Acid Rain Monitoring Project

FY16 Annual Report

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Bureau of Waste Prevention

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Introduction

This report covers the period January 1, 2016 to June 30, 2016, the fifteenth year of Phase IV of the Acid Rain Monitoring Project. Phase I began in 1983 when about one thousand citizen volunteers were recruited to collect and help analyze samples from nearly half the state's surface waters. In 1985, Phase II aimed to do the same for the rest of the streams and ponds[1] in Massachusetts. The third phase spanned the years 1986-1993 and concentrated on a subsample of streams and ponds to document the effects of acid deposition to surface waters in the state. Over 800 sites were monitored in Phase III, with 300 citizen volunteers collecting samples and doing pH and ANC analyses. In 2001, the project was resumed on a smaller scale: about 60 volunteers are now involved to collect samples from approximately 150 sites, 26 of which are long-term sites with ion and color data dating back to Phase I. In the first years of Phase IV (2001-2003), 161 ponds were monitored for 3 years. Between Fall 2003 and Spring 2010, the project monitored 151 sites twice a year, mostly streams, except for the 26 long-terms sites that are predominantly ponds. Since 2011, reduced funding eliminated our October sampling and monitoring now occurs in April only. In 2011, we also stopped monitoring some of the streams in order to add and revisit ponds that were monitored in 2001-2003. This year is the sixth year of monitoring for those added ponds. One major change this year was a change in staff at the Water Resources Research Center, as Elizabeth Finn left the University of Massachusetts and Travis Drury was hired in the Research Fellow position that includes running the Acid Rain Monitoring project.

Goals

The goals of this project are to determine the overall trend of sensitivity to acidification in Massachusetts surface waters and whether the 1990 Clean Air Act Amendment has resulted in improved water quality.

Methods

The sampling design was changed in 2011 to monitor both streams and ponds, and that design continues to date. In 2001-2003 mostly ponds were monitored. In Fall 2003 the sampling scheme switched to streams to evaluate their response to air pollution reductions. In 2011 the site list was modified to include both ponds and streams. Half of the streams monitored since 2003 were kept, and half of the ponds monitored in 2001-2003 were added back. The streams that were removed were chosen randomly within each county. Ponds that were reinstated on the sampling list were chosen at random within those counties and by ease of accessibility to replace the removed streams. Because those sites were chosen without a preconceived plan, they can be considered picked at random.

One collection took place this year, on April 3, 2016.

Methods were unchanged from previous years: Volunteer collectors were contacted six weeks before the collection to confirm participation. Clean sample bottles were sent to them in the mail, along with sampling directions, a field sheet/chain of custody form, and directions including latitude and longitude coordinates along with maps to the sampling sites. Volunteers collected a surface water sample at their sampling sites either from the bank or wading a short distance into the water body. They collected water one foot below the surface, upstream of their body, after rinsing their sample bottle three times with pond or stream water. If collecting by a bridge, they collected upstream of the bridge unless safety and access did not allow it. They filled in their field data sheet with date, time, and site code information, placed their samples on ice in a cooler and delivered the samples to their local laboratory right away. They were instructed to collect their samples as close to the lab analysis time as possible. In a few cases, samples were collected the day prior to analysis because the lab is not open on traditional "ARM Sunday." Previous studies by our research team have established that pH does not change significantly in 24 hours when the samples are refrigerated and stored in the dark.

Volunteer labs were sent any needed supplies (sulfuric acid titrating cartridge, electrode, buffers), two quality control (QC) samples, aliquot containers for long-term site samples, and a lab sheet one week to ten days before the collection. They analyzed the first QC sample (an unknown) in the week prior to the collection and called in their results to the Statewide Coordinator. If QC results were not acceptable, the volunteer analyst discussed possible reasons with the Statewide Coordinator and made modifications until the QC sample analysis gave acceptable results. On collection day or the day after, volunteer labs analyzed the second QC sample before and after the regular samples, and reported the results on their

[1] Note: The term stream in this report refers to lotic waters (from creeks to rivers) and the term ponds refers to lentic waters (lakes and ponds, but not marshes)

lab sheet along with the regular samples. Analyses were done on their pH-meters with KCl-filled combination pH electrodes. Acid neutralizing capacity (ANC) was measured with a double end-point titration to pH 4.5 and 4.2. Most labs used a Hach digital titrator for the ANC determination, but some used traditional pipette titration equipment. Aliquots were taken from 25 long-term sites to fill two 50mL bottles and one 50mL tube per site for later analysis of ions and color. These aliquots were kept refrigerated until retrieved by UMass staff. Note that one of our 26 long-term sites was not sampled (Great Pond in Wellfleet on Cape Cod) again this year, the third year in a row. We will endeavor to find new volunteer collectors on the Cape to make sure this important site is sampled again in the future.

Aliquots, empty bottles, and results were collected by the ARM Statewide Coordinator between one and three days after the collection. The Cape Cod National Seashore lab mailed those in, with aliquot samples refrigerated in a cooler with dry ice.

The Statewide Coordinator reviewed the QC results for all labs and flagged data for any lab results that did not pass Data Quality Objectives (within 0.3 units for pH and within 3mg/L for ANC). pH and ANC data were entered by one ARM staff and proofread by another. Data were entered in a MS excel spreadsheet and uploaded into the web-based database at http://63.135.115.71/acidrainmonitoring/. Data were also posted on the ARM web page at http://wrrc.umass.edu/research/acid-rain-monitoring-project.

Water Resources Research Center's Travis Drury, with the help of senior student Brooke Andrew, managed the Environmental Analysis Lab (EAL) and provided the QC samples for pH and ANC to all of the volunteer labs. EAL also provided analysis for pH and ANC for samples from Hampshire and Franklin Counties, and color analysis for the long-term site samples. The UMass Extension Soils Laboratory analyzed the samples from the long-term sites for cations, and University of New Hampshire's Water Quality Analysis Laboratory, under the direction of Jody Potter, analyzed the samples from the long-term sites for anions.

Aliquots for 25 long-term sites were analyzed for color on a spectrophotometer within one day; anions within two months on an Ion Chromatograph; and cations within one month on an ICP at the UMass Extension Soils Laboratory on the UMass Amherst campus. The available data was sent via MS Excel spreadsheet to the Statewide Coordinator who uploaded it into the web-based database.

The Project Principal Investigator plotted the data to check for data inconsistencies and gaps. She then analyzed the available April data from 1983 through 2016, using the statistical software JMP (http://www.jmp.com/software/) to run bivariate analyses of pH, ANC, and ions against date. This yielded trends analyses with a fitted X Y line, using a 95% confidence interval.

Results

1. There were 150 sites to be monitored, 77 ponds and 73 streams. Of those, 19 ponds and 7 streams are "long-term" sites that are sampled every year and analyzed for color and a suite of ions in addition to pH and ANC.

2. Sampling was completed for 145 sites (72 ponds and 73 streams) including 25 of our long-term sites.

3. There were some quality control problem this year, resulting in the failure of UMass Boston lab to pass pH and ANC. This reduced the data we could analyze to only include 139 sites. We also had an issue at the UMass EAL, and had to discard our color analyses. This was due to the change in lab staff and has been corrected for next year.

4. The network of volunteers was maintained and kept well informed on the condition of Massachusetts surface waters so that they would be able to participate effectively in the public debate. This was accomplished by e-mail and telephone communications, as well as through updates via an internet listserv. 49 volunteers participated in this year's collection. Several new volunteer collectors were recruited to replace ill or retiring volunteers via several internet listservs and by word of mouth. There were 11 volunteer labs across the state, in addition to the EAL at UMass Amherst, in charge of pH and ANC analyses (Table 1). As the Holden lab was not available this year, we used instead the Upper Blackstone Water Pollution Abatement District's lab in Millbury. Work-study student Brooke

Andrews continued to manufacture QC samples and perform pH and ANC analyses at the UMass Amherst lab.

Table 1: Volunteer Laboratories

Analyst Name	Affiliation	Town
Joseph Ciccotelli	Ipswich Water Treatment Department	Ipswich
Laurissa Gulich	UMass Boston	Boston
Mark Putnam	MDC Quabbin Lab	Belchertown
Dave Bennett	Cushing Academy	Ashburnham
Alyssa Reischauer	Cape Cod National Seashore	South Wellfleet
Robert Caron	Bristol Community College	Fall River
Bob Bentley	Analytical Balance Labs	Carver
Dave Christensen	Westfield State University	Westfield
Debra LaVergne	UBWPAD	Millbury
Carmen DeFillippo	Pepperell Waste Water Treatment Plant	Pepperell
Cathy Wilkins	Greenfield High School	Greenfield
Travis Drury, Brooke Andrew	UMass Amherst Environmental Analysis Lab	Amherst

5. The ARM web site and searchable database were maintained and updated. 2016 pH, ANC, and ion data that met data quality objectives were added to the web database via the uploading tool created in previous years. The database was evaluated for quality control and uploading errors were corrected.

6. The data collected was analyzed for trends in pH and ANC in April months (139 sites) and for ions (25 sites), using the JMP® Statistical Discovery Software (http://www.jmp.com/software/). Trend analyses (scatter plots, regression, and correlation) were run on pH, ANC, and each ion separately, predicting concentration vs. time.

Data Analysis Results

pH and ANC

Trend analysis for pH and ANC

Table 2 displays the number of sites out of a maximum of 139 that show a significant change over time for pH or ANC. If the difference was not statistically significant ($p>0.05$), the sites are tabulated in the 'No Change' category.

Table 2: Trend analysis results for pH and ANC, April 1983 – April 2016

	All Sites		Ponds		Streams	
	pH	**ANC**	**pH**	**ANC**	**pH**	**ANC**
Increased	43	53	17	29	26	24
Decreased	6	1	1	0	5	1
No Change	90	85	49	38	41	47
Total	139	139	67	67	72	72

Those results are also graphed in Figure 1.

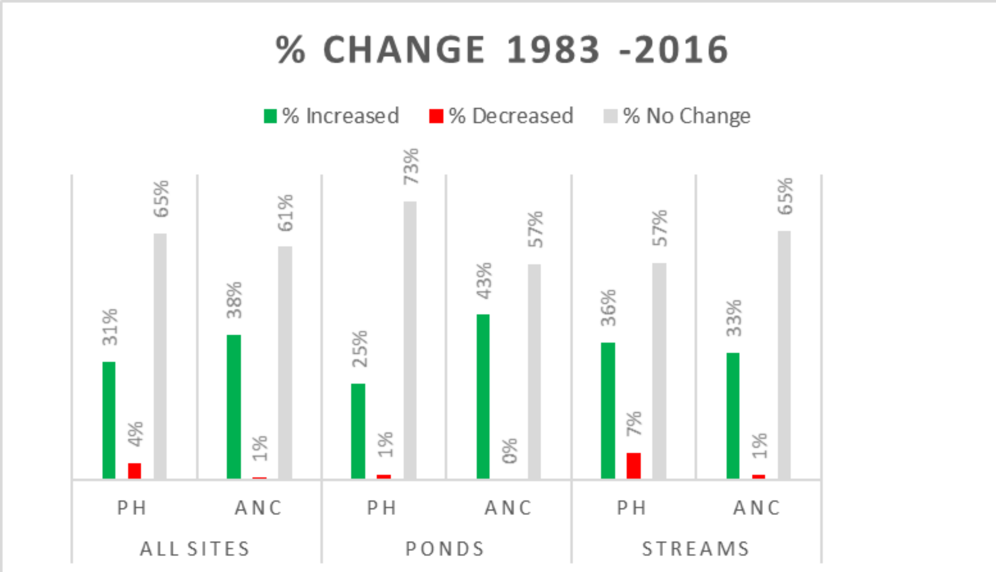

Figure 1. Percent change in number of sites for pH and ANC, from trend analysis, April 1983-2016

This trend analysis indicates that for most sites, neither pH nor ANC changed significantly over time. However, for those sites that show a significant change, many more show an increase than a decrease in value: 31% of the sites saw an increase in pH and 38% had an increase in ANC.

We again note a difference between ponds and streams. More streams (36%) than ponds (25%) saw an increase in pH, while for ANC, more ponds (43%) than streams (33%) saw an increase. Only one site, Torrey Creek in Seekonk (Bristol County) showed a decrease in ANC, while 1 pond and 5 streams showed a decrease in pH over the 33-year study period.

Now in our sixth year of monitoring both ponds and streams, we continue to see a positive trend in ponds and streams, which seem to be improving a little more each year. This year we saw less snowfall than in the past three years, though it actually snowed on collection day. We therefore did not catch a snowmelt acid pulse this year.

Ions
Trend analyses were run for the 25 long-term sites that were analyzed for eleven ions.

Table 3 and Figure 2 show the results of the trend analysis for all parameters.

Table 3: Trend analysis results for ions and color April 1983 – April 2016

	Increase	Decrease	No Change
Mg	6	0	19
Mn	1	4	20
Fe	0	4	21
Cu	5	0	20
Al	2	3	20
Ca	3	2	20
Na	11	0	14
K	8	0	17
Cl	15	0	10
NO_3	8	1	16
SO_4	0	22	3

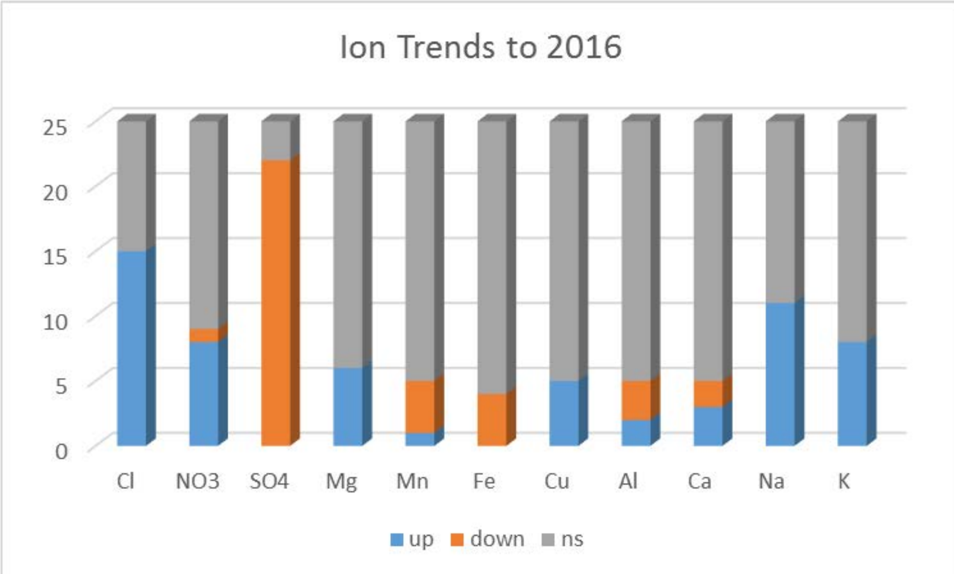

Figure 2: Results of trend analysis for ions at 25 long-term sites, April 1983-2016
Shown is how many sites showed an increase (up), decrease (down), or no significant change (ns) over the period 1983 – 2016

Results are similar to previous years, with most cations showing no significant change over the years, or if they do, the change is a decrease more often than an increase, except for Sodium where 10 sites show an increase. This is probably tied to the increase of Chloride (15 sites), due to road salting practices in Massachusetts. We continue to see a very significant downward trend in Sulfate (22 sites). We will need several more years of data to confirm or disprove an increase in nitrates in our surface waters. As our color analysis was flawed this year, we cannot confirm whether color is still increasing in most of our sites.

Discussion

This was our fourth year with new laboratories for the analysis of ions, and trends seem to be confirmed. The continued trend in decreasing sulfate confirms that the Clean Air Amendment of 1990 is having a positive effect in the quality of the Commonwealth's surface water quality. Road salting in the winter continues to affect the concentration of sodium and calcium in the water bodies. Continued monitoring will help tease out whether nitrate pollution is countering the beneficial effect of decreased sulfates.

Acknowledgements

Thank you to all of the project's volunteers who make this project possible by collecting samples all over the state under any weather conditions, and who spend many hours in the lab analyzing samples.

Cover photo: Volunteer Caleb Walk collects a water sample from Greenwood Pond in Templeton, MA. Photo by Nichole Lacoy.

Appendix

Table 4: April 2016 ARM Ion Data (All data reported as parts per million)

Sample Name	Palsite	Mn	Fe	Cu	Al	Na	K	Mg	Ca	Cl	NO_3	SO_4
Shingle Island Brook	188	0.106	0.382	0.007	0.529	8.959	2.998	2.934	16.305	15.368	0.130	1.527
Belmont Reservoir	21010	0.063	0.018	0.006	0.381	0.910	1.758	1.293	4.458	4.290	0.017	1.161
Cobble Mountain Reservoir	32018	0.034	0.082	0.008	0.192	13.091	1.864	1.970	3.108	15.683	0.059	1.143
Hawley Reservoir	34031	0.045	0.044	0.006	0.244	8.411	1.924	1.561	4.094	15.169	0.040	1.752
Lake Wyola	34103	0.038	0.042	0.008	0.295	5.123	9.714	1.250	2.503	9.451	0.013	1.379
Upper Naukeag Lake	35090	0.030	0.018	0.007	0.215	8.106	1.633	1.084	1.605	13.882	0.012	0.921
Crystal Lake	36043	0.053	0.135	0.006	0.155	0.911	1.701	0.947	1.001	4.608	0.012	0.164
Lake Lorraine	36084	0.029	0.027	0.006	0.136	19.818	2.272	1.531	3.642	31.762	0.013	1.363
Quabbin Station 202	36129	0.028	0.018	0.005	0.127	4.780	1.979	1.350	2.620	9.319	0.020	1.389
Nipmuck Pond	42039	0.032	0.018	0.007	0.319	6.951	1.497	1.182	2.145	20.316	0.146	1.632
North Watuppa Lake	61004	0.036	0.028	0.006	0.171	11.779	1.748	1.651	2.625	21.019	0.019	1.761
Ashby Reservoir	81001	0.049	0.132	0.006	0.221	13.392	2.162	1.399	2.822	19.154	0.027	1.476
Wright Pond	81160	0.036	0.100	0.006	0.272	8.158	1.458	1.186	1.829	14.186	0.013	0.995
Whitehall Reservoir	82120	0.034	0.080	0.005	0.221	17.778	2.278	2.029	4.346	35.482	0.014	1.424
Hedges Pond	94065	0.029	0.020	0.006	0.183	7.246	2.260	1.964	1.591	14.172	0.015	1.332
College Pond	95030	0.025	0.018	0.006	0.137	3.956	1.577	1.522	1.362	8.017	0.014	1.101
Ezekiel Pond	95051	0.027	0.021	0.007	0.127	16.493	2.340	1.979	2.380	21.325	0.165	1.548
Little Sandy Pond	95092	0.031	0.018	0.005	0.127	11.626	2.189	1.817	1.753	29.803	0.236	1.696
Kinnacum Pond	96163	0.051	0.018	0.007	0.152	9.861	1.908	2.120	0.994	18.357	0.012	0.815
Caldwell Creek	3626575	0.042	0.018	0.006	0.277	6.633	1.429	1.319	2.213	11.862	0.012	1.591
West Branch Swift River	3626800	0.042	0.040	0.006	0.212	3.123	1.697	1.123	1.880	7.019	0.015	1.433
East Branch Swift River	3627200	0.059	0.156	0.005	0.254	6.483	2.294	1.375	2.858	12.801	0.017	1.504
Rattlesnake Brook	6235125	0.059	0.285	0.007	0.418	9.769	1.696	1.453	2.216	16.388	0.012	1.797
Angeline Brook	9560000	0.034	0.238	0.007	0.527	7.686	2.300	2.001	2.823	15.403	0.106	1.237
Bread and Cheese Brook	9560150	0.059	0.394	0.007	0.452	30.621	3.702	2.334	4.644	53.348	0.382	1.540
Hatches Creek	9661525	0.103	0.292	0.007	0.351	165.024	3.288	3.951	6.994	324.505	2.522	3.426

Table 5: April 2016 ARM pH and ANC Data

Name	Palsite	Town	pH	Alkalinity (mg $CaCO_3$/L)
Shingle Island Brook	188	Freetown	5.17	0.2
Beagle Club Pond	371	Dartmouth	6.33	3.2
Cheshire Res. North	11002	Cheshire	8.01	79.4
Belmont Res;Steam Sawmi	21010	Hinsdale	5.24	0.2
Lake Garfield	21040	Monterey	7.48	47.3
Long Pond	21062	Great Barrington	7.78	61.0
Trout Pd 2; Demming Pd	31042	Tolland	5.70	1.2
Upper Spectacle Pond	31044	Sandisfield	6.70	7.5
Buck Pond	32012	Westfield	6.75	15.6
Cobble Mtn. Reservoir	32018	Blandford	6.65	2.0
Ashfield Pd;Ashfield L;	33001	Ashfield	7.76	36.9
Bog Pond; Anthony Pond	33003	Savoy	5.93	1.0
Plainfield Pond	33017	Plainfield	6.20	1.3
Brass Mill Pond	34011	Williamsburg	7.16	12.3
Fiske Pond	34023	Wendell	5.27	-0.1
Hawley Reservoir	34031	Pelham	6.06	1.6
Scarboro Pond	34080	Belchertown	6.26	2.7
Lake Wyola; Locks Pond	34103	Shutesbury	6.39	1.7
Bassett Pond	35002	New Salem	5.73	0.4
Cowee Pd;Marm Johns Pd	35013	Gardner	5.32	-0.1
Lake Denison	35017	Winchendon	6.04	0.4
Greenwood Pond	35026	Templeton	5.20	-0.2
Moores Pond; Lake Moore	35048	Warwick	6.38	1.8
Stump Pond	35085	Gardner	5.45	0.9
Tully Pond	35089	Orange	6.41	3.0
Upper Naukeag Lake	35090	Ashburnham	6.16	0.8
Lake Watatic	35095	Ashburnham	6.37	3.6
L Rohunta; South Basin	35107	Athol	5.97	2.7
Bickford Pd;Ropers Res	36015	Hubbardston	6.35	5.6
Cloverdale Street Pond	36036	Rutland	6.59	5.6
Crystal Lake	36043	Palmer	5.89	1.0
Lake Lorraine	36084	Springfield	6.76	6.3
Quabbin Res.Station 202	36129	Belchertown	6.65	4.0
Thompsons Pond	36155	Spencer	6.64	5.7
East Brimfield Res	41014	Brimfield	6.19	5.6
Nipmuck Pond	42039	Webster	5.71	0.7
Coes Reservoir	51024	Worcester	7.23	15.6
Holden Res 1;Upper Hold	51063	Holden	6.53	4.4
Lynde Brook Reservoir	51090	Leicester	7.00	9.7

Name	Palsite	Town	pH	Alkalinity (mg $CaCO_3$/L)
Wallis Res/Whitin Reservoir	51179	Douglas	5.70	0.6
Plain Street Pond	52032	Mansfield	6.51	7.0
N Watuppa L;N Watuppa R	61004	Fall River	6.18	1.4
Deep Pond	62058	Taunton	6.57	4.1
Johnson Pd; Factory Pd	62097	Raynham	6.37	3.7
Winnecunnet Pd;Winnecon	62213	Norton	6.89	7.9
Upper Mystic Lake	71043	Winchester	7.03	33.4
Farm Pond	72039	Sherborn	6.16	2.9
Lake Pearl; Whitings Pd	72092	Wrentham	6.54	12.4
Pleasant St. Pd;Frankli	72095	Franklin	6.94	16.6
Stony Brook Pond	72113	Norfolk	6.97	20.7
Storrow Pond	72115	Westwood	5.99	3.6
Blue Hills Reservoir	73004	Quincy	7.08	18.1
Ashby Reservoir	81001	Ashby	6.38	2.3
Grove Pond	81053	Ayer	6.70	22.4
Heald Pond	81056	Pepperell	6.98	15.3
Phoenix Pond; Double Pd	81100	Shirley	6.93	23.4
Robbins Pond	81111	Harvard	7.71	45.8
Sandy Pond	81117	Ayer	6.70	6.2
L Wampanoag; Nashua Res	81151	Ashburnham	5.26	0.2
Wright Pd; Upper Wright	81160	Ashby	6.17	1.7
Whitehall Reservoir	82120	Hopkinton	6.47	3.0
Mystic Pond	84043	Methuen	6.94	23.3
Upper Attitash Pond	84072	Amesbury	7.49	19.6
Duck Pond	84083	Groton	6.20	2.4
Hedges Pond	94065	Plymouth	6.04	0.8
Indian Pond	94072	Kingston	6.54	14.0
College Pond	95030	Plymouth	6.50	1.9
Ezekiel Pond	95051	Plymouth	6.56	4.1
Little Sandy Pond	95092	Plymouth	5.96	1.0
New Long Pond	95112	Plymouth	6.28	1.5
Turner Pd;Turners Mill	95151	New Bedford	4.87	-0.4
Noquockoke L;South Basi	95170	Dartmouth	6.27	3.6
Kinnacum Pond	96163	Wellfleet	5.01	-0.5
Soda Creek	2103725	Sheffield	7.15	35.2
Williams River	2104100	West Stockbridge	8.07	128.8
Sleepy Hollow Brook	2104200	Richmond	8.11	72.7
Barton Brook	2105350	Dalton	7.32	28.2
Anthony Brook	2105425	Dalton	6.65	5.2
Kilburn Brook	2105700	Peru	6.98	7.8

Name	Palsite	Town	pH	Alkalinity (mg $CaCO_3$/L)
Cady Brook	2105725	Washington	7.24	16.9
Bilodeau Brook	2105750	Hinsdale	7.15	21.6
Fox Brook	3106825	Granville	6.51	2.5
Benton Brook	3107375	Otis	6.30	5.6
Babcock Brook	3107625	Tolland	5.74	0.2
Valley Brook	3107700	Granville	6.36	3.0
Little River	3208725	Westfield	6.82	8.9
Walker Brook	3210300	Becket	7.26	12.7
Hinsdale Brook	3313175	Shelburne	7.96	56.0
Shingle Brook	3313850	Shelburne	7.50	66.3
North River	3314100	Colrain	7.42	19.9
Kinsman Brook	3314450	Heath	7.07	13.2
Vincent Brook	3314550	Colrain	7.29	15.9
Underwood Brook	3314650	Heath	6.84	6.4
East Oxbow Brook	3314925	Charlemont	6.85	5.6
Hartwell Brook	3315075	Charlemont	7.46	22.3
Bozrah Brook	3315325	Hawley	7.26	14.6
Todd Brook	3316050	Charlemont	6.65	3.8
Lord Brook	3316550	Rowe	6.73	4.3
Bagg Brook	3417750	West Springfield	7.52	66.9
Mill River	3419825	Conway	7.49	36.4
Black Brook	3522675	Warwick	6.35	2.0
Kenny Brook	3523750	Royalston	6.17	1.6
Beaman Brook	3523825	Winchendon	5.92	0.4
Wilder Brook	3523950	Gardner	5.43	0.4
Baker Brook	3524050	Gardner	5.91	1.8
Towne Brook	3524200	Royalston	5.87	0.8
Robbins Brook	3524250	Winchendon	5.48	0.4
Sucker Brook	3625975	New Braintree	6.62	4.7
Maynard Brook	3626475	Oakham	5.67	0.7
Cadwell Creek	3626575	Pelham	5.91	0.9
West Br Swift River	3626800	Shutesbury	5.58	0.9
Hop Brook	3627000	New Salem	6.80	4.5
East Br Swift River	3627200	Barre	6.41	2.9
Flat Brook	3627500	Ware	6.68	7.8
West Br Ware River	3628175	Hubbardston	6.18	2.6
French River	4230075	Oxford	6.64	10.1
Wellington Brook	4230325	Oxford	6.61	22.8
Round Meadow Brook	5131275	Mendon	5.72	2.6
Aldrich Brook	5131425	Millville	5.95	2.4
Sewall Brook	5132600	Boylston	7.14	17.6

Name	Palsite	Town	pH	Alkalinity (mg $CaCO_3$/L)
Cronin Brook	5132625	Grafton	6.62	8.0
Dorothy Brook	5132700	Worcester	6.66	17.2
Bungay River	5233750	North Attleborough	6.64	16.4
Torrey Creek	5334075	Seekonk	6.23	12.6
Rocky Run	5334100	Rehoboth	6.45	8.1
Clear Run Brook	5334150	Seekonk	6.90	35.6
Kickamuit River	6134500	Swansea	6.22	6.0
Blossom Brook	6134700	Fall River	4.44	-1.8
King Phillip Brook	6134725	Fall River	4.35	-2.1
Rattlesnake Brook	6235125	Freetown	4.89	-0.5
Mulberry Meadow	6235775	Easton	6.75	9.4
Beaver Brook	6235800	Easton	6.68	12.8
Bassett Brook	6236100	Raynham	6.78	12.6
Godfrey Brook	7240375	Milford	6.98	13.6
Gulf Brook	8143675	Pepperell	7.05	14.3
Robinson Brook	8143825	Pepperell	7.20	26.5
McGovern Brook	8144725	Lancaster	6.85	12.3
Bartlett Pond Brook	8146000	Leominster	5.14	0.3
Millham Brook	8247475	Marlborough	7.15	19.1
Ipswich River	9253500	Ipswich	6.90	24.8
Black Brook	9253700	Hamilton	6.70	22.4
Boston Brook	9253925	Middleton	6.76	21.0
Angeline Brook	9560000	Westport	5.32	0.6
Bread And Cheese Brook	9560150	Westport	6.18	3.6
Hatches Creek	9661525	Eastham	6.20	7.4

Note: Values in red did not pass QC