Water Quality Monitoring in the Lake Iroquois Tributaries

2014

Phosphorus, Turbidity and Chlorides

Within the towns of Hinesburg and Williston

By

~~(Could add in a picture)~~

For
The Lake Iroquois Association
With support from The Vermont Department of Environmental Conservation LaRosa Partnership Grants Program
January, 2014

Introduction

This is the fourth annual report of the Lake Iroquois Tributary Monitoring Program (the "Program") that was carried out under the LaRosa Environmental Partnership Program. The Program began in 2011. This report covers the fourth year of the Program in 2014 as well as observations of the project from 2015 and 2016. The Program was managed by the Lake Iroquois Association, Inc. ("LIA"), a Section 501(c)(3) environmental conservation organization focused on the water quality of Lake Iroquois, Vermont. Tributary monitoring was suspended for 2015 while LIA continued its work in planning and assessing run-off mediation projects on the lake's west side. Design of the LaRosa project, including preparation of the initial proposal, handling of pre-log packets, bottle orders, field sampling, and delivery of samples to the laboratory were handled by members of the LIA Board and other interested citizens who were recruited for the Program, all on a volunteer basis.

Description of the project waters

Lake Iroquois, formerly Hinesburg Pond, is a eutrophic kettle pond located in a valley between Dow and Magee Hills on the east, and Mount Prichard on the west. It lies in the Lake Champlain watershed. It is located on the borders of the towns of Williston, Hinesburg and Richmond. The town of St. George also lies within the lake's watershed. It is about 15 miles from Vermont's principal urban area of Burlington. The lake was formed after the last ice coverage in Vermont receded about 15,000 years ago. Over the years, the lake has naturally become more eutrophic, and it has been the site of significant human development and use in the last 150 years. A dam built on the lake's outlet in the mid-1800s was used to control the water supply to mills downstream in Hinesburg. The mills are no longer operational. Around the 1960s the dam was intentionally cemented in its top position, keeping the pond at an artificially high level throughout the year. The outflow of the lake is over the dam in the south end. The outlet stream flows into a lower pond in Hinesburg, into the LaPlatte River and then to Lake Champlain.

About 91 camps and homes are located on the lake shore. The four towns in the watershed formed the Lake Iroquois Recreation District which operates a public beach on the north end of the lake. The Vermont Fish & Wildlife Department maintains a public fishing access at the north end of the lake. There is some conserved land around the north end. Almost all of the rest of the lake shore has been developed, with many summer camps and year-round residences located quite near the shoreline.

Goal of Monitoring Program

Present usage of the lake, its persistent high water level, shoreline erosion, runoff from development and roads, outdated septic systems and other factors are activities that are suspected of accelerating the productivity of the lake and increasing nutrient concentrations within the lake. Increasing nutrient loads in the lake have impaired the water quality and public uses of Lake Iroquois and contribute to nutrient levels in Lake Champlain. The lake has a significant invasion of Eurasian watermilfoil. In the fall of 2010 and again in 2011 major blooms of blue-green algae (cyanobacteria) occurred in the lake. Assuming no change in current regulations, it is anticipated that changes in the watershed such as new development and increased motor boat usage in the lake will continue unabated because the major population growth area of Vermont lies within close proximity of the lake. Without a concentrated effort to identify and reduce major contributors to the lake's nutrient load, its water quality could deteriorate rapidly.

MONITORING PROCESS:

An earlier LIA watershed survey identified as many as 21 tributaries flowing into Lake Iroquois. Many of these tributaries flow only intermittently during the period of the year when the lake is not frozen. A number of these tributaries have been created as a result of development around the lake, including the construction of homes, roads, and parking areas. The ten tributary sites, identified on a map in Appendix A and locations are described in Appendix B, were chosen to continue the monitoring that began in 2011, to provide additional data on the effect of remediation projects being undertaken on the west side of the lake, and to provide general data on in-flows into the lake.

Lab tests were performed for chloride (on six sites only), total phosphorus and turbidity.

In 2014 between May 28 and ending August 21, volunteers sampled 6 times (BIWEEKLY?) from the ten sites that were sampled in 2012 and 2013 with the addition of site 11 at the outlet of the lake just below the dam. In the 2011 Monitoring Program, five sites were sampled. The same 2013 sites (identified as sites 1 through 10) were sampled in 2014. Site 6 was sampled only on the first two dates of the season. It was then eliminated as the lowest flow site. The lake outflow, site 11, was monitored for phosphorus and turbidity on four sampling dates during the season.

Measurements of phosphorus at the lake's outflow supplement in-lake measurements of phosphorus, chlorophyll and S~~s~~ecchi Disk transparency~~clarity~~ that are taken in the Vermont Lay Monitoring Program ("LMP"). This outflow data is helpful not only in assessing the effectiveness of surface water remediation actions, but also in identifying sources of phosphorus loading in the LaPlatte River. Lake Iroquois is the largest body of water in the LaPlatte River watershed.

Water Quality Monitoring Results

Graphic illustrations of the mean measured concentrations (with standard deviation) of chloride, total nitrogen, total phosphorus, and turbidity are provided in Excel spreadsheets submitted with this report. Concentrations of these analytes for each of the sampling events are included in the Excel spreadsheets as well.

The following observations are made following the 2014 testing:

CHLORIDES

Chloride does not become toxic to aquatic life until levels approach 230mg/l. The Vermont Water Quality Sstandards (October 2014) adopted the chloride criteria of 230 mg/l chronic (daily mean over four dayfour-day period), and 860 mg/l acute (one dayone-day mean).

Table 1 Chlorides in Lake Iroquois Tributaries (mg/L)

Sites	2011	2012	2013	2014
1	8.0	13.0	12.0	
2	1.0	.01 check this value	2.0	
3	12.5	22.0	17.5	
4	20.0	25.50	23.0	36.81
5	16.0	21.0	17.0	24.33
6		.01 check this value	2.0	14.40
7		55.0	43.0	59.33
8		27.5	23.0	28.91
9		16.0	13.0	15.63
10		21.0	20.0	

Overall, chloride levels are well below the Vermont Water Quality Standards. Most sample sites tested for cChloride levels are on the west side except for the sample taken at site 6. In the past as in 2014, sample sites on the west side of the lake are notably higher. These sample sites receive runoff from developed areas include the town road, Pond Road. Sites 7 and 4 are highest. Site 7 collects runoff from the town road, Pond Road as well as the private roads above (Dynamite Hill) and below the road (includes part of Pine shore road. The cChloride levels for Site 6 are lower, which corresponds to the less developed watershed; however, levels have actually increased over the previous two2 sample years.

There are some studies suggesting the Eurasian watermilfoil tolerates chloridechlorine better than native pond weeds, suggesting that techniques to reduce the levels of road salt usage on Pond Road could aid the efforts to reduce milfoil infestation in the pond.

Phosphorus and Turbidity

Total phosphorus (TP), and turbidity were sampled and compared to the VT's 2014 Water Quality Standards (WQS) criteria for wadeable streams. The nutrient criteria were derived to protect aquatic life from the detrimental effects of enrichment. The recently adopted phosphorus TP guidance values for "Medium High Gradient" MHG streams~~ the guidance value~~ is 15 ug/l under low median monthly flow conditions. The VT Water Quality Standard for turbidity in Class B streams is 10 NTU.

Table 2 Phosphorus and Turbidity in Lake Iroquois Tributaries

Mean Total Phosphorus (~~—~~ ug/l)~~—— Averages~~ for sampling sites					
Sites	**2011**	**2012**	**2013**	**2014**	
1	18	24	16	15.~~18~~2	
2	20	17	13	14.0~~3~~	
3	71	44	42	33.0~~3~~	
4	47	13	15	11.~~48~~5	
5	34	20	31	23.~~46~~5	
6		26	24	13.~~55~~6	
7		13	12	15.~~16~~2	
8		19	25	26.8~~0~~	
9		24	16	13.3~~4~~	
10		44	26	56.0~~2~~	
11	21*	18*	17*	14.2~~5~~	* LMP in-lake readings
Turbidity – NTU					
Turbidity					
1	1.~~75~~8	2.3	1.1	1.3~~0~~	
2	1.1	1.2~~5~~	0.4	0.~~79~~8	
3	2.4	1.7	1.1	1.3~~1~~	
4	4.1	1.2~~5~~	0.6	1.4~~0~~	
5	5.1	6.1	4.2~~5~~	11.6~~1~~	
6		0.9	2.~~75~~8	1.7~~0~~	
7		2.0	1.4	0.~~67~~7	
8		4.2~~5~~	1.1	4.4~~5~~	
9		2.~~75~~8	0.7	2.~~07~~1	
10		3.5	0.~~75~~8	1.7~~1~~	
11				1.~~09~~1	

1. Significant spikes are observed in certain phosphorus levels resulting from heavy precipitation (CAN WE ADD DATES TO THIS REPORT?). These spikes are correlated at some sites with high turbidity levels, suggesting that phosphorus sources are primarily from erosion off the landscape or within stream channels. Notably, site 10, with the highest average phosphorus level by far, also has one of the lower turbidity levels. Surface water reaching site 10 has passed through a wetland where flows may have

spread out and dropped any sediment load. In addition, the upper watershed does include agricultural ~~landuse~~land use, including grazing of livestock, which may provide phosphorus in a soluble form.

2. Four of the ten tributary sites monitored exceed 15 ug P/L in phosphorus when averaged over all sampling dates and thus contribute to the eutrophication of the lake~~-~~. The in-flows with the highest phosphorus levels are found at sites 10, 3, 8 and 5 in that order. Again of note is that site 3, connected with the large wetland at the north end of the lake, has shown reduced average phosphorus levels over the four years of LaRosa sampling (F~~f~~igure 1).

3. None of the streams exceed the Vermont Water Quality Standards for turbidity, although site 5 was significantly higher than the other sites. The value was also higher than in previous years (F~~f~~igure 2). Phosphorus levels at this site are not excessively high and have not risen concurrently with the turbidity levels. It may be that the road runoff from the gravel road, Pine Shore road is contributing coarse sediment, which is not necessarily high in phosphorus. Overall, the soils in the watershed do not include the fine clays and silts that tend to increase turbidity in a water body if erosion is a source of pollution, as it is for Lake Iroquois.

Instances of relatively low turbidity but high phosphorus levels (especially site 10) may indicate sources other than erosion as a source for phosphorus pollution at some sites (see also paragraph 1. above)

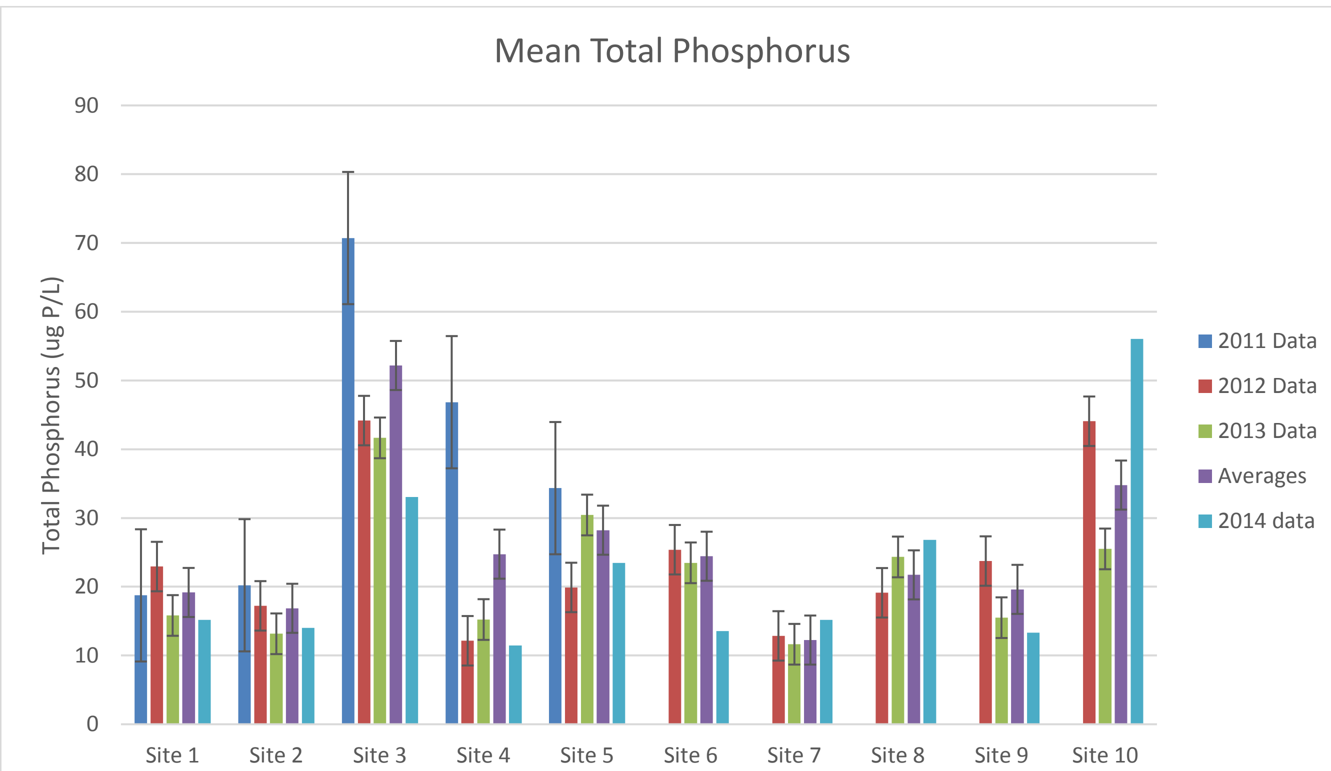


Figure 1. Average phosphorus levels for the sampling year for each site (2011 to 2014) – Maybe you should do your mean after you have plotted thru 2014 as the graph would be easier to interpret that way.

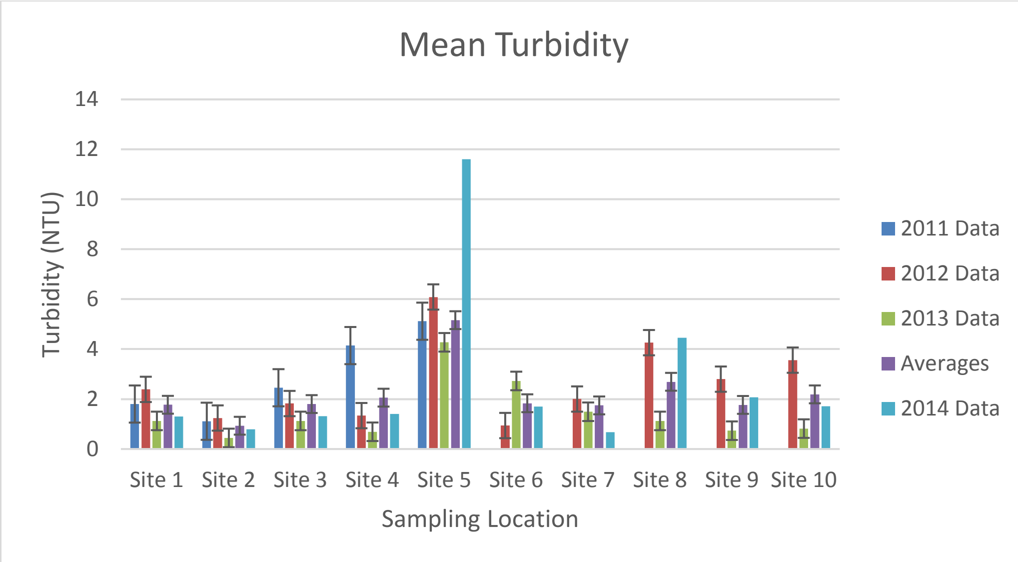


Figure 2 Average Turbidity values for the sampling year for each site (2011-2014) -same note as in Figure 1.

Proposals for Future Actions: A number of future steps are suggested by the testing based on the prior years of test results and prior lake-wide survey. The following are proposed steps to be taken or projects to be undertaken:

1. Monitor and review the upstream areas of tributary sites with highest phosphorus levels. The objectives and goals are: (i) determine the effectiveness of prior remediation actions taken to improve these sites, and (ii) discuss and implement improvements to remediation efforts.
   a. Further upstream surveys and study are warranted for the sites with the highest phosphorus to determine the sources of this pollution. This is especially true of site 10 where high phosphorus levels but low turbidity levels may be due to agricultural sources, septic issues or home gardening use of fertilizers.

2. Pursue educational outreach efforts to encourage and assist in better property management practices, especially riparian buffers, which can reduce phosphorus pollution coming from developed properties. Helping homeowners manage road runoff from private roads would also help to clean up the lake.

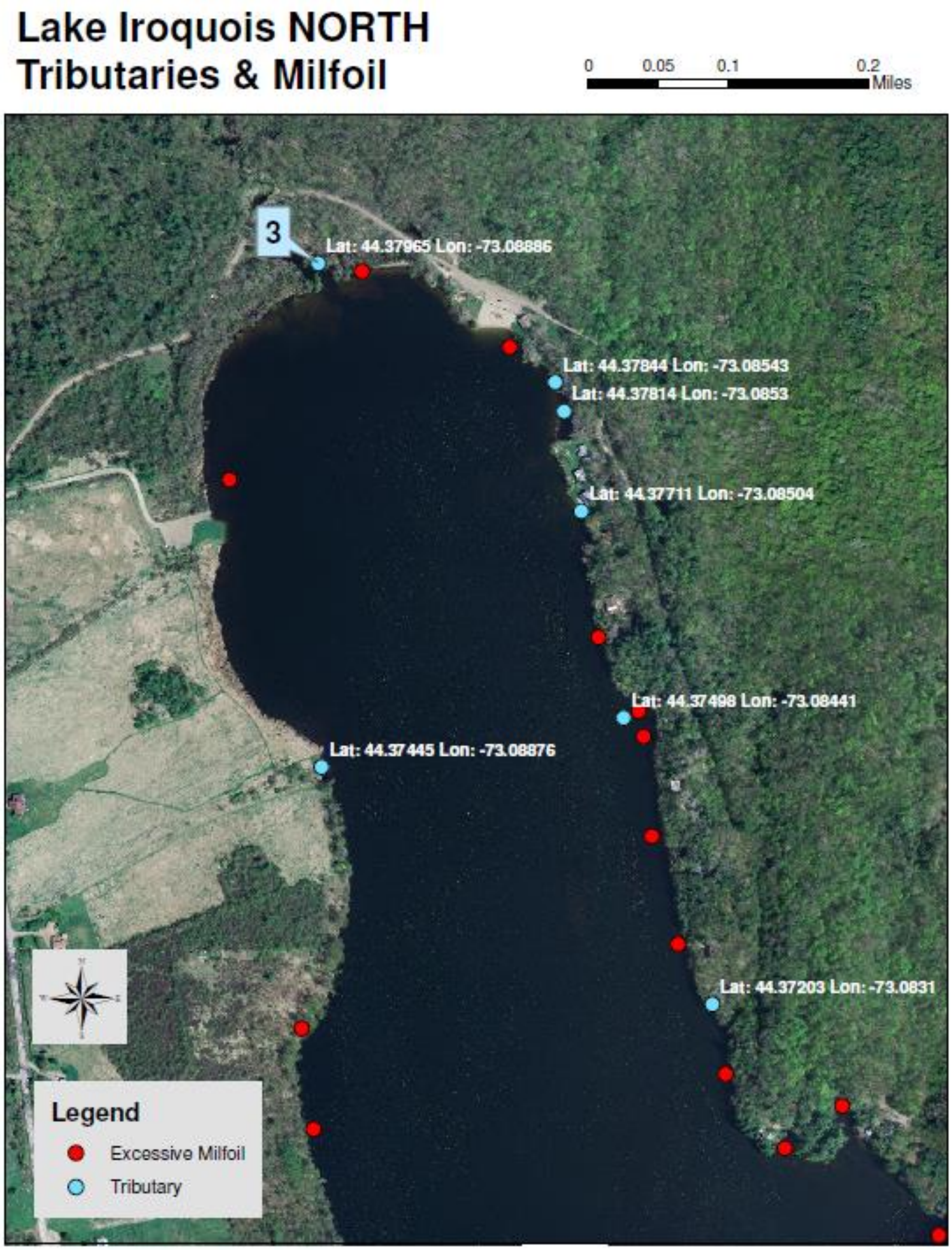
3. Develop closer ties with other watershed groups, particularly the LaPlatte Watershed Partnership and Lewis Creek Association.

4. Resume tributary monitoring in 2017, including outflow monitoring with changes as suggested above.

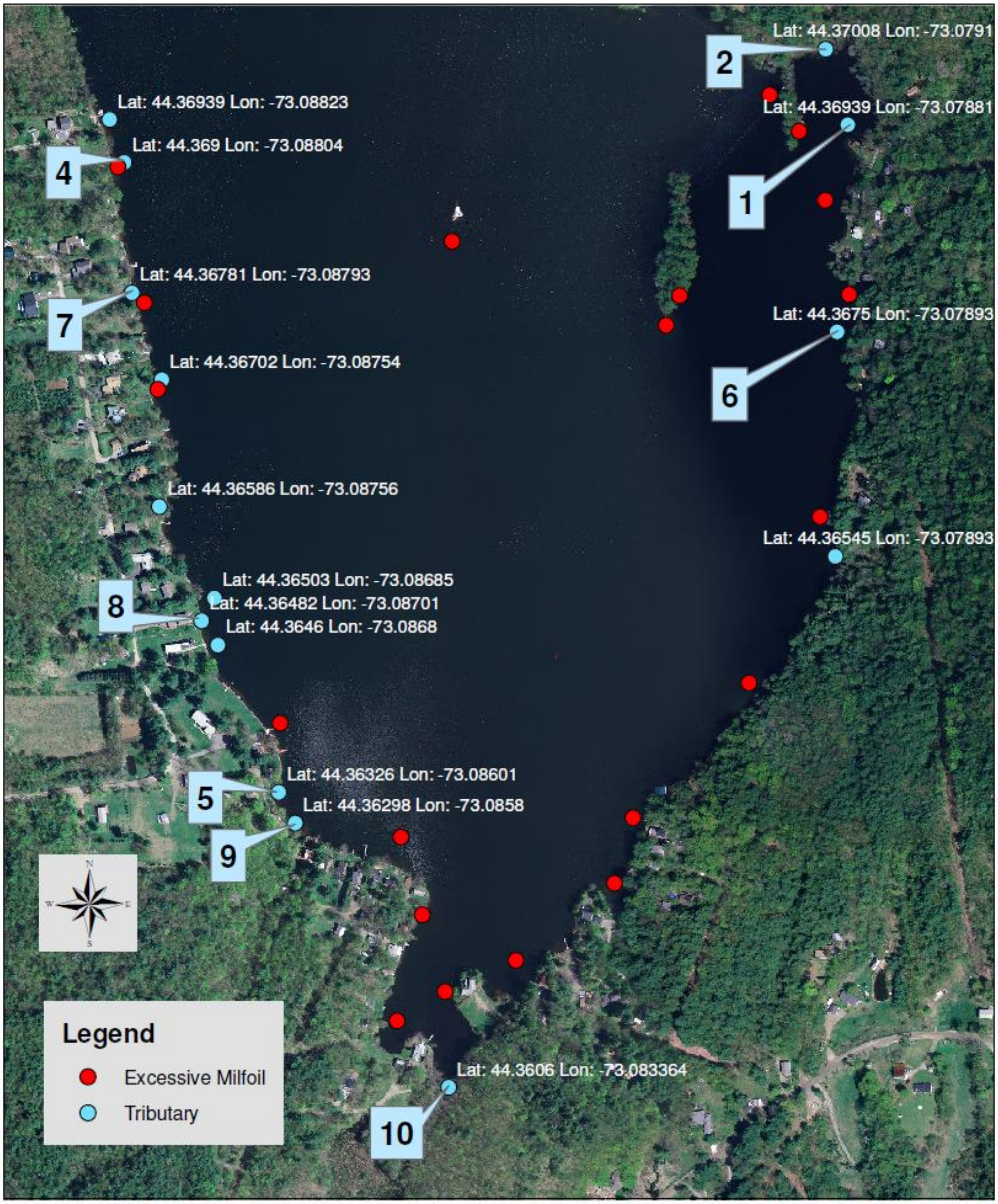
Conclusion: Lake Iroquois is part of the greater LaPlatte River watershed of Lake Champlain. In comparison to concentrations of total phosphorus, total nitrogen, and chloride measured over the 20+ year period of the Lake Champlain Long Term Monitoring Program, the monitoring results for the Lake Iroquois tributary monitoring are on par or are better than the average concentrations observed in the LaPlatte River. Given the relatively small size of the Lake Iroquois watershed, this is not too surprising. Chloride levels at all sites meet the Vermont Water Quality Standards, although are higher on west side where a busy town road is located. For most of the sampling dates, the phosphorus levels do not meet Vermont Water Quality Standards in four of the ten tributary sites monitored (exceed 15 ug P/L in phosphorus). Turbidity values are also relatively low, except for at site 5. (is there precipitation information?) You can use information provided by the nearest volunteer monitor who records precipitation on a daily basis for the National Weather Service (or you could find out directly by posting the question on your local Front Page Forum and tabulating specifically for these annual reports. See attachment for how observe and record flows each time you go out. We conduct training on this at our annual orientation each year as LaRosa Partners are asked to do this now. It helps a lot with the reports to know what the flows were.

The Lake Iroquois Tributary Monitoring Program has identified tributaries in this watershed for which management actions could be directed to improve water quality to the benefit of Lake Iroquois, the LaPlatte River, and ultimately Lake Champlain. The LIA intends to move forward to achieve some or all of the action items listed above. LIA hopes to use the monitoring data as part of an ongoing effort- to educate lake residents and users about the effect of human actions on water quality and to assess the effects of remedial actions and better practices on water quality.

Appendix A:


Lake Iroquois NORTH
Tributaries & Milfoil
0 0.05 0.1 0.2
Miles
3
Lat: 44.37965 Lon: -73.08886
Lat: 44.37844 Lon: -73.08543
Lat: 44.37814 Lon: -73.0853
Lat: 44.37711 Lon: -73.08504
Lat: 44.37498 Lon: -73.08441
Lat: 44.37445 Lon: -73.08876
Lat: 44.37203 Lon: -73.0831
Legend
Excessive Milfoil
Tributary

Lake Iroquois SOUTH
Tributaries & Milfoil



Appendix B: D ~~d~~escription of L~~l~~ocations

Site 1: This stream originates on Magee Hill. The stream crosses under Richmond Road (a paved, well-traveled public road running from Hinesburg to Richmond) and passes in culverts under East Shore Road and Dimick Road before entering the lake on its east shore. Through long-time casual observation, this is the largest tributary of Lake Iroquois and it is generally known to flow continuously through the season. The sampling location was approximately 10 meters from the lake. The stream is contained in a mostly rocky-bottomed bed before entering the lake.

Site 2: This stream enters the east side of the lake after passing under Dimick Road. The stream flows into a marshy area next to the lake. The sampling location was a culvert at Dimick Road that is approximately 30 meters before the stream enters the lake. This stream is believed to drain a largely wooded area to the east of the lake and is not known to pass under any regularly used public or paved roads.

Site 3: This stream drains a large, low-lying area on the north side of the lake. This northern portion of the lake is naturally more of a wetland and would be a larger swampy marsh if it were not for the dam on the lake's southern outlet that keeps the lake's water level artificially higher than the natural level of the pond. There are several smaller streams that converge upstream of the sampling site. In August, 2013 we took phosphorus samples from two of these smaller streams, identified as sites 3A and 3B. The stream here passes under the well-travelled Beebe Lane and also drains sparsely developed areas in Williston north of the lake. The watershed area here extends north of South Road in Williston. Further survey work h~~w~~as been done in an attempt to determine the principal sources of phosphorus at this site.

Site 4: This stream comes off Mount Pritchard and descends in a line perpendicular to the lake's west shore. The stream bed is partly man-made as a result of development, and runs parallel to Shadow Lane, a dirt road that runs directly down the hillside to the lake shore. The stream crosses the well-travelled, paved Pond Road. This site is affected by remediation work, including the construction of retention ponds, that was undertaken at the end of the 2012 sampling season and extended into summer and fall 2013. Sampling in 2014 suggests that the remediation work on this stream may not have the effect of reducing phosphorus loading.

Site 5: This is a low volume site on the lake's west side that has been affected significantly by development. This stream crosses Pond Road in a culvert. The stream bed has been altered by development, and like site 4, it drains an area that descends directly to the west side of the lake. Remediation efforts to improve culverts and to build a retention pond were undertaken during the summer of 2012. The retention pond filled more quickly than anticipated. Accumulated sediment was removed in fall, 2013. This site, along with sites 4 and 8 were dry for three or four of the sampling dates.

Site 6: This is an intermittent drainage area at the north end of the lake. This may drain a portion of the parking area of the public beach. It had no flow in 8 of the 14 sampling dates in 2013. In 2014, two samples were taken here.

Site 7: A stream on the west side that carries water coming across Pond Rd. The stream is affected by runoff from developed areas uphill and to the west of Pond Rd. The stream passes under Pine Shore Rd. before entering the lake.

Site 8: A stream on the west side that passes under Pine Shore Rd.

Site 9: A stream that drains an area on the southwest side of the lake along and under Old Pump Rd.

Site 10: This stream drains an area southwest of the lake which may include some agricultural use. The stream enters a swampy area south of Pike Point Rd. before passing under a culvert at Pike Point Rd. and then entering the lake.

Site 11: This site is the outlet of the lake. Samples were taken just below the dam in the stream that drains the lake. No, you don't need to include the location id, but suggest you use your Site #'s and descriptors from 2015 QAPP.

~~Location ID (not needed?)~~	**LocationName (could include more of a descriptor?)**	**Latitude**	**Longitude**	**LIA sample site number**
507883	Unnamed Trib. to Lake Iroquois	44.3606	-73.08337	
507891	Unnamed Trib. to Lake Iroquois	44.36298	-73.0858	
505511	Unnamed Trib. to Lake Iroquois	44.36326	-73.08601	
507889	Unnamed Trib. to Lake Iroquois	44.36482	-73.08701	
507888	Unnamed Trib. to Lake Iroquois	44.36781	-73.08793	
505515	Unnamed Trib. to Lake Iroquois	44.369	-73.08804	
505512	Unnamed Trib. to Lake Iroquois	44.36939	-73.07881	
505513	Unnamed Trib. to Lake Iroquois	44.37008	-73.0791	
507884	Unnamed Trib. to Lake Iroquois	44.37965	-73.08886	
507885	Unnamed Trib. to Lake Iroquois	44.3797	-73.0869	
510232	Lake Iroquois Outlet	44.36222	-73.08111	

Appendix C. Quality Assurance

<u>Quality Assurance:</u> Participation in a project of this nature was new in 2011 to everyone on the LIA Board as well as to the other individuals recruited as volunteers for taking samples for the Program. The 2012 and 2013 Programs built on the experience among the volunteers in the sampling protocols for the in-lake Lay Monitoring Program ("LMP") of the VTDEC and in the prior LaRosa Program sampling. Training for the Program included a spring training session at the lab. All sampling in 2014 was handled by volunteers who were experienced in the Program from prior years and training.

The Quality Assurance Project Plan (QAPP) was developed based on the "Generic QAPP" provided by VTDEC and the earlier QAPP developed for the Program. The Program relies wholly on non-professional volunteer staffing. Volunteers for the Program are personally dedicated to the Program goals and have been receptive to learning proper sampling techniques, storage of samples and delivery to the lab. The 2014 sampling was carried out exclusively by two volunteers who have been trained in proper techniques.

The Program QAPP was not discussed in detail with the VTDEC Project Contact or with other professionals associated with the Program. The initial QAPP was revised in January, 2013 to reflect the change in one of the sampling sites (site 6). The actual site 6 as used in the Program has been properly described in Section 10 of the QAPP, including a recorded latitude/longitude of site 6 and the other sampling sites.

Our volunteers are committed to continually expand the knowledge of the LIA Board and all Program volunteers concerning quality assurance of the sampling undertaken in the Program. The addition of site 11, the elimination of nitrogen sampling, and the limitation of chloride sampling in 2014 were discussed with the LaRosa Program Director. Also discussed was the suspension of sampling in 2015. A decision was reached that the sampling data from 2011-2014 could be effectively used as a baseline to measure the effectiveness of future projects anticipated by the LIA to improve water quality in the lake tributaries. Once several significant remediation projects have been completed, tributary sampling could be resumed to measure the effects of the changes in the watershed.

(Dan, I don't see where you completed the RPD (see next page for the instructions)

Table X: Quality assurance measures for total Phosphorus, turbidity and chlorides

Date	**Site ID**	**Sample Type**	**Relative Percent Difference Between Duplicate Pairs (RPD)**
		Phosphorus	
		Turbidity	
		Chloride	

Appendix B continued

QAPP – Summary of steps need for data analysis

(Dan, did you complete the following calculations for samples taken? I tried to make this somewhat reader friendly, but it needs improvement. If you haven't completed this section, I can work with you on it)

1) To screen for contamination, the average blank concentration, by parameter, should be calculated. This average value should be as close as practical to the Reporting Limit listed in Table 1.

2) To assess the precision of results, the Mean Relative Percent Difference (RPD) between field duplicate samples should be calculated. The average RPD should be less than or equal to the Estimated Precision listed in Table 1 . This simple measure is calculated as follows (see also figure 1):

$RPD_{\text{field duplicate pair 1}}$ = absolute value ($sample_1$ - $sample_2$) / average ($sample_1$ and $sample_2$);

and,

The Mean RPD for "n" duplicate pair = average ($RPD_{\text{pair 1}}$ + $RPD_{\text{pair 2}}$ + ... + $RPD_{\text{pair n}}$)

3) Reconciliation with Project Quality Objectives (PQOs)

As indicated above, mean blank concentrations and mean relative percent differences will be compared to data quality objectives established in Table 1.

Table 1 – Laboratory Analysis Protocols for Water Samples :

Parameter	Reporting Limit [A]	Accuracy[B] (% Recovery)	Estimated Precision for Field Duplicates [C] (RPD)	Laboratory Precision (RPD)	Analytical Method Reference[B]
Total and dissolved phosphorus	**5 µg/l**	**85-115%**	**≤30%**	**15% [B]**	***Std. Methods* (21st ed.)** **4500-P H**

Total Suspended Solids	**1 mg/l**	**80-120%**	**≤15%**	**≤ 15%**	***Std. Methods*** **(21st ed.)** **2540D**
Turbidity	**0.2 NTU**	**N/A**	**≤ 15%**	**≤15%**	**EPA 180.1**
Total nitrogen (persulfate digestion)	**0.1 mg/l**	**85%-115%**	**≤20%**	**≤10%**	***Std. Methods*** **(21st ed.)** **4500-N C**
Total NOx	**0.05 mg/l**	**85%-110%**	**≤10%**	**≤5%**	**EPA 353.2**

(A) - Reporting Limit is the minimum reported value (lowest standard in calibration curve or MDLx3)
(B) - Section 5.0, Vermont Dept. of Conservation Laboratory QA Plan, 2008
(C) - Generated by the analysis of field duplicates
(D) - EPA's New England Regional Laboratory recommends that all samples resulting in Too Numerous To Count (TNTC) growth, defined as greater than 200 colonies on the membrane filter, be recorded as "TNTC."
(E) -As a quality control check on bacteria counts, if two or more analysts are available, each should count colonies on the same membrane plate for about 10% of the samples, and agree on the # of colonies within 10%.

Table 2 – Project Completeness

Parameter	**Number of Samples Anticipated**	**Number of Valid Samples Collected & Analyzed**	**Percent Complete ***
Total Phosphorus			
Chloride			
Turbidity			

***   Percent Complete = # of Valid Samples Collected and Analyzed / # of Samples Anticipated**
Analyzed / # of Samples Anticipated

Calculating Relative Percent Difference

Data quality goals for precision are typically expressed as the **relative percent difference** (RPD). RPD is calculated using the following equation:

RPD = (Result 1 - Result 2) ÷ ((Result 1+ Result 2) ÷ 2) x 100

Take the absolute value of (Result 1 - Result 2) if Result 1 is less than Result 2.

Example:
Volunteers collected a field replicate sample from an agricultural stream in Addison County, which was analyzed for *E. coli* with the following results:

Result 1 = 248 cfu/100 mL
Result 2 = 238 cfu/100 mL

RPD = (248 - 238) ÷ ((248 + 238) ÷ 2) x 100 = 4.1%

This meets the field precision goal for *E. coli* set by the project of ± 30%.

Figure 1.

Raw data 2014 – (need LIA sample site numbers) (Would be good to add information about stream flows and could also add in column for showing where QAPP processes were completed like RBD)

LocationID	Latitude	Longitude	VisitDate	VisitDate	CharName	RemarkCode	Result
505511	44.36326	-73.08601	41787	5/29/2018 0:00	Total Chloride (mg/l)		28.05
505511	44.36326	-73.08601	41802	6/13/2018 0:00	Total Chloride (mg/l)		27.9
505511	44.36326	-73.08601	41826	7/7/2018 0:00	Total Chloride (mg/l)		24.8
505511	44.36326	-73.08601	41851	8/1/2018 0:00	Total Chloride (mg/l)		21.7
505511	44.36326	-73.08601	41872	8/22/2018 0:00	Total Chloride (mg/l)		19.2
505515	44.369	-73.08804	41787	5/29/2018 0:00	Total Chloride (mg/l)		26.64
505515	44.369	-73.08804	41802	6/13/2018 0:00	Total Chloride (mg/l)		31.8
505515	44.369	-73.08804	41826	7/7/2018 0:00	Total Chloride (mg/l)		35.9
505515	44.369	-73.08804	41851	8/1/2018 0:00	Total Chloride (mg/l)		43.25
505515	44.369	-73.08804	41872	8/22/2018 0:00	Total Chloride (mg/l)		46.45
507885	44.3797	-73.0869	41851	8/1/2018 0:00	Total Chloride (mg/l)		14.1
507885	44.3797	-73.0869	41872	8/22/2018 0:00	Total Chloride (mg/l)		14.7
507888	44.36781	-73.08793	41787	5/29/2018 0:00	Total Chloride (mg/l)		57.5
507888	44.36781	-73.08793	41802	6/13/2018 0:00	Total Chloride (mg/l)		65.5
507888	44.36781	-73.08793	41826	7/7/2018 0:00	Total Chloride (mg/l)		56
507888	44.36781	-73.08793	41837	7/18/2018 0:00	Total Chloride (mg/l)		58
507888	44.36781	-73.08793	41851	8/1/2018 0:00	Total Chloride (mg/l)		56
507888	44.36781	-73.08793	41872	8/22/2018 0:00	Total Chloride (mg/l)		63
507889	44.36482	-73.08701	41787	5/29/2018 0:00	Total Chloride (mg/l)		27.96
507889	44.36482	-73.08701	41802	6/13/2018 0:00	Total Chloride (mg/l)		30.3
507889	44.36482	-73.08701	41826	7/7/2018 0:00	Total Chloride (mg/l)		26.8
507889	44.36482	-73.08701	41851	8/1/2018 0:00	Total Chloride (mg/l)		28.6
507889	44.36482	-73.08701	41872	8/22/2018 0:00	Total Chloride (mg/l)		30.9
507891	44.36298	-73.0858	41787	5/29/2018 0:00	Total Chloride (mg/l)		17.4
507891	44.36298	-73.0858	41802	6/13/2018 0:00	Total Chloride (mg/l)		14.5
507891	44.36298	-73.0858	41826	7/7/2018 0:00	Total Chloride (mg/l)		15.2
507891	44.36298	-73.0858	41837	7/18/2018 0:00	Total Chloride (mg/l)		15.4
505511	44.36326	-73.08601	41787	5/29/2018 0:00	Total Phosphorus (ug/l)		9.75
505511	44.36326	-73.08601	41802	6/13/2018 0:00	Total Phosphorus (ug/l)		56.3
505511	44.36326	-73.08601	41826	7/7/2018 0:00	Total Phosphorus (ug/l)		24.9
505511	44.36326	-73.08601	41851	8/1/2018 0:00	Total Phosphorus (ug/l)		10.5
505511	44.36326	-73.08601	41872	8/22/2018 0:00	Total Phosphorus (ug/l)		25.6
505512	44.36939	-73.07881	41787	5/29/2018 0:00	Total Phosphorus (ug/l)		11.5
505512	44.36939	-73.07881	41787	5/29/2018 0:00	Total Phosphorus (ug/l)		9.69
505512	44.36939	-73.07881	41802	6/13/2018 0:00	Total Phosphorus (ug/l)		28.1
505512	44.36939	-73.07881	41802	6/13/2018 0:00	Total Phosphorus (ug/l)		26.5

505512	44.36939	-73.07881	41826	7/7/2018 0:00	Total Phosphorus (ug/l)		13.1
505512	44.36939	-73.07881	41826	7/7/2018 0:00	Total Phosphorus (ug/l)		13.3
505512	44.36939	-73.07881	41837	7/18/2018 0:00	Total Phosphorus (ug/l)		14.3
505512	44.36939	-73.07881	41837	7/18/2018 0:00	Total Phosphorus (ug/l)		12.3
505512	44.36939	-73.07881	41851	8/1/2018 0:00	Total Phosphorus (ug/l)		13.2
505512	44.36939	-73.07881	41851	8/1/2018 0:00	Total Phosphorus (ug/l)		12.3
505512	44.36939	-73.07881	41872	8/22/2018 0:00	Total Phosphorus (ug/l)		13.9
505512	44.36939	-73.07881	41872	8/22/2018 0:00	Total Phosphorus (ug/l)		14
505513	44.37008	-73.0791	41787	5/29/2018 0:00	Total Phosphorus (ug/l)		8.57
505513	44.37008	-73.0791	41802	6/13/2018 0:00	Total Phosphorus (ug/l)		27.1
505513	44.37008	-73.0791	41826	7/7/2018 0:00	Total Phosphorus (ug/l)		11.8
505513	44.37008	-73.0791	41837	7/18/2018 0:00	Total Phosphorus (ug/l)		11.4
505513	44.37008	-73.0791	41851	8/1/2018 0:00	Total Phosphorus (ug/l)		12.4
505513	44.37008	-73.0791	41872	8/22/2018 0:00	Total Phosphorus (ug/l)		12.9
505515	44.369	-73.08804	41787	5/29/2018 0:00	Total Phosphorus (ug/l)		7.16
505515	44.369	-73.08804	41802	6/13/2018 0:00	Total Phosphorus (ug/l)		19.9
505515	44.369	-73.08804	41826	7/7/2018 0:00	Total Phosphorus (ug/l)		11.8
505515	44.369	-73.08804	41851	8/1/2018 0:00	Total Phosphorus (ug/l)		10.6
505515	44.369	-73.08804	41872	8/22/2018 0:00	Total Phosphorus (ug/l)		7.96
507883	44.3606	-73.08337	41787	5/29/2018 0:00	Total Phosphorus (ug/l)		21.5
507883	44.3606	-73.08337	41802	6/13/2018 0:00	Total Phosphorus (ug/l)		83.3
507883	44.3606	-73.08337	41826	7/7/2018 0:00	Total Phosphorus (ug/l)		52.9
507883	44.3606	-73.08337	41837	7/18/2018 0:00	Total Phosphorus (ug/l)		70.6
507883	44.3606	-73.08337	41851	8/1/2018 0:00	Total Phosphorus (ug/l)		74.3
507883	44.3606	-73.08337	41872	8/22/2018 0:00	Total Phosphorus (ug/l)		33.5
507884	44.37965	-73.08886	41787	5/29/2018 0:00	Total Phosphorus (ug/l)		15.3
507884	44.37965	-73.08886	41802	6/13/2018 0:00	Total Phosphorus (ug/l)		41.1
507884	44.37965	-73.08886	41826	7/7/2018 0:00	Total Phosphorus (ug/l)		42.5
507884	44.37965	-73.08886	41837	7/18/2018 0:00	Total Phosphorus (ug/l)		39.2
507884	44.37965	-73.08886	41851	8/1/2018 0:00	Total Phosphorus (ug/l)		32.6
507884	44.37965	-73.08886	41872	8/22/2018 0:00	Total Phosphorus (ug/l)		27.5
507885	44.3797	-73.0869	41851	8/1/2018 0:00	Total Phosphorus (ug/l)		13.3
507885	44.3797	-73.0869	41872	8/22/2018 0:00	Total Phosphorus (ug/l)		13.8
507888	44.36781	-73.08793	41787	5/29/2018 0:00	Total Phosphorus (ug/l)		6.63
507888	44.36781	-73.08793	41802	6/13/2018 0:00	Total Phosphorus (ug/l)		53.6
507888	44.36781	-73.08793	41826	7/7/2018 0:00	Total Phosphorus (ug/l)		8.31
507888	44.36781	-73.08793	41837	7/18/2018 0:00	Total Phosphorus (ug/l)		6.58
507888	44.36781	-73.08793	41851	8/1/2018 0:00	Total Phosphorus (ug/l)		7.61
507888	44.36781	-73.08793	41872	8/22/2018 0:00	Total Phosphorus (ug/l)		8.24
507889	44.36482	-73.08701	41787	5/29/2018 0:00	Total Phosphorus (ug/l)		23.1

507889	44.36482	-73.08701	41802	6/13/2018 0:00	Total Phosphorus (ug/l)		79.9
507889	44.36482	-73.08701	41826	7/7/2018 0:00	Total Phosphorus (ug/l)		11.9
507889	44.36482	-73.08701	41851	8/1/2018 0:00	Total Phosphorus (ug/l)		17.3
507889	44.36482	-73.08701	41872	8/22/2018 0:00	Total Phosphorus (ug/l)		16.7
507891	44.36298	-73.0858	41787	5/29/2018 0:00	Total Phosphorus (ug/l)		10.4
507891	44.36298	-73.0858	41802	6/13/2018 0:00	Total Phosphorus (ug/l)		24.9
507891	44.36298	-73.0858	41826	7/7/2018 0:00	Total Phosphorus (ug/l)		15.4
507891	44.36298	-73.0858	41837	7/18/2018 0:00	Total Phosphorus (ug/l)		10.3
507891	44.36298	-73.0858	41851	8/1/2018 0:00	Total Phosphorus (ug/l)		9.46
507891	44.36298	-73.0858	41872	8/22/2018 0:00	Total Phosphorus (ug/l)		9.56
510232	44.36222	-73.08111	41787	5/29/2018 0:00	Total Phosphorus (ug/l)		12.7
510232	44.36222	-73.08111	41802	6/13/2018 0:00	Total Phosphorus (ug/l)		19.5
510232	44.36222	-73.08111	41826	7/7/2018 0:00	Total Phosphorus (ug/l)		12.8
510232	44.36222	-73.08111	41837	7/18/2018 0:00	Total Phosphorus (ug/l)		12.1
505511	44.36326	-73.08601	41787	5/29/2018 0:00	Turbidity (NTU)		1.88
505511	44.36326	-73.08601	41802	6/13/2018 0:00	Turbidity (NTU)		15.4
505511	44.36326	-73.08601	41826	7/7/2018 0:00	Turbidity (NTU)		18.9
505511	44.36326	-73.08601	41851	8/1/2018 0:00	Turbidity (NTU)		6.47
505511	44.36326	-73.08601	41872	8/22/2018 0:00	Turbidity (NTU)		15.4
505512	44.36939	-73.07881	41787	5/29/2018 0:00	Turbidity (NTU)		0.95
505512	44.36939	-73.07881	41802	6/13/2018 0:00	Turbidity (NTU)		1.48
505512	44.36939	-73.07881	41826	7/7/2018 0:00	Turbidity (NTU)		0.85
505512	44.36939	-73.07881	41837	7/18/2018 0:00	Turbidity (NTU)		1.36
505512	44.36939	-73.07881	41851	8/1/2018 0:00	Turbidity (NTU)		1.61
505512	44.36939	-73.07881	41872	8/22/2018 0:00	Turbidity (NTU)		1.56
505513	44.37008	-73.0791	41787	5/29/2018 0:00	Turbidity (NTU)		0.33
505513	44.37008	-73.0791	41802	6/13/2018 0:00	Turbidity (NTU)		1.56
505513	44.37008	-73.0791	41826	7/7/2018 0:00	Turbidity (NTU)		0.82
505513	44.37008	-73.0791	41837	7/18/2018 0:00	Turbidity (NTU)		0.54
505513	44.37008	-73.0791	41851	8/1/2018 0:00	Turbidity (NTU)		0.72
505513	44.37008	-73.0791	41872	8/22/2018 0:00	Turbidity (NTU)		0.78
505515	44.369	-73.08804	41787	5/29/2018 0:00	Turbidity (NTU)		0.35
505515	44.369	-73.08804	41802	6/13/2018 0:00	Turbidity (NTU)		0.26
505515	44.369	-73.08804	41826	7/7/2018 0:00	Turbidity (NTU)		0.79
505515	44.369	-73.08804	41851	8/1/2018 0:00	Turbidity (NTU)		1.99
505515	44.369	-73.08804	41872	8/22/2018 0:00	Turbidity (NTU)		3.61
507883	44.3606	-73.08337	41787	5/29/2018 0:00	Turbidity (NTU)		0.53
507883	44.3606	-73.08337	41802	6/13/2018 0:00	Turbidity (NTU)		1.36
507883	44.3606	-73.08337	41826	7/7/2018 0:00	Turbidity (NTU)		2
507883	44.3606	-73.08337	41837	7/18/2018 0:00	Turbidity (NTU)		2.4

507883	44.3606	-73.08337	41851	8/1/2018 0:00	Turbidity (NTU)		2.29
507883	44.3606	-73.08337	41872	8/22/2018 0:00	Turbidity (NTU)		1.84
507884	44.37965	-73.08886	41787	5/29/2018 0:00	Turbidity (NTU)		0.42
507884	44.37965	-73.08886	41802	6/13/2018 0:00	Turbidity (NTU)		1.31
507884	44.37965	-73.08886	41826	7/7/2018 0:00	Turbidity (NTU)		1.33
507884	44.37965	-73.08886	41837	7/18/2018 0:00	Turbidity (NTU)		2.06
507884	44.37965	-73.08886	41851	8/1/2018 0:00	Turbidity (NTU)		0.98
507884	44.37965	-73.08886	41872	8/22/2018 0:00	Turbidity (NTU)		1.76
507885	44.3797	-73.0869	41851	8/1/2018 0:00	Turbidity (NTU)		1.69
507885	44.3797	-73.0869	41872	8/22/2018 0:00	Turbidity (NTU)		1.71
507888	44.36781	-73.08793	41787	5/29/2018 0:00	Turbidity (NTU)		0.71
507888	44.36781	-73.08793	41802	6/13/2018 0:00	Turbidity (NTU)		1.9
507888	44.36781	-73.08793	41826	7/7/2018 0:00	Turbidity (NTU)		0.26
507888	44.36781	-73.08793	41837	7/18/2018 0:00	Turbidity (NTU)		0.32
507888	44.36781	-73.08793	41851	8/1/2018 0:00	Turbidity (NTU)		0.32
507888	44.36781	-73.08793	41872	8/22/2018 0:00	Turbidity (NTU)		0.5
507889	44.36482	-73.08701	41787	5/29/2018 0:00	Turbidity (NTU)		1.77
507889	44.36482	-73.08701	41802	6/13/2018 0:00	Turbidity (NTU)		18
507889	44.36482	-73.08701	41826	7/7/2018 0:00	Turbidity (NTU)		0.38
507889	44.36482	-73.08701	41851	8/1/2018 0:00	Turbidity (NTU)		1.13
507889	44.36482	-73.08701	41872	8/22/2018 0:00	Turbidity (NTU)		0.95
507891	44.36298	-73.0858	41787	5/29/2018 0:00	Turbidity (NTU)		0.71
507891	44.36298	-73.0858	41802	6/13/2018 0:00	Turbidity (NTU)		2.31
507891	44.36298	-73.0858	41826	7/7/2018 0:00	Turbidity (NTU)		0.73
507891	44.36298	-73.0858	41837	7/18/2018 0:00	Turbidity (NTU)		5.27
507891	44.36298	-73.0858	41851	8/1/2018 0:00	Turbidity (NTU)		2.55
507891	44.36298	-73.0858	41872	8/22/2018 0:00	Turbidity (NTU)		0.86
510232	44.36222	-73.08111	41787	5/29/2018 0:00	Turbidity (NTU)		0.94
510232	44.36222	-73.08111	41802	6/13/2018 0:00	Turbidity (NTU)		1.1
510232	44.36222	-73.08111	41826	7/7/2018 0:00	Turbidity (NTU)		0.91
510232	44.36222	-73.08111	41837	7/18/2018 0:00	Turbidity (NTU)		1.39