

**Annual Report of the 2014 Lake Iroquois Tributary
Monitoring Program & 2015-16 Observations
(Project Code 45)**

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.

Roster of Sites: In 2014, water samples were taken 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. 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, described below, 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.

Measurements of phosphorus at the lake’s outflow supplement in-lake measurements of phosphorus, chlorophyll and secchi 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.

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 was 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.

Sampling Events and Tests: Volunteers took samples from the sites on 6 weeks during the 2014 Program, starting May 28 and ending August 21. Lab tests were performed for chloride (on six sites only), total phosphorus and turbidity.

Quality Assurance: 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.

Observations of Test 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:

1. Significant spikes are observed in certain phosphorus levels resulting from heavy precipitation. These spikes are correlated at some sites with high turbidity levels. Notably, site 10, with the highest average phosphorus level by far, also has one of the lower turbidity levels. This suggests that phosphorus loading at site 10 is due to sources other than erosion.
2. Six of the ten tributary sites monitored exceed 15 ug P/L in phosphorus 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.
3. 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 which may be affected by agricultural uses, septic issues or home gardening use of fertilizers.
4. Chloride levels are notably higher along the west side and in particular at sites 7, 4, 8 & 5, in that order. There are some studies suggesting the Eurasian watermilfoil tolerates chlorine 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.
6. 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. This suggests an effort to identify sources of phosphorus at these sites.

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.
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.
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.

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.

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.