VT DEC Water Quality Division

LaRosa Environmental Partnership Program

Annual Report of the 2012 Lake Iroquois Tributary Monitoring Program (Project Code 45)

Introduction: This is the second 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 second year of the Program in 2012. 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. Design of the project, preparation of the initial proposal, as well as 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 2012, water samples were taken from ten sites. In the 2011 Monitoring Program, five sites were sampled. The same 2011 sites (identified for both years as sites 1 through 5) were also sampled in 2012, with the addition of five new sites (sites 6 through 10). An earlier 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 that 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 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 data on in-flows into the southern portion of the lake.

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 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. The stream here passes under the well-travelled Beebe Lane and also drains sparsely developed areas in Williston north of the lake.

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.

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. 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.

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.

Sampling Events and Tests: Volunteers took four samples from each site on 14 dates during the Program, starting during the spring melting season until leaf drop in the fall. Lab tests were performed for chloride, total nitrogen, total phosphorus and turbidity. The first samples were taken on May 5, 2012. Sampling was to occur generally on a bi-weekly basis and also was to include unscheduled sampling dates after a significant rain event and another sample date after leaf-drop in the fall.

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 Program built on the limited experience among the volunteers in the sampling protocols for the in-lake Lay Monitoring Program ("LMP") of the VTDEC and in the 2011 LaRosa Program. Training for the Program included a spring training session at the lab. In July, the Program was able to schedule a session at the lake with our Watershed Coordinator, Karen Bates, to go over the elements of the tributary sampling and to conduct an on-site review of the sampling techniques used at each of the sites.

In the first part of the 2012 Program, a Quality Assurance Project Plan (QAPP) was developed based on the "Generic QAPP" provided by VTDEC. Some aspects of quality assurance for the Program are characterized by the fact that the Program relies wholly on non-professional volunteer staffing. Volunteers for the Program are personally dedicated to the Program goals, however, and have been receptive to learning proper sampling techniques, storage of samples and delivery to the lab.

The work of carrying out the Program in 2012 was enhanced by regular dialog with professionals at the lab at UVM as well as the training and review session that was held at the lake and sampling sites in July, 2012.

The drafted Program QAPP was not discussed in detail with the VTDEC Project Contact or with other professionals associated with the Program. The initial QAPP, dated April 22, 2012, 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.

One aspect of the Program that may be addressed further in the future is an effort to continually expand the knowledge of the LIA Board and all Program volunteers concerning quality assurance of the sampling undertaken in the Program.

Observations of Test Results: During the time samples were taken, some remedial work was being done on the west side of the lake to deal with storm water runoff coming across Pond Rd. and into the lake. Some of this work was completed in mid-summer. Additional work just south of Shadow Lane did not begin until late summer and early fall. The effect of these remediation efforts will not be fully reflected in the quality of the tributaries until 2013. 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 2012 testing:

1. Significant spikes are observed in phosphorus levels resulting from heavy precipitation.

2. Much of the water entering the lake exceeds 15 ug P/L in phosphorus and thus contributes to the eutrophication of the lake. The in-flows with the highest phosphorus levels are found at sites 3, 8 and 10.

3. Site 1 may bring the most tributary phosphorus overall into the lake because of the volume of water in the stream. Further study should include a method to estimate overall volume from this stream as well as others.

4. Further upstream surveys are warranted for several sites, especially 3, 6, 9 and 10, to determine the possible sources of phosphorus in the water.

5. Chloride levels are notably higher along the west side and in particular at sites 7 & 8.

6. Instances of relatively low turbidity but high phosphorus levels may indicate sources other than erosion as a source for phosphorus pollution at some sites.

Proposals for Future Actions: A number of future steps are suggested by the testing based on the 2011 and 2012 test results and prior lake-wide survey. The following are proposed steps to be taken or projects to be undertaken:

1. Undertake watershed surveys upstream of sites 1, 3, 9 and 10 to develop ideas for remedial actions to reduce phosphorus in-flows from these tributaries.

2. Submit a 2013 LaRosa proposal to continue tributary monitoring, including assessment of the effects of remedial actions taken on the lake's west side as well as continued data development on in-flows from other tributaries monitored in 2012.

3. Conduct a survey of the upstream area of sites 7 & 8 and follow up with experts from the towns and other consultants to formulate actions to reduce chloride runoff in these tributaries.

4. Consult with water scientists to determine whether we can estimate total nutrient loads from the monitored sampling sites based on the volume of water flow from each site.

5. Implement a program to evaluate shoreline erosion at various strategic points on the lake.

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 22-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, but also reassuring. The Lake Iroquois Tributary Monitoring Program has identified the 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. In addition LIA hopes to use the monitoring data 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.