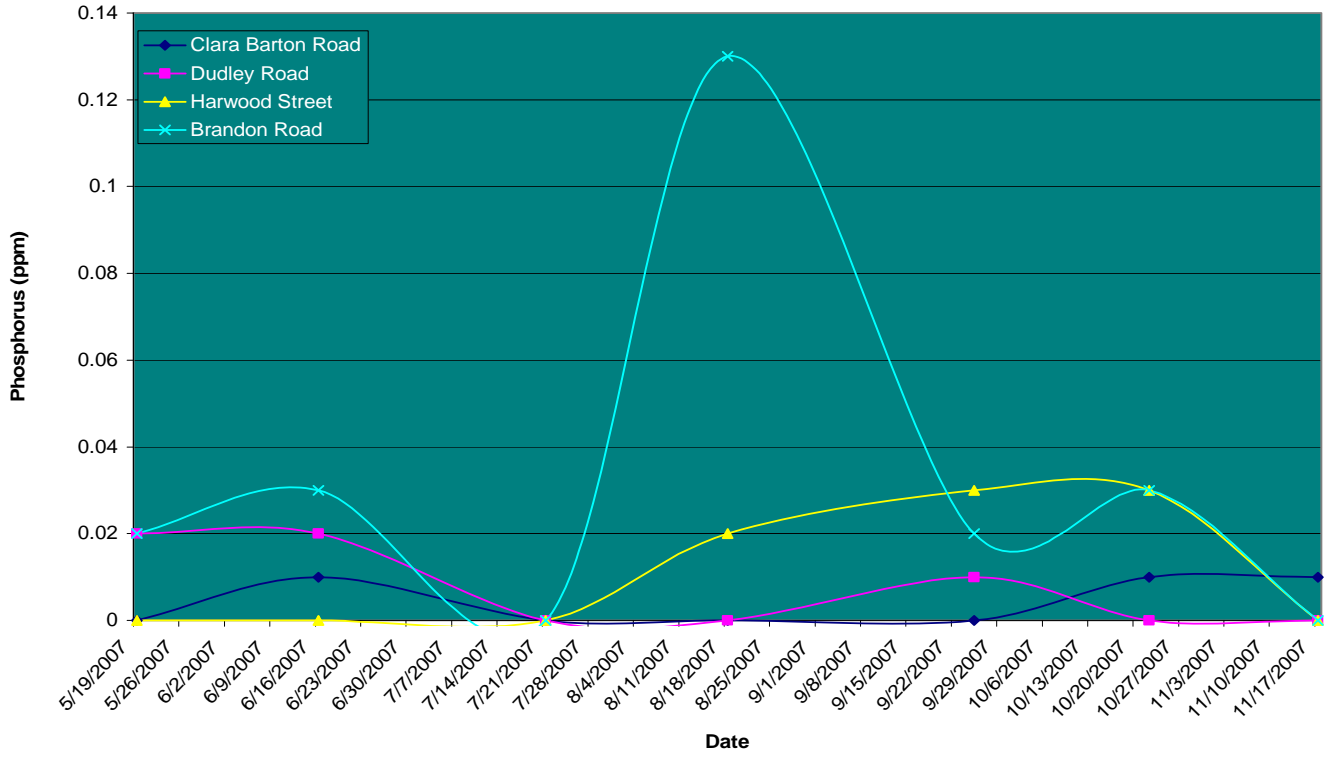


2009

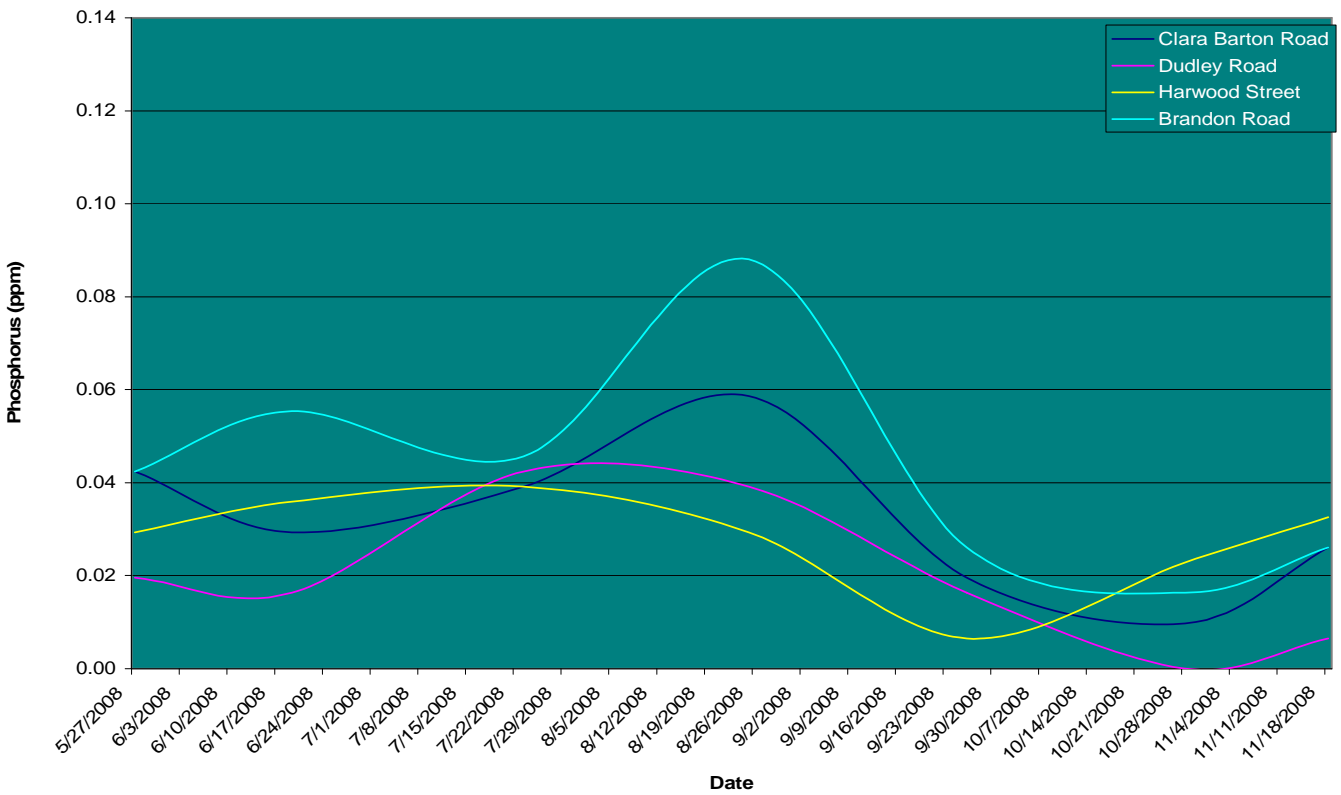


2010

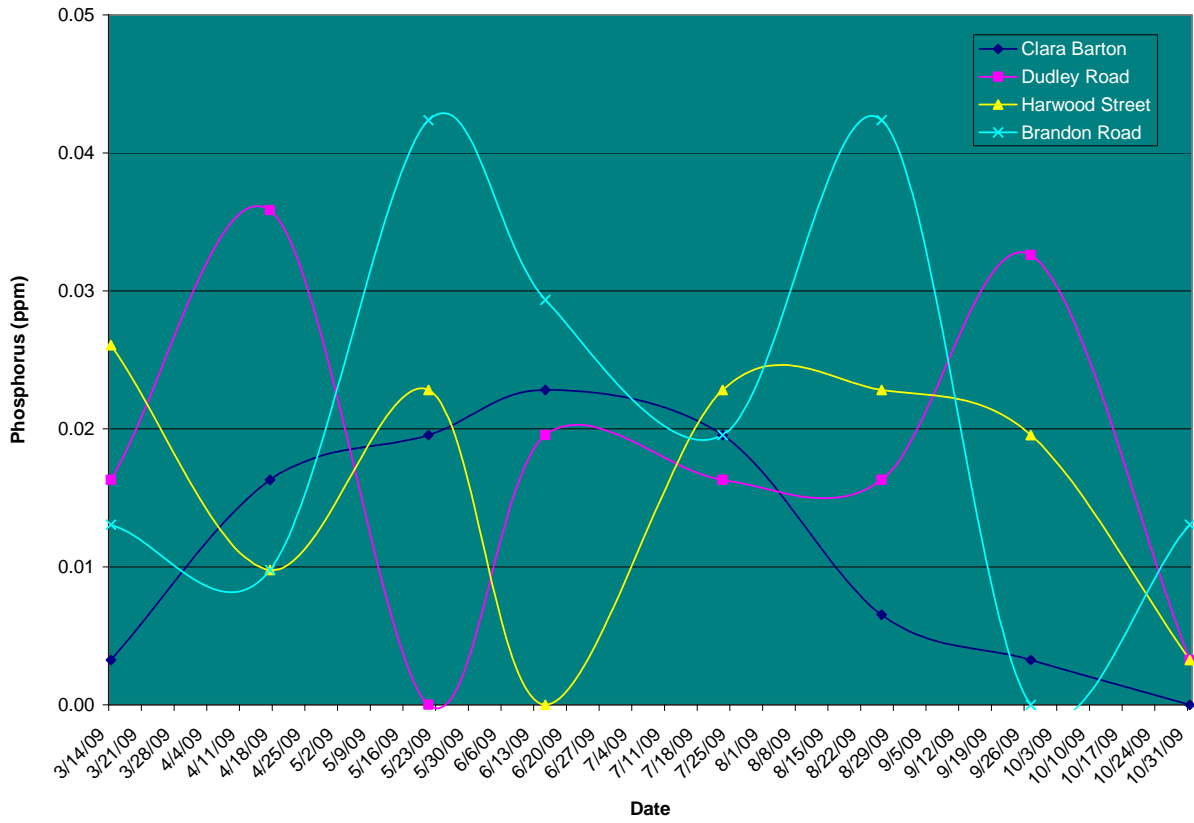
Phosphorus at French River Stations



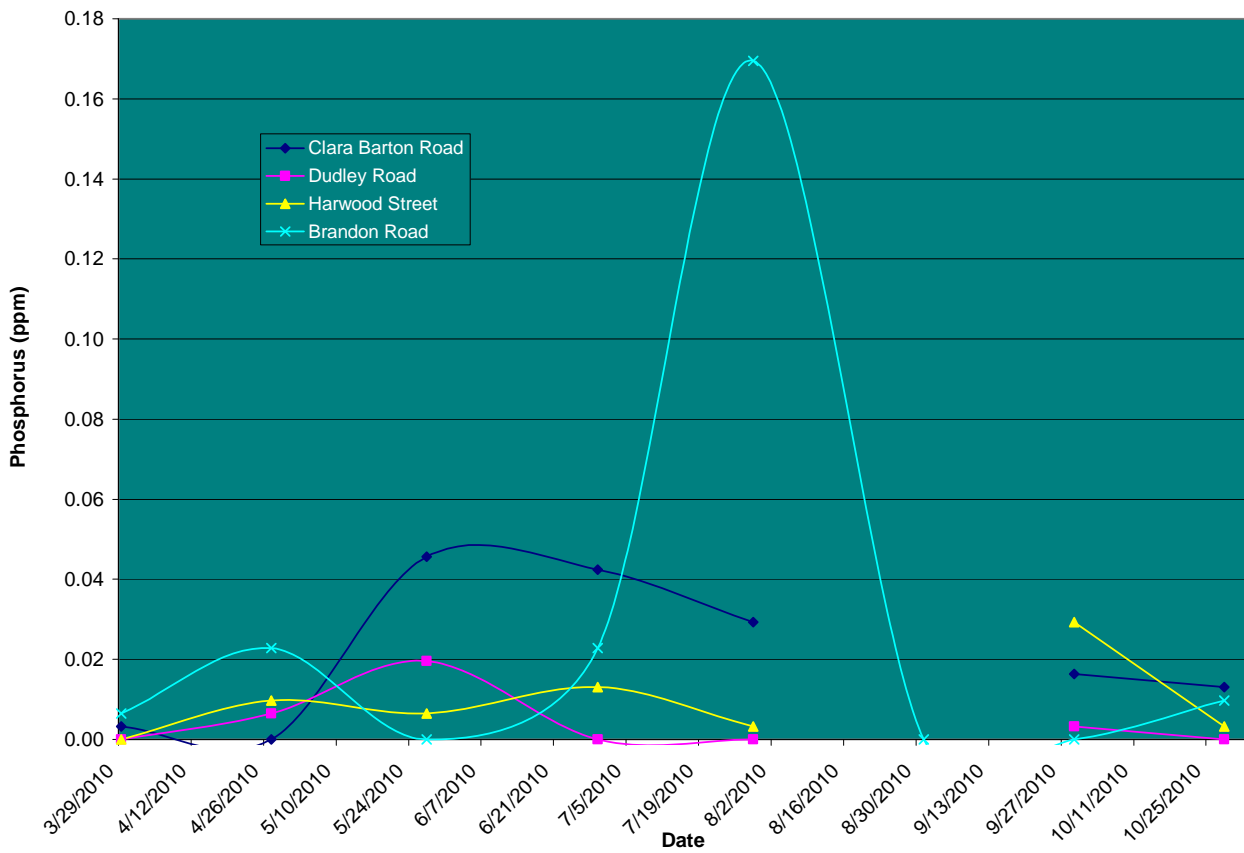
2007



2008



2009

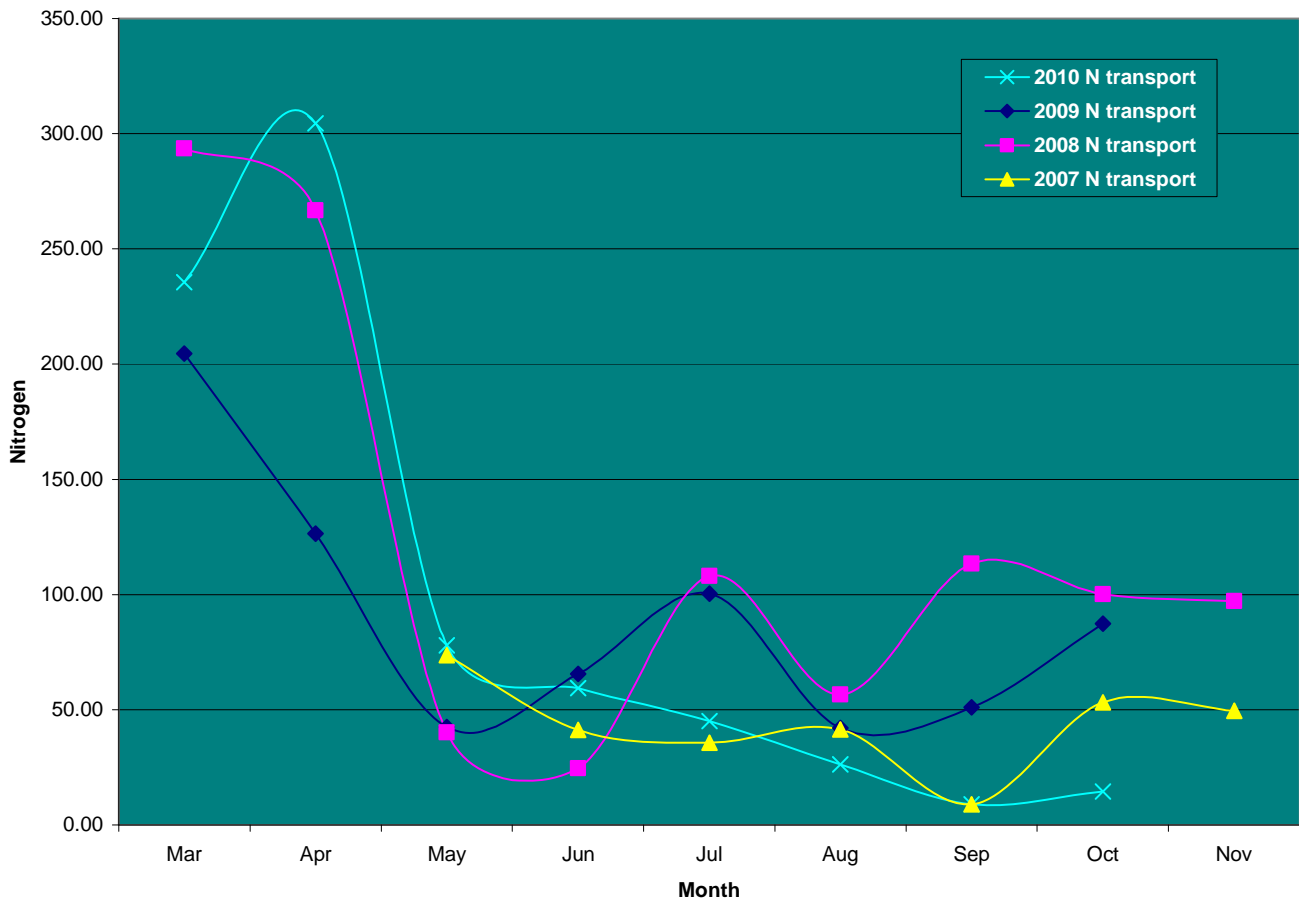


2010

Until this year, the highest values of Nitrogen among these four sites were found at Harwood Street. With August data not obtained, we'll never know if that might have happened again in 2010. Although there is an apparent spike at Brandon Road, the value is similar to other years.

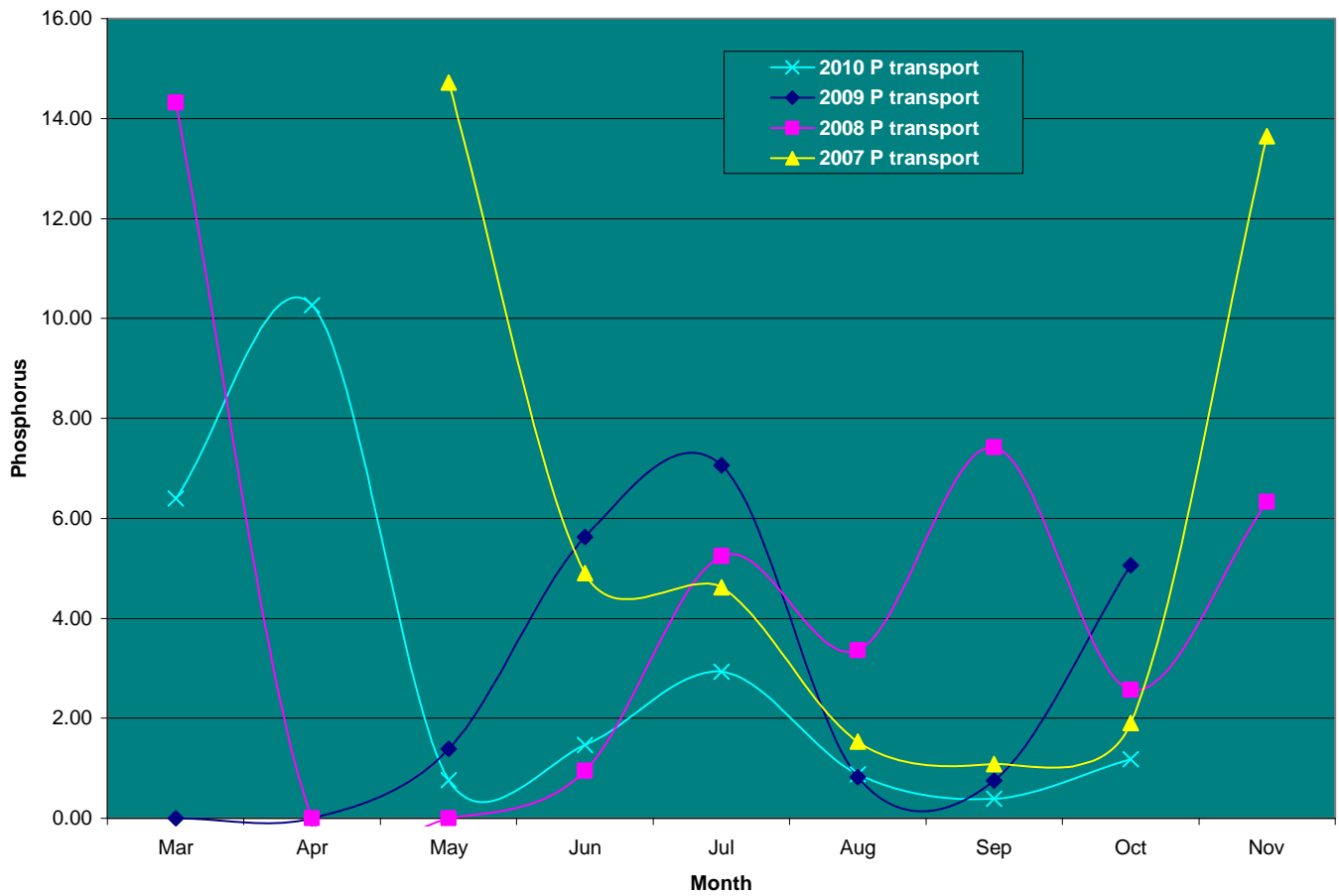
As in previous years, the highest Phosphorus concentration among these four sites was recorded at Brandon Road, a one-time event. This year is the highest recorded. This is similar to the previous low-flow year of 2007.

Of course, concentrations of nutrients do not tell the whole story; the amount of water being discharged carrying those concentrations is needed to show the quantity of nutrients transported downriver. At the Stateline site we can get an idea of the quantity of nutrients leaving the state. There is no gauge at that site, but we can use the gauge upriver at Pleasant Street as an indicator, remembering however that there are several inputs into the river between the gauge and the site, most notably the Webster Wastewater Treatment Plant. If we multiply the concentration by the discharge we can an indication of the relative amounts of nutrients being transported each month, measured in arbitrary units of ppm x cubic feet/second.



Relative nitrogen transport down the French River

Since our nitrogen measurements are off the scale in July and September, transport was more than shown. We should anticipate this and run our colorimeter tests on properly diluted samples.



Relative phosphorous transport down the French River

One can see from these graphs that high concentrations don't necessarily mean large quantities of nutrients are going downriver. Flow, which can vary by a factor of 100 or more over the season, is much more important

:

5.0 TEMPERATURE DATA LOGGING

In 2007, we initiated a program of temperature data logging in five streams. Mass DEP defines a Class B Cold water Fishery : Shall not exceed 68°F (20°C) based on the mean of the daily maximum temperature over a seven day period unless naturally occurring. Our objective was to identify streams that may be candidates for cold water fisheries designations or cold water fishery resource listings, as indicated by the Massachusetts Department of Fish and Game. Unfortunately, due to extremely low water levels in 2007, all but one of our stream locations went dry, so we repeated the program in 2008. Brown’s Brook and Mine Brook were found to be promising coldwater candidates. However, according to CN 178.4, 2004 French and Quinebaug River Watersheds Fish Population Assessment published in September 2007, fish are not found in either location. In 2009, we deployed loggers at the Clara Barton and Stateline sites, the ends of our monitoring area, and discovered that there are periods of considerably higher temperatures than are identified by monthly TROLL monitoring. To further explore this in 2010, we deployed loggers at Clara Barton, Dudley Road, Harwood Street, and Brandon Road. We have only four, so we did not deploy at the Stateline.

5.1 Method

We selected candidates for monitoring to see if French River temperatures vary consistently over the whole length of our area. We chose sites where TROLL measurements are taken. Now that the TROLL is used by five organizations, it is difficult to take separate reference measurements at locations not visited by TROLL teams.

To conduct the temperature data logging, we deployed HOBO Pro v2 loggers manufactured by Onset Corporation.



Range:	-20 to 70 °C in air -20 to 50°C in water
Accuracy:	±0.2 °C at 25°C
Resolution:	0.02 °C at 25°C

HOBO and Specifications

The HOBOs were launched using the HOBOLite software, which set them to record a temperature every 15 minutes. They were then wired into the holes in cinder blocks and placed into the streams. This is a “hide in plain sight” strategy employed after a HOBO was lost in 2008. The HOBOs were placed in deep spots in the stream, where the water was mixing well, and in locations shaded most of the day.

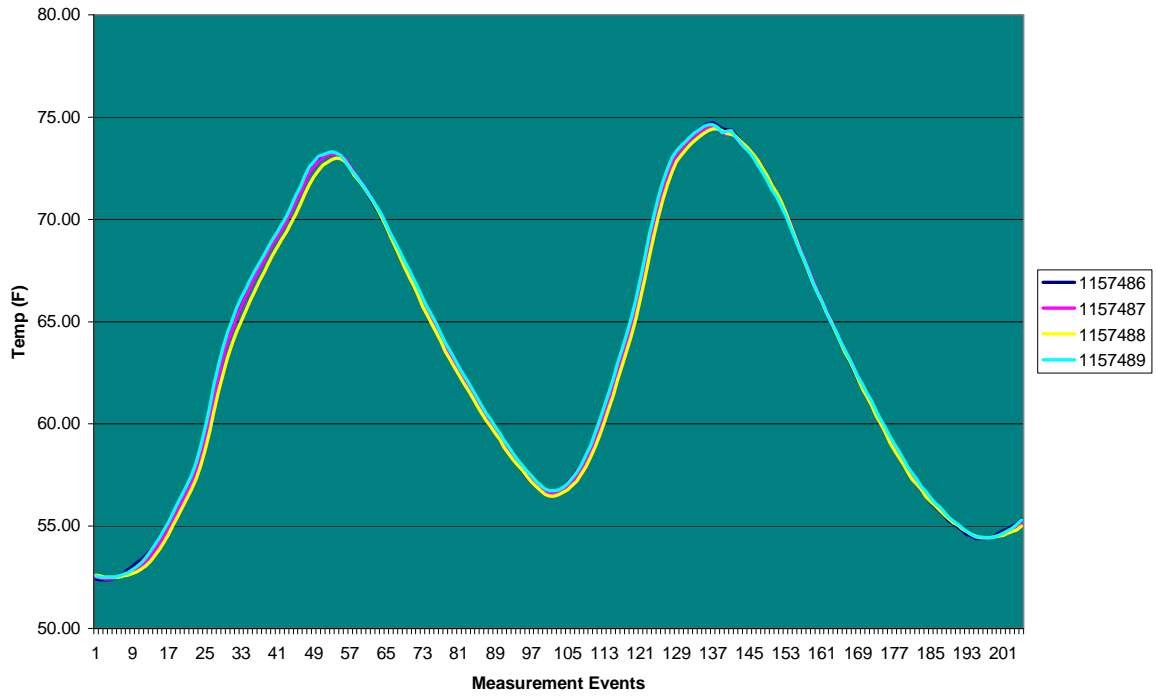
The HOBOs were placed in late May and retrieved in mid-September. Reference temperatures were recorded each time a TROLL team visited the sites.

When retrieved, the data was accessed using the HOBOLite software which produces graphs and from which data can be extracted into Excel spreadsheets. A program was written in the freeware JustBasic interpreter which calculates the seven day average maximum temperatures required for comparison with the Mass DEP standard.

5.2 Data Accuracy

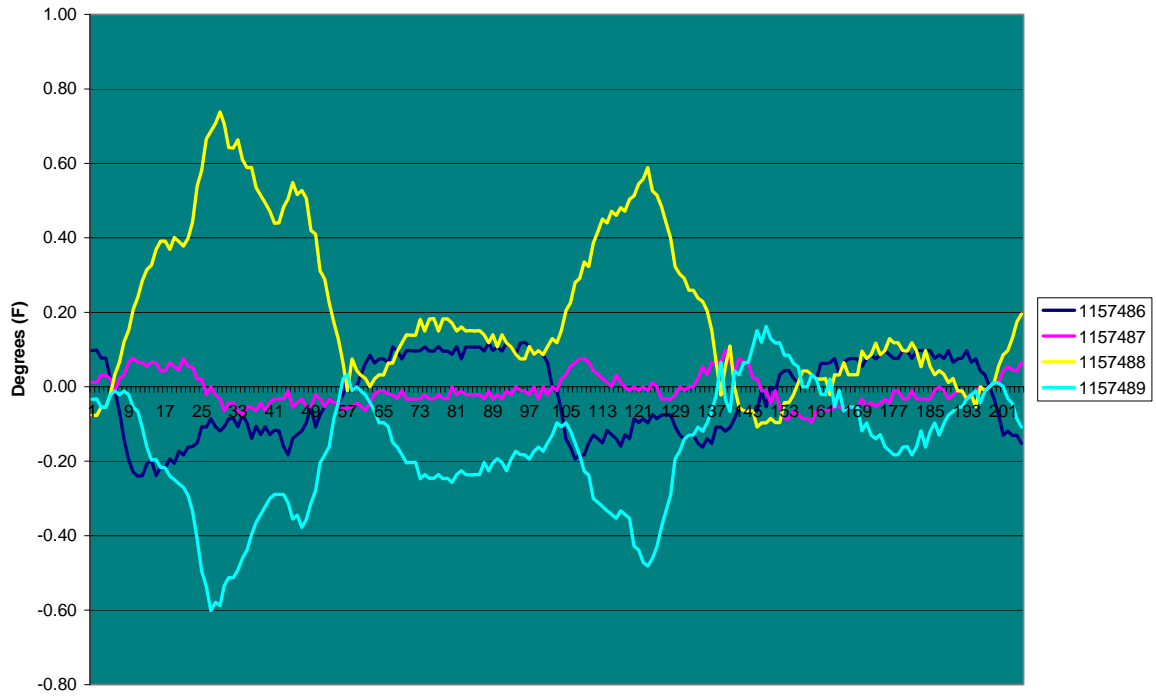
In order to determine the characteristics of HOBO measurements, a test was conducted before deployment. All the HOBOs were placed in a bucket of tap water outdoors in the evening but set for a delayed launch at 6am the next morning. They were left outdoors for more than 48 hours., recording every 15 minutes. The TROLL was not available as a reference, but in this way we are able to compare the consistency of HOBO measurements among themselves. The same procedure was followed after the HOBOs were retrieved.

HOBO Pretest Data



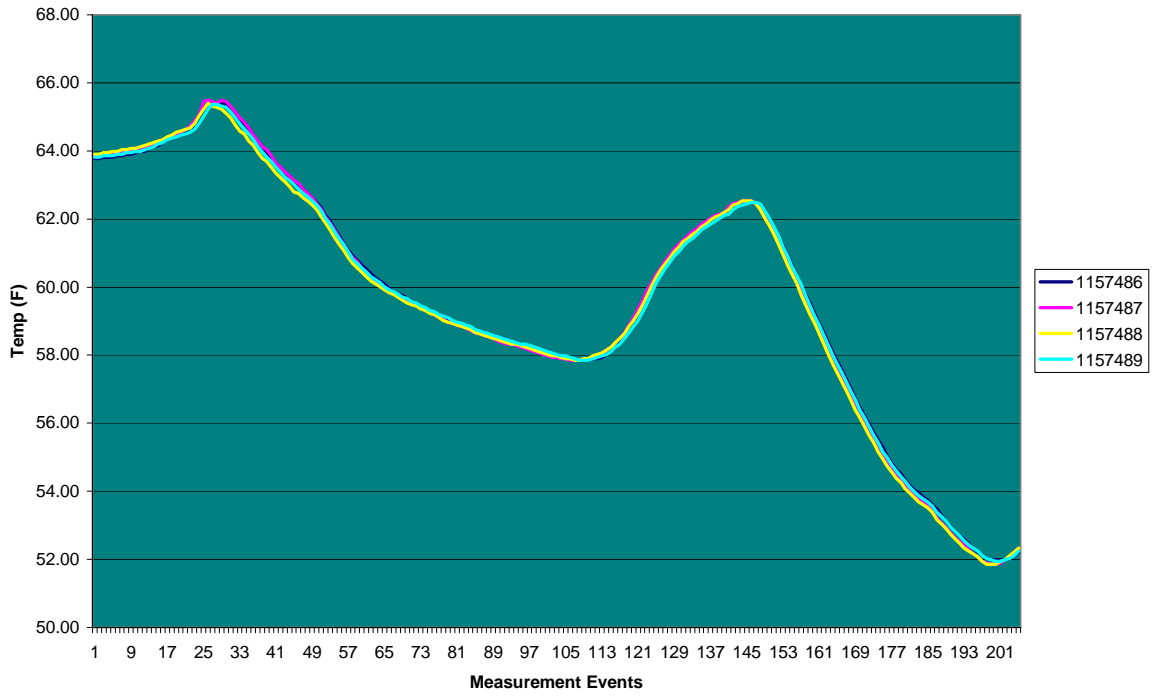
HOBO Predeployment test: Temperatures

Differences from Average



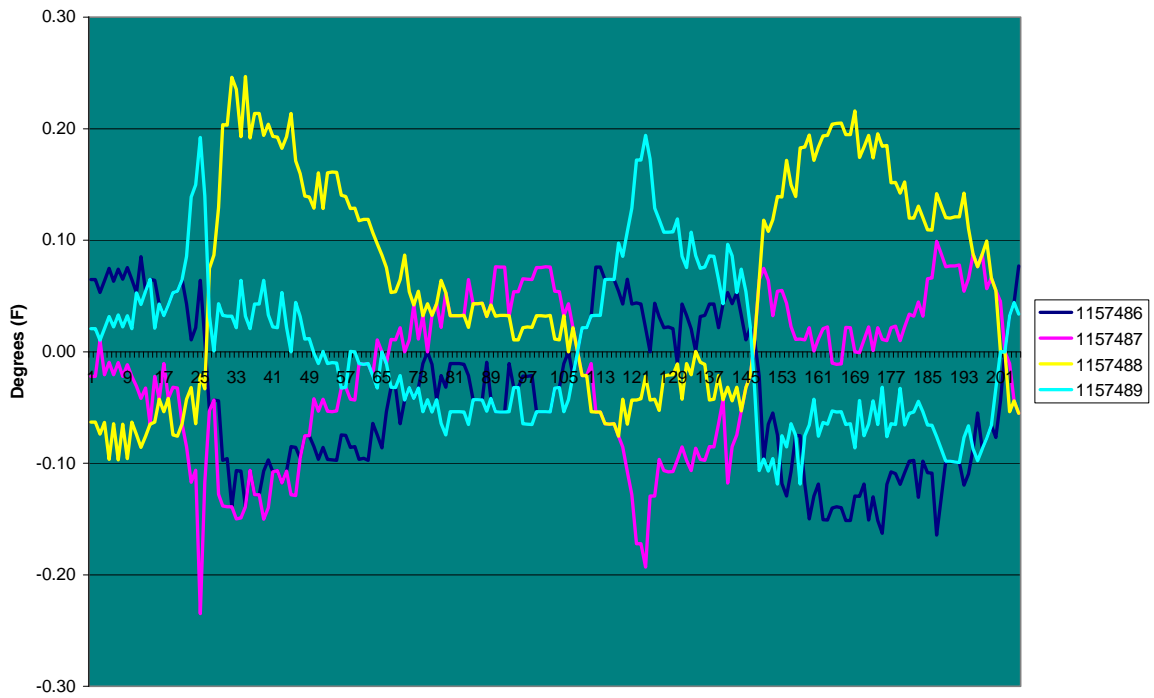
HOBO Predeployment Test: Temperature variance among HOBO readings

HOBO Posttest Data



HOBO Postdeployment test: Temperatures

Differences from Average



HOBO Postdeployment Test: Temperature variance among HOBO Readings

The pre-deployment test data shows a somewhat greater variation than we might expect. The HOBO accuracy is listed as +/- .2 C. or .36 F. Hence it is reasonable to expect variations in HOBO temperatures to be less than .8 degrees F. Two of the HOBOS vary by more than a degree and show a clear opposite tendency to lead or lag the average as the temperature trend direction changes. This variation is greater than seen in the 2009 predeployment test, but much less than the postdeployment test

The postdeployment test data shows considerably less variation, rarely reaching .4 degrees. This is a marked improvement over 2009 where variations reached 3 degrees. Hobo_488 in particular shows a tendency to read higher than the others. It was deployed at Dudley Road, where its readings were compatible with the TROLL reference measurements.

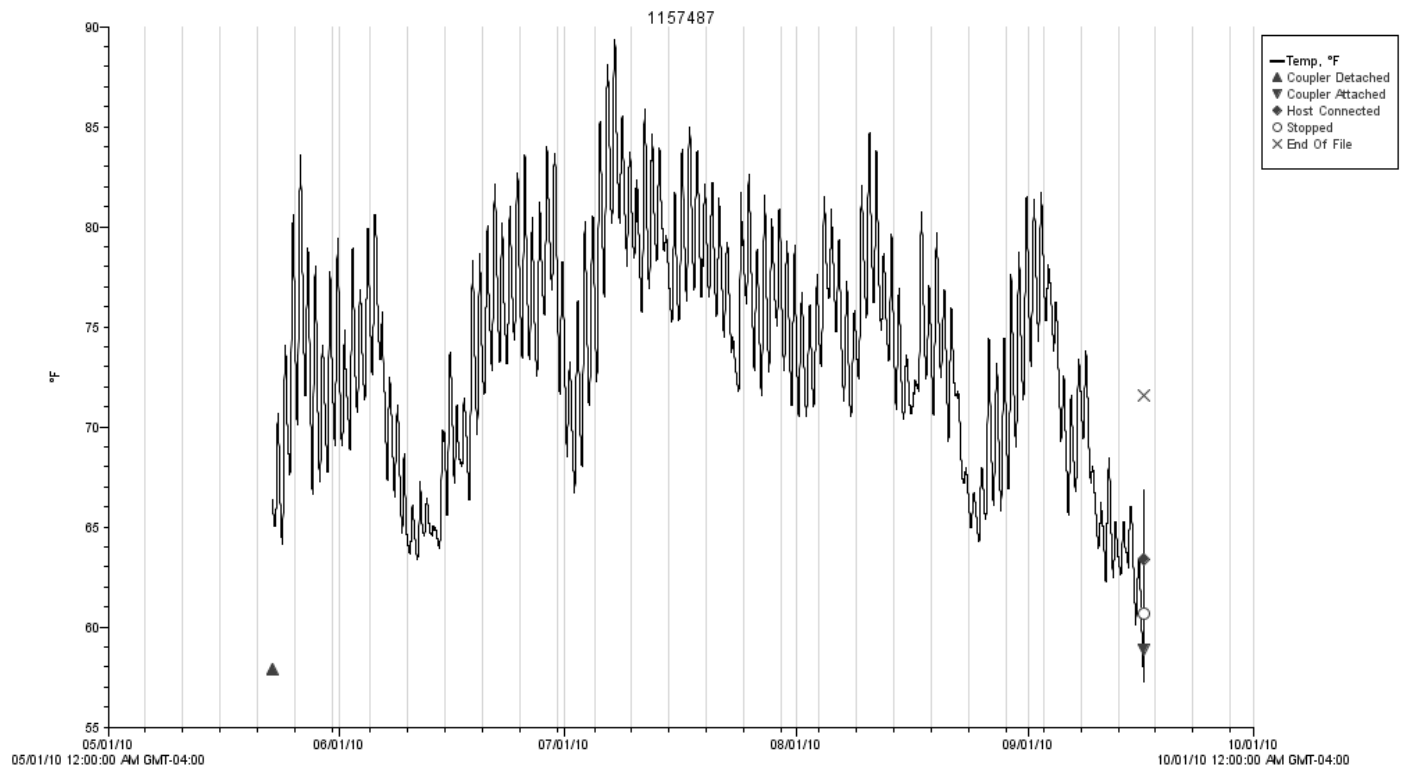
The table below compares the TROLL reference temperatures taken during the monitoring season to the nearest (in time) HOBO measurement at each site. The two temperatures are usually within .5 degrees which is to be expected, and not far from that on two occasions. Note that the HOBO temperatures are higher (with one exception) as they were in 2009.

Date	Time	TROLL Temp	HOBO Temp	Difference
		Clara Barton		
6/5/2010	10:17	74.08	74.25	.17
7/3/2010	9:55	68.98	69.30	.32
8/4/2010	10:12	74.05	74.42	.37
9/4/2010	11:05	73.88	74.25	.37
		Dudley Road		
6/5/2010	10:48	75.02	75.38	.36
7/3/2010	10:24	69.20	69.26	.06
8/4/2010	10:54	73.07	73.17	.10
9/4/2010	11:44	72.91	73.08	.17
		Harwood Street		
6/5/2010	10:57	73.62	73.73	.11
7/3/2010	10:35	67.53	67.59	.06
8/4/2010	11:06	72.45	73.04	.59
9/4/2010	11:59	71.52	72.14	.62
		Brandon Road		
6/5/2010	8:51	73.41	73.56	.15
7/3/2010	8:35	70.72	70.72	0.0
8/4/2010	8:36	72.77	72.87	.10
9/4/2010	9:00	72.04	71.79	(.25)

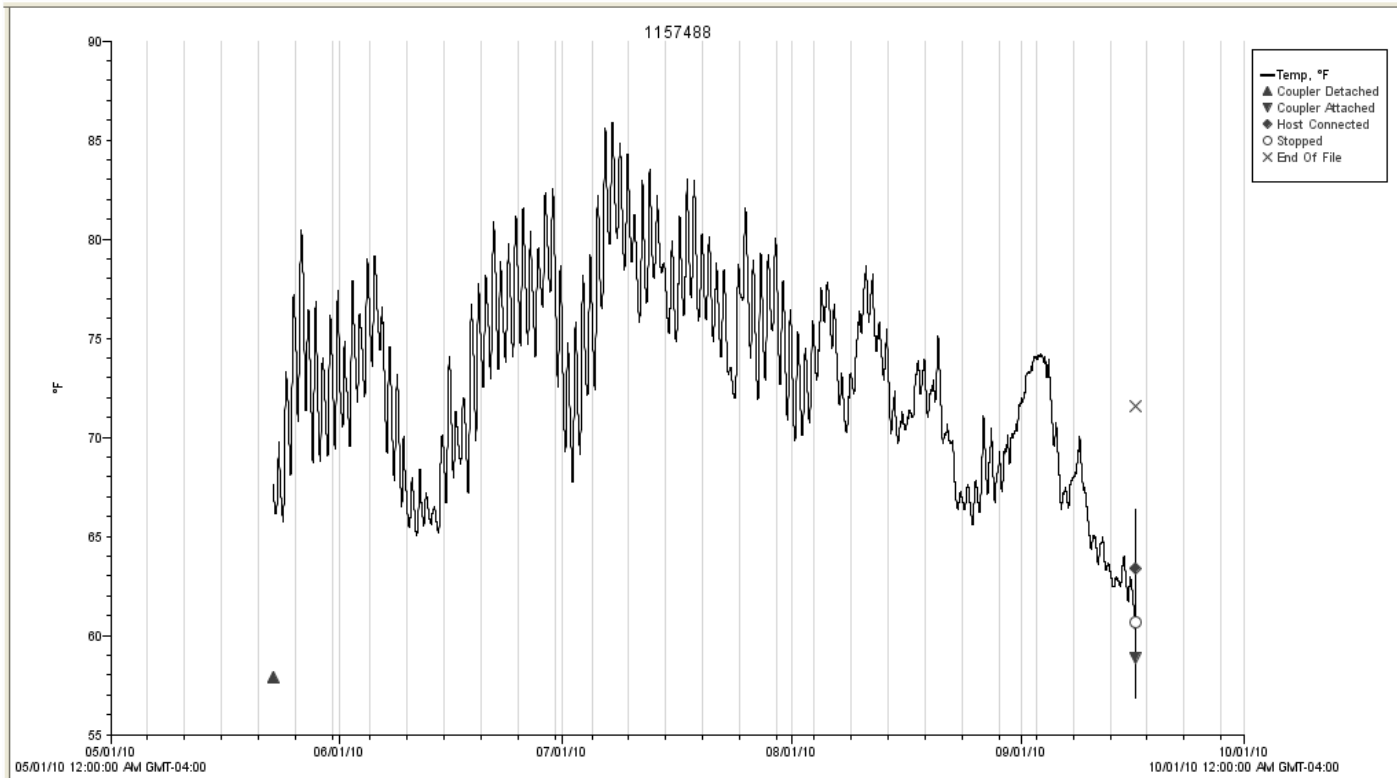
TROLL Reference Data

5.3 Data and Observations

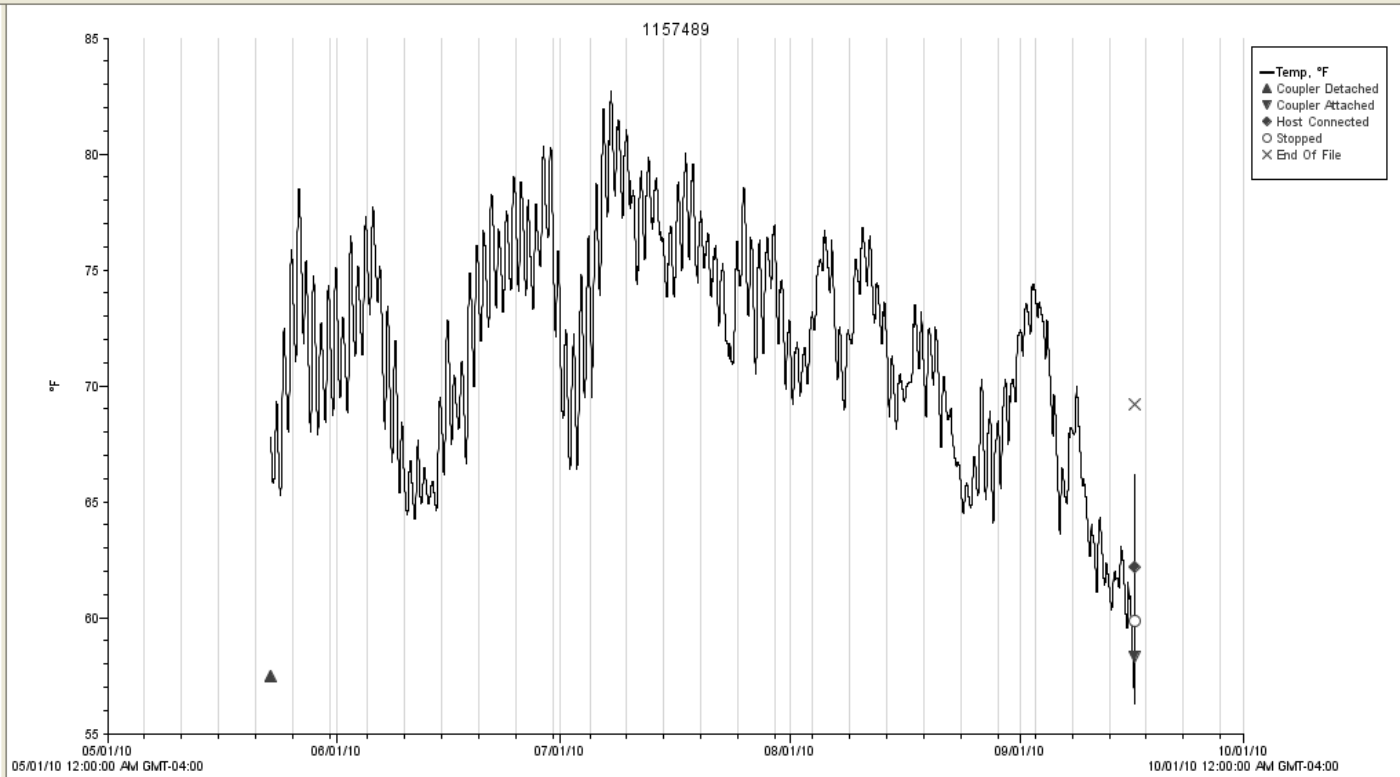
The following pages contain the graphs created from the raw HOBO data by the HOBOLite software. Each graph contains more than 10000 data points. .



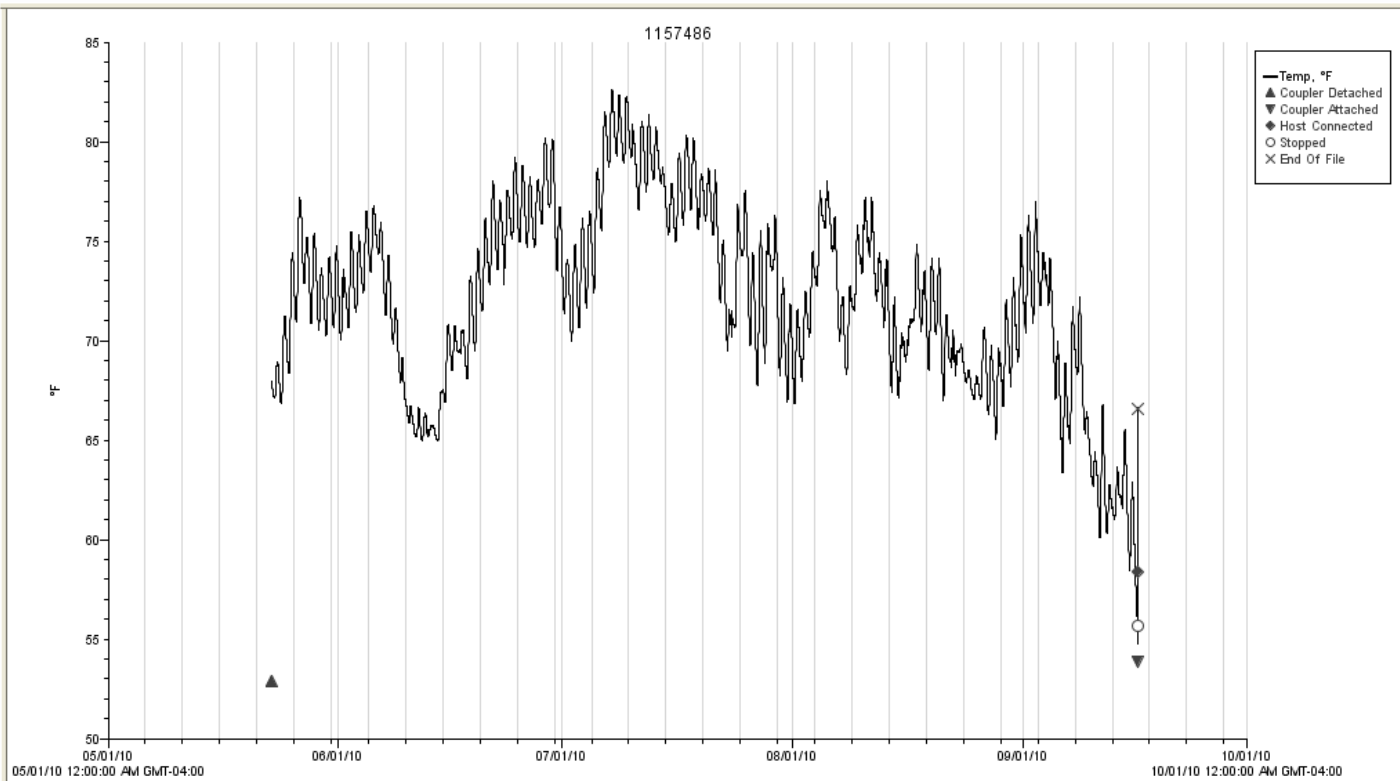
Clara Barton HOBO Data



Dudley Road HOBO Data



Harwood Street Hobo data



Brandon Road Hobo Data

5.4 Analysis

Temperatures can be seen to exceed 80 degrees at all locations and reach almost 90 one occasion at Clara Barton Road.

The seven day rolling average of maximum daily temperatures was computed. Each entry is for that day and the following six. The dates marked in red are above the warm water standard of 83F

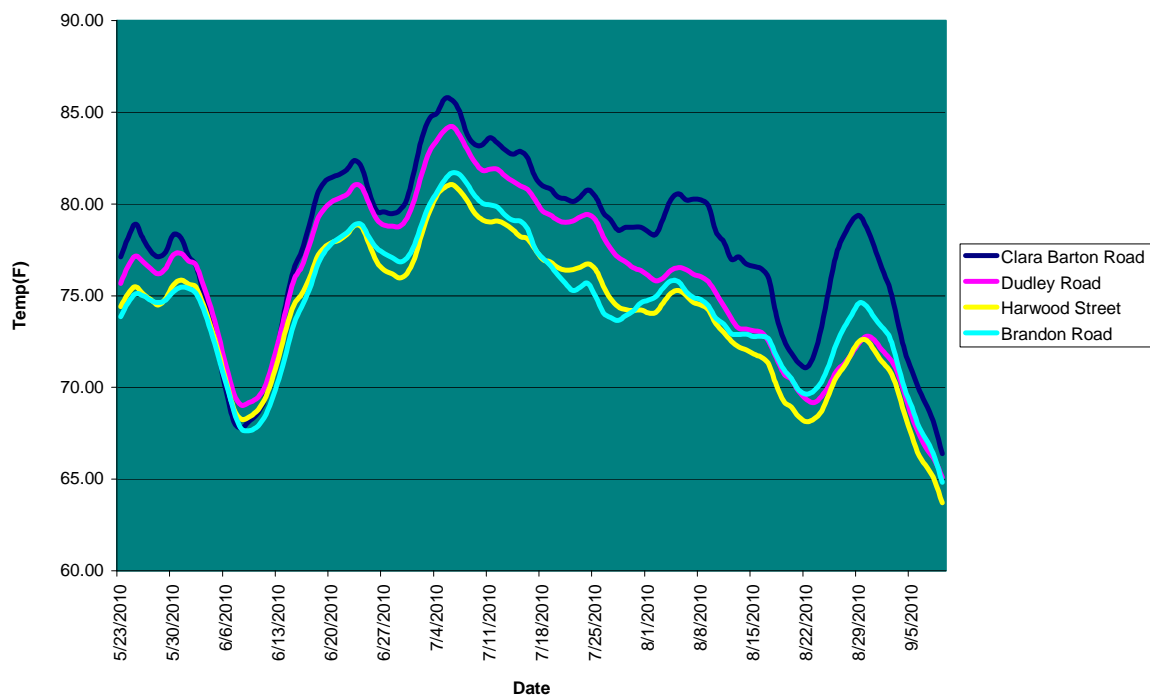
Date	Clara Barton	Dudley Road	Harwood Street	Brandon Road
5/23/2010	77.12	75.67	74.39	73.86
5/24/2010	78.13	76.59	75.11	74.61
5/25/2010	78.90	77.17	75.49	75.11
5/26/2010	78.07	76.83	75.07	74.99
5/27/2010	77.41	76.46	74.79	74.74
5/28/2010	77.11	76.18	74.49	74.62
5/29/2010	77.38	76.49	74.86	74.77
5/30/2010	78.33	77.23	75.58	75.22
5/31/2010	78.14	77.30	75.86	75.47
6/1/2010	77.15	76.90	75.62	75.40
6/2/2010	76.61	76.66	75.48	75.12
6/3/2010	75.15	75.54	74.49	74.26
6/4/2010	73.61	74.35	73.29	73.06
6/5/2010	71.80	72.84	71.92	71.66
6/6/2010	69.77	71.13	70.31	70.17
6/7/2010	68.13	69.67	68.82	68.72
6/8/2010	67.76	69.03	68.26	67.74
6/9/2010	68.14	69.16	68.38	67.62
6/10/2010	68.48	69.36	68.68	67.81
6/11/2010	69.25	69.95	69.29	68.33
6/12/2010	70.83	71.13	70.32	69.28
6/13/2010	72.57	72.64	71.69	70.46
6/14/2010	74.71	74.31	73.24	71.94
6/15/2010	76.47	75.85	74.49	73.45
6/16/2010	77.39	76.54	75.06	74.35
6/17/2010	78.81	77.73	75.91	75.32
6/18/2010	80.42	79.03	77.04	76.55
6/19/2010	81.17	79.73	77.60	77.34
6/20/2010	81.43	80.10	77.88	77.85
6/21/2010	81.61	80.30	78.03	78.13
6/22/2010	81.87	80.51	78.33	78.43
6/23/2010	82.36	81.04	78.82	78.87
6/24/2010	81.96	80.89	78.73	78.86
6/25/2010	80.64	79.98	77.79	78.17
6/26/2010	79.60	79.16	76.85	77.60
6/27/2010	79.57	78.84	76.39	77.30
6/28/2010	79.46	78.80	76.20	77.07
6/29/2010	79.65	78.77	75.97	76.85
6/30/2010	80.28	79.21	76.21	77.05
7/1/2010	81.88	80.24	77.03	77.78
7/2/2010	83.61	81.67	78.37	78.93
7/3/2010	84.68	82.88	79.64	79.99
7/4/2010	84.97	83.50	80.51	80.67
7/5/2010	85.74	84.03	80.91	81.32
7/6/2010	85.64	84.22	81.06	81.70
7/7/2010	85.05	83.73	80.72	81.59

7/8/2010	83.77	82.97	80.17	81.07
7/9/2010	83.22	82.27	79.47	80.43
7/10/2010	83.24	81.82	79.14	80.03
7/11/2010	83.62	81.89	79.02	79.95
7/12/2010	83.32	81.89	79.07	79.83
7/13/2010	82.96	81.52	78.91	79.40
7/14/2010	82.71	81.23	78.59	79.10
7/15/2010	82.86	80.98	78.23	79.05
7/16/2010	82.50	80.78	78.09	78.64
7/17/2010	81.47	80.21	77.53	77.55
7/18/2010	80.99	79.60	76.99	77.05
7/19/2010	80.83	79.40	76.84	76.68
7/20/2010	80.37	79.12	76.54	76.11
7/21/2010	80.28	79.01	76.39	75.66
7/22/2010	80.13	79.06	76.41	75.28
7/23/2010	80.37	79.29	76.56	75.46
7/24/2010	80.75	79.44	76.74	75.66
7/25/2010	80.38	79.11	76.42	74.94
7/26/2010	79.53	78.22	75.53	74.09
7/27/2010	79.14	77.58	74.84	73.81
7/28/2010	78.57	77.09	74.39	73.66
7/29/2010	78.73	76.85	74.24	73.90
7/30/2010	78.73	76.53	74.20	74.15
7/31/2010	78.73	76.37	74.22	74.60
8/1/2010	78.47	76.11	74.06	74.77
8/2/2010	78.35	75.81	74.08	74.94
8/3/2010	79.20	75.97	74.60	75.42
8/4/2010	80.22	76.36	75.12	75.80
8/5/2010	80.55	76.52	75.28	75.75
8/6/2010	80.23	76.41	75.00	75.23
8/7/2010	80.27	76.18	74.62	74.89
8/8/2010	80.22	76.04	74.49	74.78
8/9/2010	79.89	75.76	74.22	74.44
8/10/2010	78.50	75.15	73.47	73.78
8/11/2010	77.94	74.44	73.00	73.45
8/12/2010	76.97	73.77	72.53	72.93
8/13/2010	77.12	73.22	72.20	72.89
8/14/2010	76.72	73.17	72.04	72.90
8/15/2010	76.59	73.09	71.82	72.77
8/16/2010	76.47	73.00	71.63	72.79
8/17/2010	75.90	72.48	71.23	72.61
8/18/2010	73.90	71.62	70.13	71.74
8/19/2010	72.61	70.75	69.24	70.98
8/20/2010	71.85	70.45	68.93	70.49
8/21/2010	71.32	69.78	68.41	69.86
8/22/2010	71.10	69.33	68.14	69.61
8/23/2010	71.80	69.16	68.30	69.83
8/24/2010	73.28	69.50	68.70	70.30
8/25/2010	75.39	70.10	69.64	71.24
8/26/2010	77.29	70.88	70.58	72.39
8/27/2010	78.34	71.31	71.17	73.30
8/28/2010	79.06	71.84	71.90	73.97
8/29/2010	79.36	72.43	72.53	74.61

8/30/2010	78.69	72.78	72.56	74.42
8/31/2010	77.66	72.59	72.02	73.81
9/1/2010	76.50	72.04	71.42	73.30
9/2/2010	75.42	71.57	70.91	72.72
9/3/2010	73.75	70.90	69.95	71.40
9/4/2010	72.04	69.70	68.57	69.97
9/5/2010	70.90	68.39	67.33	68.92
9/6/2010	69.83	67.40	66.26	67.78
9/7/2010	68.93	66.59	65.62	67.03
9/8/2010	67.88	66.03	64.89	66.15
9/9/2010	66.39	65.09	63.71	64.82

Seven Day Average Maximums

French River Temperature Averages



French River Temperature Averages

5.5 Interpretation

It is somewhat surprising how warm the river becomes, almost reaching 90 degrees at Clara Barton Road. At that site and at Dudley Road the temperature does exceed the warmwater fisheries standard for a few days. There appears to be a general trend toward lower temperatures downstream. The high temperatures at Clara Barton, which were also observed last year, may be explained by the broad impoundment directly above it, which is exposed to sun most of the day, and perhaps at low flow rates, the water is staying there for quite a while.

6.0 CONCLUSIONS and RECOMMENDATIONS

Conclusions and recommendations are discussed in this section, but first we consolidate summary findings and present a report card following the guidance of Mass DEP's SMART Monitoring Program, which summarizes our general findings for data gathered this year.

6.1 Summary Findings

In general the year was characterized by historically low flows. In addition, the duration of highest water temperatures was longer than previously seen. These factors combined to produce low dissolved oxygen levels, occurring at more sites, at lower levels, for longer durations. There were twelve instances where state dissolved oxygen standards were not met. Similarly, conductivity was generally higher than in previous years, with particularly high levels at the Stateline, Commerce Parking Lot, both Mill Brook, Nancy Drive, and Old Mill Brook sites. There were 22 instances where state pH standards were not met. These occurred during high flow in March and April as well as during the warm months.

High nutrient levels were observed at the Stateline site, below the wastewater treatment plant.

We monitored during a storm in May and found slightly elevated turbidity throughout the watershed, measurable but not visually noticeable. However, the Potash Brook, Commerce Parking Lot, Mill Brook Webster Nursery, and Old Mill Brook sites were murky and exhibited mid-double-digit turbidity values, clearly carrying a sediment load. There were also instances of warm weather turbidity, with values in the low double digits at the Packard Pond, both Mill Brook, and Old Mill Brook sites. This has rarely been seen.

Other observations include:

In August, a beaver dam was started at the Mill Brook Bigelow Road site. At the end of our season, it was two feet high and its fate is under consideration by the town.

In the spring, we continued to observe that snow and sand has been pushed into the Commerce Parking Lot storm drain

From July on, flow was so low that a volunteer had to climb into the chasm that is the Low Pond outflow. It's not unusual to have to do this a couple of times, but not five.

Potash Brook was dry on two occasions, and Packard Pond outflow was on one occasion not flowing enough to collect nutrient samples. Although flowing, Nancy Drive brook was once too shallow to sink the TROLL.

There is roadside trash accumulating around many sites, but only the Low Pond outflow is being used as a dumpsite for larger objects.

It continues to be striking how high individual temperatures found with the HOBOS can be, compared to the monthly collection of TROLL data taken in the morning, on days which may not be particularly hot.

Record high conductivity and the presence of oil slicks at the Mill Brook Webster Nursery site may indicate a developing problem. Cranston Print Works has ceased industrial activity there, and perhaps a problem which would have previously been seen is escaping notice.

6.2 Report Card

The report card is arranged from upstream to down. Right justified station names are upstream of the station following. The report card is for data collected this year. The **Level** column is an indication of how well the data covers the annual hydrologic cycle. We cover 9 months, monthly. The **Nutr** column refers only to Phosphorus. The **Aesth** column refers to aesthetics, where lower scores are given for accumulated debris, odors, and the presence of oil, and lowest scores for active dumping. **Temp** scores come from HOBOS where used, otherwise from TROLL measurements. HOBOS cause lower scores, as they are certain to catch the highest temperatures.

River Stations	Tributary Stations	Level	Temp	DO	pH	Cond.	Turb	Nutr	Aesth
Clara Barton Road		3	Yellow	Green	Green	Green	Green	Green	Green
	Little River	3	Green	Yellow	Orange	Green	Green	Green	Green
Dudley Road		3	Yellow	Yellow	Orange	Green	Green	Green	Green
	Lowe's Brook	3	Green	Yellow	Yellow	Orange	Green	Green	Green
Harwood Street		3	Green	Yellow	Yellow	Green	Green	Green	Green
	Old Mill Brook	3	Green	Orange	Yellow	Orange	Yellow	Green	Green
	Nancy Drive	3	Green	Red	Green	Red	Green	White	Green
	Mill Brook Webster Nursery	3	Green	Green	Yellow	Red	Red	White	Orange
	Mill Brook Bigelow Road	3	Green	Orange	Red	Red	Yellow	Orange	Orange
	Commerce storm drain	3	Green	Green	Green	Orange	Green	White	Green
	Low Pond outflow	3	Green	Green	Green	Green	Green	Green	Red
Brandon Road		3	Green	Yellow	Green	Green	Green	Green	Green
	Potash Brook	3	Green	Green	Green	Green	Yellow	Green	Green
	Packard Pond outflow	3	Green	Green	Green	Green	Green	Green	Green
State line		3	Green	Green	Green	Yellow	Green	Orange	Green

Green	Meets Smart criteria with few exceptions
Yellow	Shows a downward trend
Orange	Frequently fails to meet criteria
Red	Generally does not meet criteria, by a considerable margin
White	No data

The relevant SMART Criteria on which this report card is based is shown below. Yellow denotes a downward trend.

Indicator Group		GOOD	FAIR	POOR
Chemistry				
Dissolved Oxygen	Warm Water (Spring)	5-6 mg/l (5.5-6.5 mg/l)	4-5 mg/l (5.0-5.5 mg/l)	< 4 mg/l (< 5 mg/l)
pH	Standard Units	6.5-8.5 Δ 0.5	6.0-9.0 Δ 1.0	< 6.0 or > 9.0 Δ 1.5
Temperature	Warm Water	24-26.6°C (75-80°F)	> 26.6-28.3°C (80-83°F)	> 28.3°C (83°F)
Conductivity	uSm/cm	80% > 120	50% > 240	20% > 360
Nutrients				
PO4-P	Rivers	.025-.05 ppm	.050-.1 ppm	> .1 ppm
Aesthetics				
Turbidity		1-5 NTU	5-50 NTU	> 50 NTU
Other Aesthetics	Trash, oil, odor	None	Visible oil sheen, or scattered trash	Dump

6.3 Conclusions

Our conclusions are based on our objectives for the year:

Objective	Results
Demonstrate to the public that the French River is no longer an industrial sewer, but is worthy of protection and enjoyment	Our report card this year has many fewer green block than in the past. Very low flows tend to bring out the worst. Still we generally do not find the main stem discolored, oily, or dirty to the extent many expect. It's clear and well oxygenated for most of the year.
Locate pollution sources and report our findings to local and state officials for appropriate action	The Commerce Parking Lot Storm Drain is no longer a problem, pH changes between the two Mill Brook stations is unchanged. Low DO and high conductivity remain constants at the Nancy Drive site. There is a DO "dip" in mid-summer at Dudley Road and Harwood Street which appears to be consistent. A new area of concern is the Webster Nursery upstream site on Mill Brook, with an oil slick and very high conductivity. One might ask if, since Cranston Print Works ceased operation, there is something that is not being noted that formerly would have been. This year for the first time we collected storm data (in May). It shows what locations are immediately and dramatically affected by high run-off.
Gather data to use when commenting to local officials on decisions before them affecting the river	Now that we have 45 samples over five years taken under a QAPP in most cases, we are getting into a better position to do this. We have 36 samples taken over four years for all sites monitored this year.
Assist Nichols College in gathering flow data for regional hydrology studies	We provided our staff gauge data, but did not install any new gauges
Collect data for baseline, descriptive purposes	We have a very good understanding of what to expect at each station. Graphs of the river stations help us to visualize a consistency during each season and across seasons which is not readily apparent from looking at numbers.
By maintaining a monitoring program over many years, document trends in the health of the river	Over the last four seasons, we have two of low flow, 2007 and 2010, and can see some consistency between them. 2009, a year of high flows, show a contrast
Engage community members in the monitoring program to interest them in the river as a community resource	This year we had twelve new volunteers for French River monitoring, including students from Shepherd Hill High School, and USACE student volunteers. Shepherd Hill appears ready to expand their participation.

6.4 Recommendations

Our recommendations are mostly to ourselves; what can we do better?

Organization: We need more people taking responsible positions. Essentially the project manager does everything except gather the nutrient data. We need a couple of people willing to share calibration, lead teams in the field, perform QA checks, take responsibility for the HOB0 temperature monitoring, and share in report writing. We should try to get nutrient data taken the same day as TROLL data as often as possible

Volunteers: We need to continue to recruit new volunteers for one event per year, and increase the participation of students, who are serious and eager team members.

Equipment: We think the procedure of calibrating the TROLL every time a group goes out, which is much more than the manufacturer recommends, should be re-visited. It is reasonable for one user, using it once a month, to calibrate, but it does not seem reasonable for multiple groups to all calibrate. We have gathered three years of data to support reconsideration. If we declared the pH sensor to be accurate to +/- .2 rather than +/- .1 it should be good for a month. We also need to obtain some information on how long an opened bottle of conductivity solution holds its specified value.

We should consider giving up use of the HOB0s to other programs in the area who may be able to document cold-water streams, which is why we have them.

Procedures: We need to run some tests simulating the post-test of the pH probe, to determine if it is drifting higher during a monitoring day as it appears to be.

We should anticipate off-scale Nitrate findings at the Stateline site and dilute the samples to get accurate readings.

Site coverage: We need to consider dropping the Low Pond outflow site if it can be reached only by a very agile volunteer.

We should be extra attentive to the Mill Brook Webster Nursery site, and be armed with a camera when we visit it.

Coordination: In 2009 and 2010 there were five organizations using the TROLL. The users should form a Users Group to more formally organize schedules, maintenance actions, problem reporting and resolution, and purchase of supplies

In November 2009, DEP published the [French and Quinebaug River Watersheds 2004-2008 Water Quality Assessment Report](#), which includes recommendations based in part, in some instances, on our findings. Below we list those recommendations and note how our 2010 findings relate to them.

DEP Recommendation	Related 2010 findings
Deploy an unattended multiprobe to determine the oxygen dynamics in segment MA42-04	We continued to see low oxygen readings at the Dudley Road and Harwood Street stations, deeper and broader this year.
Conduct a stream walk to determine the extent of the Little River segment MA42-14 affected by illegal dumping. Efforts to prevent illegal dumping and to clean up trash should be conducted	Trash near the monitoring station was removed in 2009 and has not been replenished. If the trail to this site is opened as part of the French River Greenway, it may crop up again.
Multiprobes with pH instrumentation should be deployed in Mill brook to determine the spatial variation in pH along the brook and its possible relationship to commercial property uses and Webster Lake	A consistent drop in pH from the Webster Nursery station to Bigelow Road continued this year, with pH at the latter below 6.5 seven times
Conduct bacteria sampling at the Commerce parking lot storm drain	The conditions which have resulted in concern at this location have been decreasing; none of the conditions noted in 2005 were seen in 2009 or 2010
Test for total phosphate at the State Line site, and bracketing the WWTP.	Phosphate concentrations are lower than during the very low flows in 2007, but are higher than Brandon Road, above the WWTP

One finding in the DEP report is the consistent appearance of large amounts of trash and debris in segment MA42-05 at the SMART station at Oxford Avenue/Pleasant Street, which is just downstream of downtown Webster. There is continual dumping in this area and upstream. A major cleanup previously addressed the area upstream, but the area referred to is very challenging, with steep banks, some deep holes, and rapid flows. It is impractical to clean it during the towns' spring cleanup events, when high water is the rule, and difficult to recruit a team sufficiently intrepid at any time; it's not a place for youngsters or senior citizens. It would be rewarding to find a way to get this done.