VT DEC Water Quality Division

LaRosa Environmental Partnership Program

Annual Report of the 2011 Lake Iroquois Tributary Monitoring Program (Project Code 45)

Introduction: This is the annual report of the 2011 Lake Iroquois Tributary Monitoring Program (the "Program") that was carried out under the LaRosa Environmental Partnership Program. The Program was managed by the Lake Iroquois Association, Inc. ("LIA"), a Section 501(c)(3) environmental conversation 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: Samples were taken from five sites. A lake and watershed survey project, undertaken by LIA with assistance from VT DEC, 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 that has resulted in homes and other structures being built on or near the lake shore as well as roads, parking areas, and other surfaces that have been graded and paved or otherwise stripped of vegetation. The five sites, described below, were chosen to be representative of both steady streams feeding into the lake as well as streams that produce run-off from developed areas following rainfall or spring melt.

Site 1: This is a stream that originates on Magee Hill. The stream crosses Richmond Road (a paved, well-traveled public road running from Hinesburg to Richmond) and also 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 maybe 30 meters before the stream enters open water in 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 water level artificially higher than the natural level of the pond. The stream here passes under the well-travelled Beebe Lane and also drains developed areas in Williston north of the lake.

Site 4: This is a stream that comes off Mount Pritchard in a line perpendicular to the lake's west shore. The stream bed is partly man-made as a result of development, and it 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 probably the lowest volume of the five test sites and was dry for a number of weeks in the summer.

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. The stream is almost perpendicular to the lake's west shore. This site was dry for several weeks during the summer.

Sampling Events and Tests: The Program was designed to take four samples from each site on 13 dates during the season, starting during the spring melting season until leaf drop in the fall. Lab tests were performed for chloride, total nitrogen, total phosphorus and turbidity. Because this was the first year of testing through the LaRosa Partnership and because sampling volunteers had no experience or training in this type of program, sampling could not begin until after volunteers were trained in late May. The first samples were taken on May 30. Sampling was to occur on a bi-weekly basis for 12 sampling dates and also to include an unscheduled sampling date after a significant rain event and another sample date after leaf-drop in the fall.

2011 became perhaps the most unusual and memorable year of spring run-off and summer precipitation in history. Heavy snowfalls and spring rain pushed Lake Champlain to its highest level ever recorded. Tributaries to Lake Champlain, including the Lake Iroquois watershed, were also at very high levels. Culverts upstream of our test sites 1, 4, and 5 were washed out and rebuilt during the spring and early summer. Much of the worst of the spring flooding in the Lake Iroquois watershed occurred prior to the first sampling date of May 30, and our data log does not reflect these spring events. Then in late August, Tropical Storm Irene brought tremendous rainfall to the watershed and resulted in statewide flooding that ended laboratory activity and the Program. Samples were taken immediately after the Irene rainfalls, but none of these samples were able to be tested. The Program ended with the August 21 test data. While none of the earlier sample dates were chosen as the "rainfall event" samples, two of the sampling dates occurred shortly after rain dates.

As indicated, sites 4 and 5 were dry during mid-summer sampling events and samples from these sites were not collected on July 24 and August 7. Because of the closure of the DEC laboratory due to flooding from Irene, the Program produced test results from seven testing dates at sites 1, 2 and 3 and five testing dates at sites 4 and 5.

Quality Assurance: Participation in a project of this nature was totally new to everyone on the LIA Board as well as to the other individuals recruited as volunteers for taking samples for the Program. There was some limited experience among the volunteers in the sampling protocols for the in-lake Lay Monitoring Program ("LMP") of the VT DEC. However, training for the LMP did not include detailed descriptions or training in quality control requirements or procedures other than details about rinsing equipment, care in handling filters and the storage of samples. Furthermore, because of logistics and timing, the Project Coordinator was unable to attend the one training session held for volunteers in May, 2011.

The Program's Project Coordinator was able to regularly check with the VT DEC Project Coordinator, the Voluntary Monitoring Coordinator, and the Laboratory Director about details of the Program and steps needed to meet quality assurance standards. The Program did not identify a person independent of the Project Coordinator to be responsible for quality assurance. Steps that were taken to provide quality assurance include the following:

1. All volunteers who handled samples were provided with the basic training information before sample collection.

2. The Project Coordinator and Assistant Project Coordinator regularly discussed coordination with all volunteers, the handling and storage of samples, and the delivery of samples to the laboratory.

3. The Project Coordinator oversaw field rinsing of sample containers with volunteers.

4. A schedule for the requisite number of field duplicates was developed after the Program started. Because the Program was cut short by Irene when it was only about half completed, all the requisite field duplicates were not collected.

It is anticipated that deficiencies in quality assurance protocols will be corrected in the second year of the partnership between the LIA and the LaRosa Lab in the Partnership Program. Experience gained in the initial year of participation in the Partnership Program will be invaluable in the improvement with quality assurance compliance in future years.

Observations of Test Results: Although the Program was significantly curtailed by Irene, test results from the 2011 sampling provide helpful insights for future testing and the formulation of action items to improve water quality. Graphic illustrations of the mean measured concentrations (with standard deviation) of chloride, total nitrogen, total phosphorus, and turbidity are provided in Figure 1, below. Concentrations of these analytes for each of the sampling events are illustrated in Figure 2, below, with the daily precipitation totals measured at the NOAA weather station at Burlington International Airport (http://www.ncdc.noaa.gov/cdo-web/search). The following observations are made following the 2011 testing:

1. The two sites on the lake's east side (Sites 1 and 2) have relatively good water quality. Chloride levels were below the detection limit of the laboratory for Site 2. These tributaries drain areas that are largely forested.

2. Somewhat higher chloride levels are Site 1, which crosses Pond Road, might be reduced by taking actions to improve drainage and reduce erosion at points along the stream that cross Richmond Road.

3. Site 3 may drain one of the larger portions of the watershed. The watershed area for this tributary should be assessed to determine possible steps to reduce nutrient loads. Phosphorous as well as nitrogen levels were, on average, highest at this site. Unlike sites 4 and 5, where more of the nutrient load may be attributable to soil erosion, the watershed assessment should examine other potential sources of pollution and address remedial actions.

4. Sites 4 and 5 have relatively high nutrient concentrations at the time of the sampling events. Remedial actions are planned for areas drained by these tributaries. Continual monitoring and testing will allow an assessment of the effectiveness of actions taken.

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

1. *Improve quality controls.* The Program in 2011 was handled without sufficient knowledge or training to achieve the desired level of quality control. Steps should include: additional volunteer training; develop field sheets for each sampling event to provide greater detail about sampling conditions; schedule a post-training organizational meeting for project volunteers to increase uniform and best practices in sample activities.

2. Continue to monitor all five sites from 2011.

3. Identify additional testing sites to include tributaries with significant flows during spring melt or following precipitation events.

4. Include estimates of flow from the monitored tributaries (and additional tributaries where possible) to provide essential information to calculate nutrient loads from these tributaries to Lake Iroquois.

5. Establish regular measurement of daily precipitation to assist with interpretation of the monitoring results.

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

7. Apply for additional funding to increase the frequency and duration of the monitoring program to include spring snow melt and additional rain events during the season.

8. Undertake one or more remedial actions in the north watershed area where effectiveness can be measured by test results at Site 3.

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 2011 Iroquois monitoring program identified the tributaries in this watershed for which management actions could be directed to reduce runoff into these tributaries, to the benefit of Lake Iroquois, the LaPlatte River, and ultimately Lake Champlain. The LIA intends to submit a 2012 LaRosa proposal to follow up on the 2011 Program with the objectives of achieving some or all of the action items listed above. In addition to providing a greater baseline assessment of nutrients entering the lake, the 2012 monitoring will help document the effects of some actions already planned for improving the water quality of these tributaries and for Lake Iroquois.

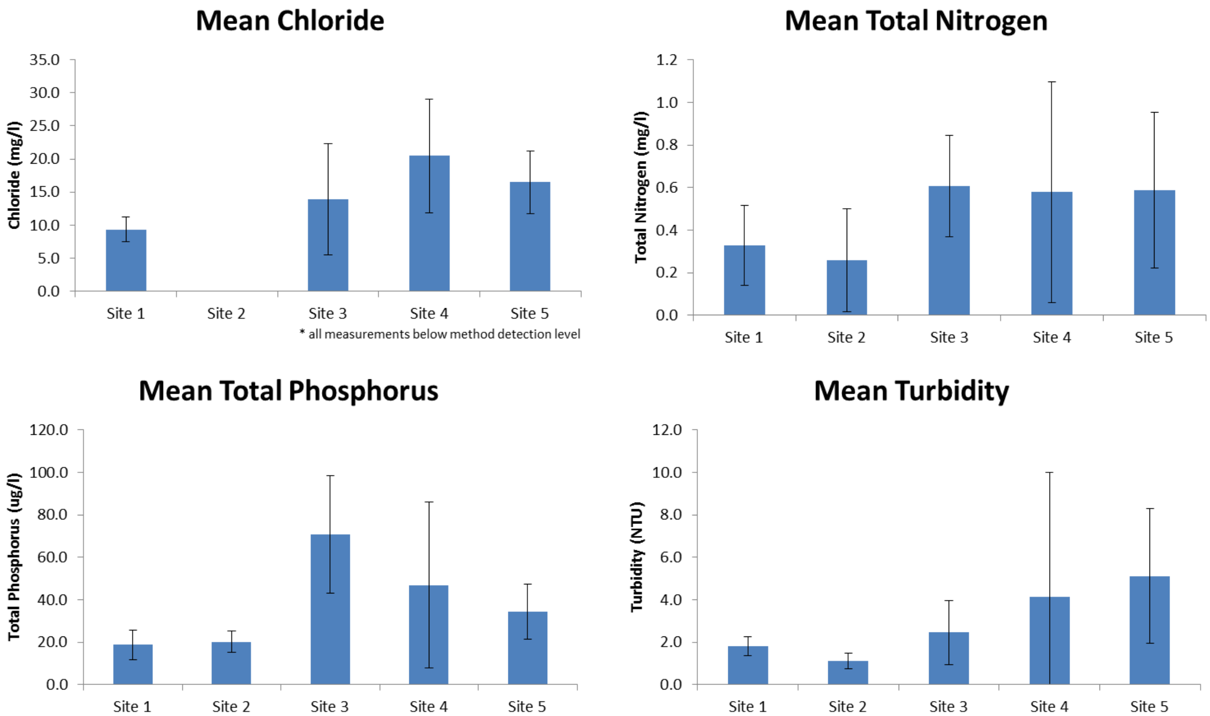

Figure 1. Mean concentrations of chloride, total nitrogen, total phosphorus, and turbidity at the five tributary monitoring sites for the 2011 Lake Iroquois Monitoring Program.

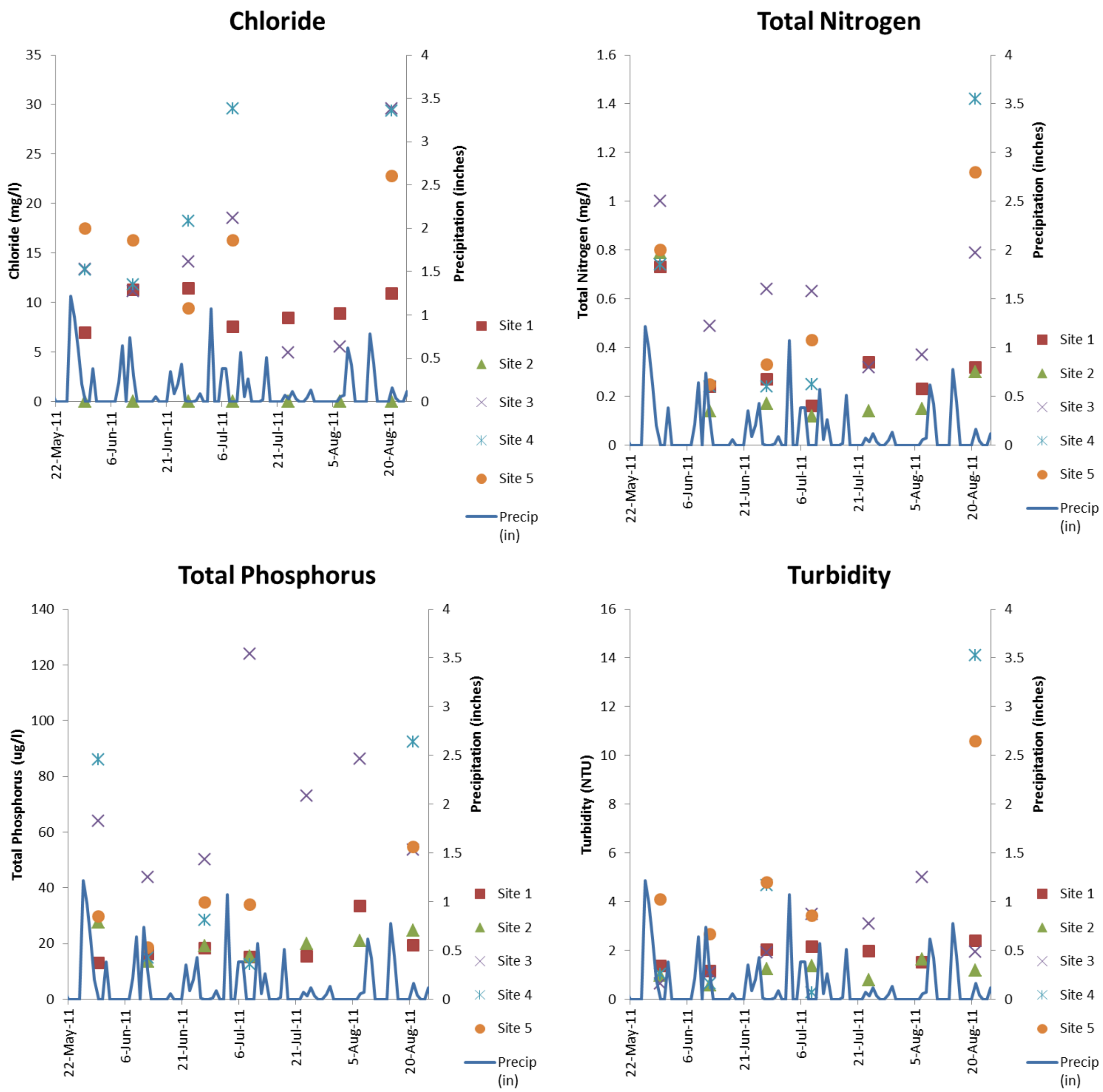

Figure 2. Concentrations of chloride, total nitrogen, total phosphorus and turbidity at each of the five sites, for each sampling event for the 2011 Lake Iroquois Monitoring Program with daily precipitation totals from Burlington International Airport.