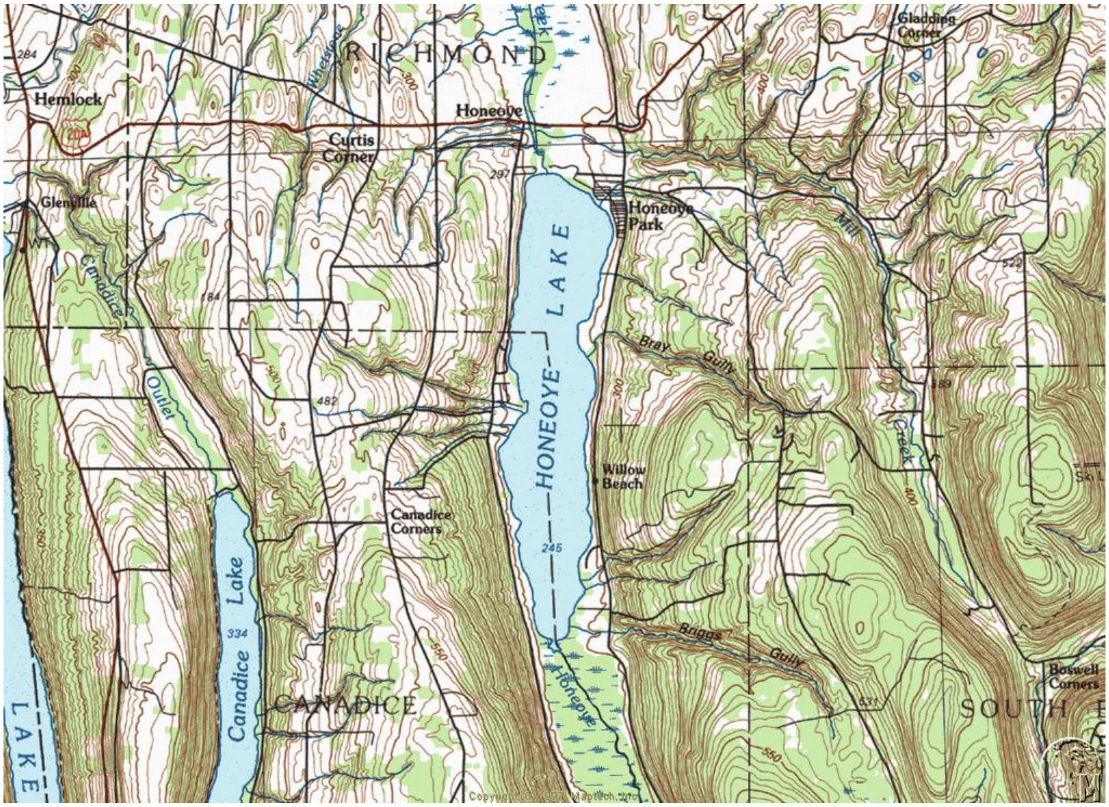
Water Quality Monitoring on Cratsley Gully and Honeoye Inlet, Part of the Honeoye Lake Watershed



Prepared for the Ontario County Planning Department

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June 2003

Executive Summary

1. A goal of this study was to initiate a monitoring program of the Honeoye Lake watershed.

2. Discharge monitoring stations were installed on Cratsley Gully and Honeoye Inlet, two subwatersheds of Honeoye Lake, to continuously measure discharge and automatically take water samples during events and non-events.

3. Ontario County Soil and Water District personnel also took stream water samples from Cratsley Gully and Honeoye Inlet from August 1999 to June 2002. Water samples were taken automatically and manually during both non-event and hydrometeorlogical event of streams. At Cratsley Gully, nine non-event samples and thirty-two event samples were taken, while at Honeoye Inlet, three non-event and twenty-three event samples were taken. Water samples were analyzed for total phosphorus, nitrate+nitrite, total suspended solids, total Kjeldahl nitrogen and sodium.

4. Concentrations of total phosphorus, total suspended solids and total Kjeldahl nitrogen were significantly higher during events versus non-events on both streams.

5. Cratsley Gully had high event concentrations of total phosphorus, total Kjeldahl nitrogen and total suspended solids. One event in May of 2000 had exceedingly high concentrations (3,098 µg/L for total phosphorus, 13,395 mg/L for total suspended solids and 25,800 µg/L for total Kjeldahl nitrogen). This is evidence that a substantial source(s) of nutrients and soil exist within the Cratsley Gully watershed. As a reference point, the concentration of phosphorus in Cratsley Creek stream water during the 12 May event exceeds the maximum allowable concentration (1 mg P/L) of effluent discharge from sewage treatments plants. This source(s) should be identified though a process known as stream segment analysis.

6. The Cratsley Gully mean event total suspended solids concentration was higher than any of the twenty-three Canandaigua Lake tributaries. The Cratsley Gully value is impacted by the maximum concentration of 13,395 mg/L observed on 12 May 2000 - level never approached in the three years of monitoring the Canandaigua Lake watershed. The high demonstrated and potential soil loss from the Cratsley Gully sub-watershed to Honeoye Lake during events is of concern. A stream segment analysis should be considered to identify the source(s).

7. Event nitrate concentrations are relatively low when compared to the watershed of Canandaigua Lake in that only two of the twenty-three watersheds have a lower mean nitrate concentration. Non-event concentrations were similar to the Canandaigua Lake sub-watersheds.

8. Event concentrations from Honeoye Inlet tend to be similar to the highest concentrations observed in Canandaigua Lake. For example, mean event phosphorus (217 µg/L), total Kjeldahl nitrogen (1220 µg/L) and total suspended solids (197 mg/L) concentrations were similar to Sucker Brook and Vine Valley in the Canandaigua Lake watershed. That is, the concentrations are high, but on a concentration basis, not as much of a concern as Cratsley Creek.

9. The stream monitoring stations were operated with mixed success. A period of 69 days from 15 September 1999 to 22 November 1999 was successfully monitored for discharge, nutrient and material loss from the Cratsley Gully subwatershed. Although event conditions were evident only 28% of the time, events contributed 64% of the discharge, 94% of the total phosphorus, 90% of the nitrate, 98% of the total suspended solids, 86% of the total Kjeldahl nitrogen and 60% of the sodium lost from the Cratsley Gully sub-watershed.

10. A comparison of a Cratsley Gully's 69 days of continuous monitoring to other watersheds in western and central New York State suggests that Cratsley Gully is moderately impacted by phosphorus. As discussed in the text, this result has to be viewed with caution because of small number of days of discharge data. A comparison of Honeoye Inlet to other New York creeks was not possible due to the lack of discharge data.

11. During the study period, the flow of water in Cratsley Gully was very intermittent. This may allow more of the constituents monitored to be stored within the watershed until they are released during the next runoff event. This may explain the extremely high concentrations during some of the events monitored. Cratsley Gully flows less often, but when it does, the constituents that are dissolved or carried from the watershed in the stream water are higher. The only way to determine if losses from the sub-watersheds are significant is to do an annual study of both discharge and water chemistry as was originally designed. However, monitoring stations require a minimum of weekly site visits to calibrate and download the stored information to ensure the operation of the equipment and validity of the data.

12. In summary, concentration (mg/L) data suggests that losses of phosphorus, total Kjeldahl nitrogen and soils from the Cratsley Gully sub-watershed to Honeoye Lake can be substantial - especially during events. Loading data (kg/day or kg/ha/day) suggest moderate losses from the watershed. However, the loading data is not conclusive by the fact that over three years of daily discharge data only 69 days were interpretable for Cratsley Creek and none for Honeoye Inlet. That is, the estimate of loss of nutrients and soils from both sub-watersheds is of limited use.

Recommendations

1. While the concentration data is of high quality, the estimates of loss of nutrients and soil from both sub-watersheds is of limited value. If loading data is required, another study is required to obtain the information.
2. The occasional high event losses of nutrients and soils from Cratsley Creek suggest a major source(s) with in this subwatershed. A segment analysis or stressed stream analysis is suggested as a mechanism of identifying sources. Possible sources are discussed in the text include soil erosion, manure spreading and malfunctioning "On Site Waste Water Treatment Plants" (OSWTS).

Introduction

Honeoye Lake is located 28 miles south of Rochester in southwestern Ontario County. With a surface area of 1,772 acres and a watershed area of 36.7 square miles (95 square kilometers), Honeoye Lake is the second smallest of the eleven Finger Lakes (NYSDEC Region 8). Honeoye Lake, which has a short water retention time (0.8 yr, Schaffner and Oglesby 1978) and a maximum depth of only 30 feet (~10m), receives nutrients from natural runoff, the sediments, and from human activities in the watershed (Gilman, 2001). As a result, Honeoye Lake is eutrophic experiencing high productivity most likely due to high levels of phosphorus (Gilman, 2001). Water inflow from the watershed was estimated as 27.8 x 10^6 m^3/yr in the early 1970s (Schaffner and Oglesby 1978). Land use data from 1971 included forest (80.7 km^2, 85%), active agriculture (9.1 km^2, 10%), inactive agriculture (3.6 km^2, 4%), and residential (1.6 km^2, 2%) (Schaffner and Oglesby 1978). Although the land use data requires an update, the watershed is still heavily forested.

The most prominent use of Honeoye Lake is for water-based recreation. According to the New York State Department of Environmental Conservation (NYSDEC), Honeoye Lake is "a highly regarded fishing lake" (NYSDEC Region 8). Walleye, largemouth bass, smallmouth bass, and chain pickerel are co-dominant sportfish species. The lake supports an excellent panfish fishery (NYSDEC Region 8). Walleye were first stocked into Honeoye around the turn of the century and are presently the only species stocked (8.7 million fry annually) into the lake (NYSDEC Region 8). The NYDEC's current management emphasis is to control panfish and alewife populations through maintaining a relatively high density of predator species (NYSDEC Region 8).

The presence of soluble, sedimentary rocks in the watershed of the Finger Lakes determines the chemical regimes comprising the lakes (Schaffner and Oglesby 1978). As the rest of the Finger Lakes, Honeoye Lake has an abundance of calcium and bicarbonate ions (Schaffner and Oglesby 1978). Nitrate + nitrite values for Honeoye Lake in 1993 (mean = 0.02 mg/L) were significantly lower ($P<0.02$) than levels from 1973 (mean = 0.07 mg/L) (Crego 1994). In 1973, Honeoye Lake had the highest total phosphorus (TP) concentration of the eight Finger Lakes examined (21.7 µg/L, August) (Schaffner and Oglesby 1978). However, there were no significant differences in total phosphorus and soluble reactive phosphorus (SRP) concentrations from 1973 to 1993 (Crego 1984).

During the summer, Honeoye Lake's deepest waters are not completely oxygenated and experience algal blooms that impair water quality (NYSDEC Region 8). Eelgrass, pondweed, Eurasian milfoil, and water stargrass are the predominant rooted aquatic plant species that are found in near shore areas out to a depth of approximately 15 feet (~5m) (NYSDEC Region 8). The large macrophyte community (weeds) and the reoccurring blooms of algae on the lake are in part the driving force of this study. Excess nutrients, especially phosphorus, can be a major cause of an over abundance of macrophytes and algae. One source of nutrients to a lake is losses from watershed. The goal of this study was to document the level of nutrient and soil loss from the watershed into Honeoye Lake.

DEFINITIONS

Total Phosphorus- A measure of all forms of the element phosphorus. Phosphorus is an element required for plant growth on land or in water. In lakes, phosphorus is often the limiting factor of phytoplankton growth and is the cause of eutrophication, or overproduction of lakes. Phosphorus may enter a watershed in soluble or organic form from several sources including sewage, heavy-duty detergents, fertilizer and agricultural waste. Some forms of phosphorus are more available to and cause more immediate activity in plants.

Soluble Reactive Phosphorus- A measure of the most available and active form of phosphorus.

Nitrates + Nitrites- A measure of the soluble forms of nitrogen used readily by plants for growth. Sources of nitrates in the environment are many and include barnyard waste and fertilizer.

Total Kjeldahl Nitrogen- The Kjeldahl method is a convenient method of analysis for nitrogen but cannot be used for all types of nitrogen compounds. It is, however, a good measure of organic nitrogen, including ammonia. Manure, for example, contains a large amount of organic nitrogen.

Sodium- A measure of the mineral, most commonly found as sodium chloride (NaCl), dissolved in water. NaCl naturally occurs in deep layers of local bedrock. Mined, it is stored and spread as a de-icing agent on roads and other pavements.

Total Suspended Solids - A measure of the loss of soil and other materials suspended in the water. Water-borne sediments act as an indicator, facilitator and agent of pollution. As an indicator, they add color to the water. As a facilitator, sediments often carry other pollutants, such as nutrients and toxic substances. As an agent, sediments smother organisms and clog pore spaces used by some species for spawning.

Methods

Ontario County Soil and Water District personnel were responsible for field operations including servicing of stream monitoring stations and transfer of electronic data and water samples to SUNY Brockport. Continuous monitoring stations (ISCO Model 6700 automated samplers with a flow module) were installed by SUNY Brockport at Cratsley Gully and Honeoye Inlet (Figure 1). Unfortunately, the monitoring stations were operated with mixed success. When the data were transferred to Brockport, it was discovered that a period of only 69 days (15 September 1999 to 22 November 1999) of the entire August 1999 to June 2002 period was successfully monitored for discharge from the Cratsley Gully subwatershed. None of the discharge data from the Honeoye Inlet were retrievable. Several discussions with the technician did not resolve the data transfer problem.

Water samples (automated and grab) were taken during events and non-events successfully. Events are hydrometerologic events; that is, any increase in stream height greater than 2.54 cm per hour triggered the sampling unit. The event samples represent a composite of hourly samples taken every hour during an event. In addition, "grab" samples were occasionally taken. At Cratsley Gully, nine non-event samples and thirty-two event samples were taken. Three non-event and twenty-three event samples were taken from Honeoye Inlet. Water samples were frozen and transported to SUNY Brockport for water chemistry analysis. Water samples for nitrate analysis were filtered (0.45 um filter) in the field to remove bacteria. Water samples were analyzed for total phosphorus, nitrate+nitrite, total suspended solids, total Kjeldahl nitrogen and sodium.

All sampling bottles were pre-coded so as to ensure exact identification of the particular sample and cleaned routinely with phosphate-free RBS. Prior to sample collection, containers were rinsed with the water being collected. In general, all procedures followed EPA standard methods (EPA 1979) or Standard Methods for the Analysis of Water and Wastewater (APHA 1999). Detailed methodology is provided below

Water Chemistry:

Total Phosphorus: Raw water was digested using the persulfate digestion procedure prior to analysis by the automated (Technicon autoanalyser) colorimetric ascorbic acid method (APHA 1999).

Nitrate + Nitrite: Dissolved nitrate + nitrite nitrogen analyses were performed by the automated (Technicon Autoanalyser) cadmium reduction method (EPA 1979, APHA 1999).

Sodium: Sodium was determined by atomic absorption spectrophotometry (Perkin-Elmer 3030) (APHA 1999).

Total Kjeldahl Nitrogen: Analysis was performed using a modification of the Technicon Industrial Method 329-74W/B. The following modifications were performed: In the sodium salicylate-sodium nitroprusside solution, sodium nitroferri-cyanide (0.4g) replaced the concentrated nitroprusside stock solution. The reservoir of the autoanalyser was filled with 0.2M H_2SO_4 instead of distilled water. Other reagents were made fresh prior to each analysis.

Total Suspended Solids: APHA (1999) Method 2540D was employed for this analysis.

Stream Velocity: Stream velocity was measured at equally spaced locations in either a culvert or cement channel of a bridge under a road with a Gurley flow meter (Chow 1964).

Rating Curve and Cross-Sectional Area: Stream cross-sectional area for Cratsley Gully at various stream depths within the bridge underpass was calculated by planimetry after measuring the cross-sectional dimensions (Figure 2a). A rating curve (stream level versus discharge) for Cratsley Gully was constructed and used for the 69 days of continuous monitoring (Figure 2b).

Watershed Areas: The watershed areas for Cratsley Gully and Honeoye Inlet were delineated by Ontario County SWCD and transmitted to SUNY Brockport.

Nutrient Loading: Daily nutrient and sediment loadings from the Cratsley Gully watershed were calculated by multiplying the discharge on the day of the sample by the concentration of the nutrient or solids from the appropriate water sample. Hourly event samples were composited into an ascending and descending sample of the event hydrograph. These ascending and descending concentrations were than multiplied by the corresponding discharge to obtain loss of nutrient or soils (kg/day).

Quality Assurance Internal Quality Control: Multiple sample control charts (APHA 1999) were constructed for each parameter analyzed, except total suspended solids. A prepared quality control solution was placed in the analysis stream for each sampling date. If the control solution was beyond the set limits of the control chart, corrective action was taken and the samples re-run.

External Quality Control: The Water Chemistry Laboratory at SUNY Brockport is State and Nationally certified through the National Environmental Laboratory Accreditation Conference (NELAC - EPA Lab Code # 01449) and New York State Department of Health's Environmental Laboratory Approval Program (ELAP - # 11439). This program includes biannual proficiency audits, annual inspections and good laboratory practices documentation of all samples, reagents and equipment. A proficiency result for the laboratory is presented in Table 1.

Results and Discussion

Tributary Concentration:

Concentration is the amount of a nutrient or a material per unit volume of water. Table 2 presents the water chemistry data from miscellaneous undefined sites at Honeoye Lake submitted to SUNY Brockport for analysis. We have no further information about these sites other than the sample label name and date so consequently the raw data is presented without further analysis except to indicate that total phosphorus and total Kjeldahl nitrogen values are exceptionally high. For example, total phosphorus at BRAY exceeded 6.5 mg/L and TKN reached 13 mg/L at site 159.

Tables 3 and 4 present the non-event and event concentrations of total phosphorus, nitrate, total Kjeldahl nitrogen, sodium and total suspended solids for Cratsley Gully and Honeoye Inlet from August 1999 to June 2002. In general, there are large differences between non-event and event concentrations.

Total phosphorus:

Phosphorus is an element required for plant growth whether on land or in the water. In lakes, phosphorus is often the limiting factor of phytoplankton growth and is the cause of eutrophication or overproduction of lakes. Phosphorus may enter a stream from the watershed as a result of sewage disposal, heavy fertilizer use for lawns or agriculture and through erosion of soil. Watersheds that have streams with high phosphorus concentrations are potentially the cause of increased phytoplankton and macrophyte (weed) production in lakes. The Cratsley Gully mean total phosphorus concentration was nearly 16 times higher during events than during non-event conditions (468.6 versus 29.4 µg P/L, Table 3). High losses of phosphorus also occur during events in Honeoye Inlet (Table 4). The mean non-event total phosphorus concentration was 17.4 µg P/L while mean event concentration was 216.7 µg P/L. During hydrometeorologic events, water running across the watershed carries nutrients and soil (dissolved and suspended) off the land and into streams.

There were four events where total phosphorus concentrations in Cratsley Gully exceeded 1 mg P/L (1000 µg P/L), with a maximum concentration of 3,098 µg P/L occurring during an event in May of 2000. At Honeoye Inlet, the maximum phosphorus concentration was 719.6 µg P/L during an event in November of 2001. Concentrations of a limiting nutrient at this high range suggest major sources of this nutrient in this sub-watershed. As a reference point, effluent discharge from sewage treatment plants cannot exceed 1000 µg/L in the Great Lakes. These values observed in these streams are significantly higher than what is allowable for sewage treatment plant effluent.

Nitrate:

Nitrate is a soluble form of nitrogen that is readily taken in by plants and can stimulate their growth. Mean non-event nitrate concentrations were 0.26 mg N/L for Cratsley Gully and 0.12 mg N/L for Honeoye Inlet. During events, mean nitrate concentrations increased to 0.34 mg N/L in Cratsley Gully (Table 3) and to 0.31 mg N/L in Honeoye Inlet (Table 4). Maximum observed concentrations of nitrate were 1.15 and 1.14 mg N/L in Cratsley Gully and Honeoye Inlet, respectively. In general, nitrate loss from these watersheds does not appear to be large.

Total suspended solids:

Total suspended solid (TSS) concentrations in stream water generally reflect the amount of suspended materials (e.g., soils) being lost from a watershed. Mean non-event total suspended solids concentrations were relatively low in the Honeoye Lake subwatersheds (20.8 mg/L in Cratsley Gully and 8.0 mg/L in Honeoye Inlet). In contrast, mean event concentrations increased over 4000% in Cratsley Gully to 944 mg/L (Table 3) and over 2000% in Honeoye Inlet to 197 mg/L (Table 4) over the mean non-event TSS concentrations. During some rain events, large amount of soil are being lost by erosion from these sub-watersheds to the lake. Of particular note is the event in Cratsley Gully on 12 May 2000, where total suspended solids reached a concentration of 13,395 mg/L. If discharge data were available, this would probably represent a major movement of soil from the watershed into the lake.

Total Kjeldahl nitrogen:

Total Kjeldahl nitrogen roughly represents the organic nitrogen present. Organic nitrogen would occur from sources such as sewage and animal manure. Similar to total phosphorus and total suspended solids, total Kjeldahl nitrogen (TKN) concentrations increased dramatically during event conditions as runoff scours the watershed of any material on the surface of the land. Mean TKN concentrations in Cratsley Gully increased from 230 (non-event) to 2,170 (event) µg N/L, an 843% increase. The increase in TKN from non-event to event stream conditions in Honeoye Inlet was 336% (280 to 1220 µg N/L, Table 4). The highest concentration of total Kjeldahl nitrogen observed was during the May 12, 2000 event in Cratsley Gully (Table 3), where the TKN concentrations reached 25,800 µg N/L. This is the same date that a large loss of suspended materials/soil and phosphorus occurred from the watershed.

There are two potential sources of TKN, most likely organic nitrogen, in the watershed. Animal manure spread on the surface of the land, particularly in areas of steep slopes and/or on snow, is readily washed off the landscape and into streams. Another possibility is onsite wastewater treatment plants (OSWTS) commonly found in these subwatersheds. The Uniform Procedures Program (UPP), which involves a standardized inspection of home wastewater treatment systems in the Ontario County Soil and Water District, has observed over a five-year period that at least fifty percent of the systems inspected have had some problems (DeRue, Personal Communication). Besides organic nitrogen, losses of phosphorus from these systems could be high.

Sodium:

Higher concentrations of sodium usually reflect the use of deicing salt in the watershed during the winter and spring seasons. Average sodium concentrations were significantly higher in

Cratsley Gully (mean = 57.13 mg/L) than in Honeoye Inlet (mean = 17.05 mg/L) ($p<0.05$). In Cratsley Gully, average sodium concentrations decreased during events (mean non-event = 71.32 mg/L, mean event = 52.70 mg/L, Table 3) as either the sodium in the stream was diluted by rain or melted precipitation or sample dates were skewed seasonally either toward or away from winter and spring, where road deicing salt is prevalent in the environment. In Honeoye Inlet (Table 4), the mean sodium concentration for non-event conditions was 3.53 mg/L (range = 0.68 to 6.07 mg/L) with a mean of 18.81 mg/L (range = 0.71 to 105.20 mg/L) for events. The high sodium concentrations in Cratsley Creek during non-events suggests a source of salt in the watershed – either natural or anthropogenic.

<u>Loss of Nutrients and Soil from the Cratsley Gully Subwatershed</u>:

Loading is the amount of nutrients and soil that is lost from the watershed and carried by the stream water into Honeoye Lake. Unlike concentration, loading considers the volume of water being lost from the watershed per day and concentration of the pollutant. Loading is often expressed as kilograms of nutrient per day lost from the watershed or the amount per day entering the lake. Unlike concentration data, loading considers the volume of water lost from the watershed and its concentration. Thus loading provides a better representation of the actual amount of soil and nutrient being lost from the subwatersheds and deposited into the lake than concentration.

Unfortunately numerous problems were encountered in running the continuous monitoring station required to get discharge. As a result, little or no usable data from the streamside data loggers was generated. Some limited comparisons and interpretation are provided below. The best set of continuous discharge is for Cratsley Gully from 15 September 1999 to 22 November 1999, a total of 69 days; 54 days of non-event discharge and 15 days of event discharge occurred

For the period, the mean daily discharge was 17,735 m^3/day, with 64.2 % of the total discharge occurring during event conditions. Mean daily total phosphorus loss was 1.3 kg/day or 2.01 g/ha/day on an areal basis, with non-event loss at a rate of 0.1 kg/day and event loss at 5.6 kg/day. Nitrate was lost from the watershed at a rate of 4.7 kg/day (0.6 kg/day non-event, 19.7 kg/day event). The loss rate for total suspended solids was 731.4 kg/day with 98.5% of the loss occurring during event conditions. Total Kjeldahl nitrogen was lost at a rate of 6.1 kg/day; 23.9 kg/day lost during events and 1.1 kg/day lost during non-event conditions. The loss rate for sodium from Cratsley Gully was 1,123 kg/day. In summary, although event conditions were evident only 28% of the time, events contributed 64% of the discharge, 94% of the total phosphorus, 90% of the nitrate, 98% of the total suspended solids, 86% of the total Kjeldahl nitrogen and 60% of the sodium lost from the Cratsley Gully watershed.

Comparisons with Other Watersheds:

Cratsley Gully

Concentration Comparisons:

Twenty-three tributaries of nearby Canandaigua Lake were monitored utilizing a mix of non-event and event stream condition grab samples over a three-year period from 1997-2000 Makarewicz and Lewis, 1998). The Canandaigua data set offers an opportunity to compare sub-watersheds during events and non-event as an indicator of nutrient and soil loss problem in the Honeoye Lake watershed (Tables 5 and 6). The Cratsley Gully mean event total suspended solids and total phosphorus concentrations were higher than any of the twenty-three Canandaigua Lake tributaries (Table 5). It is important to note that the Cratsley Gully values are skewed by the maximum concentrations observed on 12 May 2000. For example, the total suspended solids concentration of 12 May (3,395 mg/L) represents a concentration never approached in the three years of monitoring in Canandaigua Lake watershed. A high level of soil loss, which contains phosphorus, is occurring in the Cratsley Gully watershed during events. A stressed stream analysis (segment analysis) should be considered to identify the source(s) of this high level of loss from the watershed to Honeoye Lake. Total Kjeldahl nitrogen concentrations are also relatively high compared to the large number of sub-watersheds monitored in the nearby Canandaigua Lake watershed (Table 5), while Honeoye event nitrate concentrations are relatively low when compared to the sub-watershed of Canandaigua Lake. Only two of the twenty-three Canandaigua sub-watersheds have a lower mean nitrate concentration than the two Honeoye Creek tributaries. Non-event concentrations were similar to the Canandaigua Lake watersheds.

In general, the flow in Cratsley Gully was very intermittent during the study period. This may allow more of the constituents monitored to be stored within the watershed until they are released during the next runoff event. This may explain the extremely high concentrations during some of the events monitored. In other words, Cratsley Gully flows less often but when it does the constituents that are dissolved or carried with the water are higher. The only way to determine if losses from the sub-watersheds are significant is to do an annual study of both discharge and water chemistry as was originally designed.

Loading Comparisons

The various creeks of the Irondequoit Bay watershed (Monroe County, NY.) have been identified as grossly polluted prior to remedial action (O'Brien and Gere 1983). Similarly, Northrup Creek (central Monroe County), which receives effluent from a sewage treatment plant, is known to be polluted and to possess a higher loading of phosphorus than creeks in the Irondequoit Bay watershed (Makarewicz 1988). A comparison of a Cratsley Gully's 69 days of continuous monitoring to other creeks in western and central New York State is instructive in identifying the relative condition of this creek (Table 7). Compared to the other watersheds, on an areal basis, Cratsley Gully appears to be releasing a moderate amount of phosphorus. Loadings are similar to those from Irondequoit Creek post-sewage diversion and Oak Orchard Creek in Genesee and Orleans Counties, a watershed whose land-use is primarily agriculture. This conclusion has to be viewed with extreme caution because of the small amount of discharge data available for Cratsley Gully.

Comparisons for Honeoye Inlet

Event concentrations from Honeoye Inlet tended to be similar to the highest concentrations observed in Canandaigua Lake. For example, mean event phosphorus (217 µg/L), total Kjeldahl nitrogen (1220 µg/L) and total suspended solids (197 mg/L) concentrations were similar to Sucker Brook and Vine Valley. That is, the concentrations are high, but on a concentration basis, not as much of a concern as Cratsley Creek.

Acknowledgements

Corey Laxson, Daniel White, Roger Ward, Heather Halbritter, Betsy Damaske and Peter D'Aiuto of SUNY Brockport aided in the analysis of water samples. We especially thank Tom DeRue for review of the final report!

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Table 1. Results of the semi-annual New York State Environmental Laboratory Assurance Program (ELAP Lab # 11439, SUNY Brockport) Non-Potable Water Chemistry Proficiency Test, July 1999. Score Definition: 4 (Highest) = Satisfactory, 3 = Marginal, 2 = Poor, 1 = Unsatisfactory. Other audits are available for each year of the study with similar results.

Analyte	Mean/Target	Result	Score
Solids, Total Suspended	18.3 mg/L	18.2 mg/L	4
Hydrogen Ion (pH)	6.00	5.96	4
Kjeldahl Nitrogen, Total	14.70 mg/L	15.60 mg/L	4
Phosphorus, Total	1.56 mg/L	1.59 mg/L	4
Total Alkalinity Alkalinity	94.60 mg $CaCO_3$/L	98.32 mg $CaCO_3$/L	4
Nitrate (as N)	14.80 mg/L as N	13.33 mg/L as N	4
Orthophosphate (as P)	0.914 mg/L as P	0.920 mg/L as P	4
Chloride	180.0 mg/L	183.2 mg/L	4
Calcium, Total	20.30 mg/L	19.54 mg/L	4
Magnesium, Total	13.00 mg/L	14.22 mg/L	4
Potassium, Total	5.03 mg/L	5.29 mg/L	4
Sodium, Total	35.70 mg/L	36.68 mg/L	4

Table 2. Water quality concentrations for samples taken from miscellaneous tributaries in the Honeoye Lake watershed. TP = total phosphorus, TSS = total suspended solids, TKN = total Kjeldahl nitrogen.

Sample Label	Date Collected	TP (µg P/L)	Nitrate (mg N/L)	TSS (mg/L)	TKN (µg N/L)	Sodium (mg/L)
Mueller - Event	03/11/00	20.4	0.45	15.3	50	7.40
Affilter Ck	04/04/00	212.0	0.22	278.2	820	24.99
HLP	05/12/00	3966.2	0.34	5825.0	7920	11.06
159	05/12/00	1910.7	0.10	8600.0	12900	5.17
AFF	05/12/00	3358.2	0.17	4700.0	6960	8.54
BRAY	05/12/00	6890.2	0.06	10620.0	6300	8.31
BRIGGS	05/12/00	3387.2	0.06	4750.0	5400	4.15
Honeoye grab	10/05/00	105.4	0.34	85.6	580	34.84
Honeoye Unamed Trib	04/06/01	287.8	0.40	427.0	1610	6.40

Table 3. Seasonal event and non-event chemistry of Cratsley Gully. TP = total phosphorus, TSS = total suspended solids, TKN = total Kjeldahl nitrogen, NA = not available due to a cracked bottle from freezing the sample.

Cratsley Gully Event	Date	TP (µg P/L)	Nitrate (mg N/L)	TSS (mg/L)	TKN (µg N/L)	Sodium (mg/L)
Event grab	08/20/99	2861.1	1.08	3419.0	4650	32.34
to 8/21 comp	08/20/99	50.3	0.7	63.9	600	50.28
First flush grab	09/16/99	257.6	0.42	27.2	560	40.82
Comp 9/16-17	09/16/99	100.7	0.53	59.0	580	53.10
Grab - Event	09/30/99	60.5	0.22	15.0	370	49.89
Comp 9/30-10/1	10/01/99	24.2	0.41	30.6	260	66.05
Event grab	10/13/99	272.1	0.19	27.0	330	58.56
Comp 10/13-14	10/14/99	94.9	0.4	75.6	470	54.90
Event grab	11/12/99	127.0	0.14	41.1	500	94.20
Event grab	01/04/00	40.5	<0.02	9.2	170	57.66
Cratsley Grab	03/12/00	19.3	0.16	8.6	< 25	88.10
Cratsley Event	03/12/00	44.2	0.27	33.8	30	107.54
Cratsley Event	03/25/00	14.8	0.12	22.9	90	96.74
Cratsley Grab	03/25/00	11.4	0.08	15.3	< 25	76.10
Cratsley Comp	04/08/00	335.2	0.17	2161.4	4710	56.81
Cratsley - 1st flush	04/08/00	373.5	0.14	499.3	1320	69.17
Cratsley grab 0930	05/12/00	3097.7	0.28	13395.0	25800	31.79
Cratsley Event comp	05/12/00	1042.0	0.17	2317.5	4080	25.99
Cratsley grab 0850	05/12/00	929.3	<0.02	2372.5	3280	41.88
Honeoye event comp	10/5-10/6	106.6	0.30	80.6	648	33.22
Honeoye comp	7/16-7/17	174.2	0.99	428.0	1670	33.06
Honeoye-Cratsley Storm/Melt	4/6/2001	942.4	0.40	1057.5	850	46.60
Honeoye Cratsley Grab	8/31/2001	755.5	0.89	850.5	1260	33.62
Honeoye Cratsley Grab	11/29/2001	418.9	<0.02	240.8	980	36.71
Honeoye Cratsley Grab	3/27/2002	15.7	0.19	15.3	300	73.36
Honeoye Cratsley 1st Flush	3/20/2002	300.2	0.50	352.4	1500	62.92
Honeoye Cratsley Comp Event	3/20-21/2002	267.8	0.27	469.0	2360	49.16
Honeoye Cratsley Event Grab	4/2/2002	51.2	0.89	98.0	1470	75.84
Honeoye Cratsley Comp Event	4/2-3/2002	490.9	0.23	187.0	1950	22.18
Honeoye Cratsley Event Grab	5/31/2002	160.3	0.25	102.0	1080	38.55
Honeoye Cratsley Event Grab	6/4/2002	1073.1	0.25	1210.0	5100	23.03
Honeoye Cratsley Comp Event	6/4-5/02	481.8	0.20	528.6	2410	26.15
Mean		468.6	0.34	944.2	2170	52.70
Minimum		11.4	<0.02	8.6	< 25	2.18
Maximum		3097.7	1.08	13395.0	25800	107.54
Standard Error		129.5	0.05	429.2	805	4.22

Cratsley Gully Non-event	Date	TP (µg P/L)	Nitrate (mg N/L)	TSS (mg/L)	TKN (µg N/L)	Sodium (mg/L)
Baseline	10/05/99	11.1	0.07	1.3	130	71.57
Baseline	12/14/99	41.4	0.02	17.4	550	79.46
Honeoye Cratsley Grab	1/30/2001	67.4	1.15	23.6	210	94.47
Honeoye-Cratsley Winter baseline	3/23/2001	16.0	0.26	2.5	500	88.00
Honeoye Cratsley Grab	11/25/2001	62.3	<0.02	42.5	240	72.55
Honeoye Cratsley Grab	1/29/2002	18.4	0.23	20.0	< 25	55.48
Honeoye Cratsley Grab	2/1/2002	NA	0.41	NA	NA	50.71
Honeoye Cratsley Baseline Grab	3/15/2002	9.6	<0.02	0.8	< 25	95.85
Honeoye Cratsley Baseline Grab	5/24/2002	21.8	0.14	27.2	110	48.35
Honeoye Cratsley Baseline Grab	6/20/2002	16.5	0.32	52.0	330	56.79
Mean		29.4	0.26	20.8	230	71.32
Minimum		9.6	<0.02	0.8	< 25	48.35
Maximum		67.4	1.15	52.0	550	95.85
Standard Error		7.4	0.11	6.0	65	5.67

Table 4. Seasonal event and non-event water chemistry of Honeoye Inlet. TP = total phosphorus, TSS = total suspended solids, TKN = total Kjeldahl nitrogen
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Honeoye Inlet Event		TP (µg P/L)	Nitrate (mg N/L)	TSS (mg/L)	TKN (µg N/L)	Sodium (mg/L)
Inlet Grab	03/28/00	113.4	0.29	46.5	1520	8.52
Inlet Event	03/28/00	65.8	0.25	38.6	790	8.29
Inlet - 1st flush	04/08/00	135.2	0.24	69.5	1060	7.73
Inlet Comp	04/08/00	58.4	0.22	45.5	980	7.07
Inlet Grab	04/21/00	78.2	0.15	53.6	610	1.69
Inlet Comp	04/21/00	156.6	0.12	53.6	470	0.82
Inlet Event Comp	05/12/00	364.8	0.13	258.0	1710	3.04
Inlet Grab	05/12/00	570.3	0.06	327.0	1570	8.79
Lower Inlet grab	05/12/00	289.5	0.26	447.0	2560	3.30
Inlet Grab 0810	05/12/00	547.2	0.03	385.7	6600	4.37
Honeoye-Inlet Comp	4/9-10/2001	98.7	1.14	66.6	500	4.10
Honeoye Inlet Comp	4/6/2001	46.8	0.49	42.5	250	5.02
Honeoye Inlet Grab	4/6/2001	42.5	0.09	40.3	50	2.87
Honeoye Inlet	11/29/2001	719.6	0.95	1549.5	1400	62.32
Honeoye Inlet Grab	1/29/2002	16.0	0.58	12.8	40	105.20
Honeoye Inlet (first flush)	8/31/2001	695.9	<0.02	153.0	< 25	10.23
Honeoye Inlet (first flush)	2/28/2002	6.8	0.39	1.5	< 25	79.28
Honeoye Inlet Grab	2/1/2002	35.9	0.50	31.0	< 25	12.68
Honeoye Inlet Grab (Post Event)	3/21/2002	20.2	0.29	15.5	270	8.24
Honeoye Inlet Partial Comp	3/26-27/02	122.6	0.25	80.5	2090	8.49
Honeoye Inlet Grab	3/26/2002	258.0	0.35	125.0	3630	9.44
Honeoye Inlet Event Comp	4/2-3/02	406.5	0.22	528.8	1240	70.46
Honeoye Inlet Event Grab	4/2/2002	136.1	0.18	160.0	650	0.71
Mean		216.7	0.31	197.0	1220	18.81
Minimum		6.8	<0.02	1.5	<25	0.71
Maximum		719.6	1.14	1549.5	6600	105.20
Standard Error		46.9	0.06	69.0	310	6.12

Honeoye Inlet Baseline		TP (µg P/L)	Nitrate (mg N/L)	TSS (mg/L)	TKN (µg N/L)	Sodium (mg/L)
Honeoye Inlet Baseline	3/15/2002	17.6	0.28	2.6	50	6.07
Honeoye Inlet Baseline Grab	5/24/2002	14.3	0.02	13.4	310	0.68
Honeoye Inlet Baseline Grab	6/20/2002	20.2	0.05	8.0	490	3.85
Mean		17.4	0.12	8.0	280	3.53
Minimum		14.3	0.02	2.6	50	0.68
Maximum		20.2	0.28	13.4	490	6.07
Standard Error		1.7	0.08	3.1	130	1.56

Table 5. Event water chemistry for Honeoye **(bold)** (1999-2002) and Canandaigua Lake tributaries (1997-2000)(Makarewicz and Lewis, 2000). Values include the mean ± the standard error, minimum and maximum concentrations. TP = total phosphorus, TSS = total suspended solids, TKN = total Kjeldahl nitrogen and ND = non-detectable.

Creek	TP (µg P/L)	Nitrate (mg N/L)	TSS (mg/L)	Chloride (mg/L)	TKN (µg N/L)
T1 - Fall Brook	129.6 ± 37.4 (15.1 - 463.6)	2.36 ± 0.65 (0.68 - 9.42)	145.6 ± 55.4 (3.4 - 695.0)	55.5 ± 14.1 (17.6 – 237.3)	1085 ± 204 (390 - 3060)
T2 - Deep Run	149.7 ± 54.2 (9.9 - 648.8)	2.22 ± 0.60 (0.33 – 9.10)	150.0 ± 60.1 (2.5 - 635.0)	47.9 ± 9.4 (16.8 – 135.9)	1073 ± 186 (380 - 2960)
T3 - Gage Gully	170.9 ± 57.1 (10.1 - 672.1)	3.24 ± 0.68 (0.48 – 10.70)	104.8 ± 48.8 (2.2 - 596.2)	60.0 ± 14.0 (18.0 – 192.8)	1165 ± 225 (280 - 3480)
T4 - Fisher Gully	70.4 ± 19.1 (10.1 - 298.6)	0.90 ± 0.20 (0.19 – 3.19)	61.8 ± 26.1 (0.8 - 386.0)	10.9 ± 1.5 (5.5 – 25.2)	548 ± 85 (110 - 1390)
T5 - Upper Vine Valley	511.4 ± 206.5 (23.5 - 2703.0)	1.79 ± 0.29 (0.37 - 3.86)	144.9 ± 61.1 (1.6 - 861.0)	31.8 ± 4.0 (13.5 - 56.6)	3181 ± 1669 (480 - 26080)
T6 - Lower Vine Valley	233.1 ± 99.4 (15.6 - 1506.6)	0.98 ± 0.16 (0.12 - 2.31)	128.4 ± 41.3 (1.4 - 519.0)	22.0 ± 2.0 (12.6 – 36.2)	1293 ± 530 (200 - 8400)
T7 - Upper West River	202.2 ± 66.5 (20.1 - 1000.8.)	1.35 ± 0.24 (0.28 - 3.54)	164.0 ± 62.1 (<0.1 - 915.0)	38.5 ± 5.0 (17.7 – 77.2)	1132 ± 226 (310 - 3780)
T8 - Lower West River	74.2 ± 19.7 (12.2 - 288.9)	0.57 ± 0.11 (0.04 - 1.39)	27.7 ± 12.2 (1.8 - 191.0)	28.0 ± 2.2 (16.4 – 47.6)	785 ± 150 (160 - 1820)
T9 - Clark Gully	33.0 ± 7.7 (7.1 - 121.2)	0.44 ± 0.18 (0.01 – 2.63)	46.0 ± 15.0 (0.1 - 167.5)	4.6 ± 0.5 (2.6 – 8.9)	289 ± 44 (25 - 610)
T10 - Conklin Gully	43.1 ± 10.3 (2.8 – 131.1)	0.14 ± 0.04 (0.01 - 0.59)	57.7 ± 22.0 (0.3 – 328.0)	7.5 ± 0.8 (3.7 – 12.5)	292 ± 77 (ND - 950)
T11 - Naples Creek	181.7 ± 67.7 (9.7 – 977.2)	0.55 ± 0.06 (0.28 – 1.10)	253.4 ± 104.8 (7.2 – 1530.0)	20.4 ± 1.7 (11.0 - 33.0)	811 ± 181 (80 - 2580)
T13 - Cooks Point	92.5 ± 39.5 (8.6 – 603.3)	0.45 ± 0.05 (0.19 - 0.90)	120.4 ± 53.9 (0.6 – 809.0)	93.4 ± 12.7 (33.4 – 192.3)	601 ± 188 (25 - 3030)
T14 - Hicks Point	37.9 ± 12.5 (6.2 - 179.2)	0.44 ± 0.07 (0.17 – 1.23)	49.4 ± 26.3 (0.1 - 400.5)	46.8 ± 6.0 (18.5 - 98.3)	368 ± 98 (25 - 1540)
T15 - Seneca Point	106.4 ± 26.8 (8.6 - 406.2)	0.43 ± 0.07 (0.15 – 1.12)	73.6 ± 23.3 (0.1 - 327.0)	35.9 ± 4.3 (16.5 – 77.9)	715 ± 90 (140 - 1230)
T16 - Barnes Gully	35.3 ± 7.9 (8.9 – 115.8)	0.46 ± 0.06 (0.14 - 0.89)	42.5 ± 13.6 (0.2 - 136.5)	59.2 ± 9.9 (22.4 - 157.4)	391 ± 61 (90 - 970)
T17 - Menteth Gully	50.9 ± 10.8 (8.0 – 140.5)	0.62 ± 0.10 (0.24 - 1.71)	52.0 ± 15.1 (0.8 - 213.0)	46.7 ± 5.3 (22.5 – 83.9)	538 ± 59 (70 - 900)
T18 - Tichenor Gully	84.7 ± 20.9 (13.5 - 270.7)	0.89 ± 0.15 (0.36 - 2.52)	51.8 ± 18.4 (4.3 - 282.7)	43.0 ± 5.8 (15.7 – 95.3)	861 ± 90 (330 - 1460)
T19 - Upper Sucker Brook West Branch	202.5 ± 46.6 (5.5 - 553.5)	1.90 ± 0.62 (0.25 - 8.94)	75.8 ± 19.9 (14.2 - 296.0)	83.5 ± 13.7 (34.9 – 239.0)	1206 ± 123 (470 - 2310)
T24 - Tannery Creek	34.4 ± 5.0 (8.3 - 52.2)	0.32 ± 0.07 (0.14 - 0.65)	19.3 ± 6.1 (5.5 - 59.7)	11.1 ± 1.7 (5.6 - 19.6)	458 ± 109 (25 – 1100)
T25 - Eelpot Creek	92.6 ± 26.9 (22.1 - 185.7)	0.88 ± 0.10 (0.47 – 1.37)	156.5 ± 50.3 (9.3 – 443.0)	20.1 ± 2.1 (12.5 – 30.5)	620 ± 147 (180 – 1300)
T26 - Reservoir Creek	223.2± 119.1 (7.5 - 1017.0)	0.88 ± 0.25 (0.47 – 2.64)	122.8 ± 47.1 (18.8 – 428.2)	27.8 ± 4.6 (11.4 – 48.6)	524 ± 160 (25 – 1550)
T27 – Grimes Creek	44.2 ± 9.6 (13.1 - 78.7)	0.56 ± 0.09 (0.34 – 1.08)	80.6 ± 30.2 (7.5 - 261.0)	19.1 ± 2.5 (11.0 – 29.8)	410 ± 80 (90 - 800)
TSB - Sucker Brook Station	227.1 ± 36.2 (22.0 - 503.9)	1.23 ± 0.24 (0.39 – 4.32)	85.4 ± 22.3 (5.0 - 295.7)	80.2 ± 12.0 (33.8 – 212.9)	1182 ± 122 (660 - 2500)
Cratsley Gully	**486.6 ±130 (11.4 –3098)**	**0.34±.05 (.02-1.08)**	**944±429 (8.6-13,395)**	No data	**2,170±805 (25-25,800)**
Honeoye Inlet	**216.6±46.9 (6.8-720)**	**0.31±.06 (.02-1.14)**	**197±69 (1.5-1550)**	No data	**1,220±310 (25-6,600)**

Table 6. Baseline water chemistry for Honeoye (**bold**) (1999-2002) and Canandaigua Lake tributaries (1997-2000)(Makarewicz and Lewis, 2000). Values include the mean ± the standard error. Values in parentheses are the minimum and maximum concentrations. TP = total phosphorus, TSS = total suspended solids, TKN = total Kjeldahl nitrogen and ND = non-detectable.

Creek	TP (µg P/L)	Nitrate (mg N/L)	TSS (mg/L)	Chloride (mg/L)	TKN (µg N/L)
T1 - Fall Brook	20.1 ± 4.4 (2.5 – 103.6	1.47 ± 0.20 (ND – 3.63)	6.8 ± 2.2 (<0.1 - 54.8)	69.7 ± 8.0 (33.0 - 187.7)	522 ± 68 (70 - 1340)
T2 - Deep Run	15.5 ± 4.9 (1.2 - 123.3)	1.68 ± 0.43 (ND – 8.45)	4.8 ± 1.4 (<0.1 - 32.0)	51.0 ± 5.9 (2.0 – 136.9)	365 ± 44 (60 - 1050)
T3 - Gage Gully	23.6 ± 4.1 (6.9 – 120.8)	2.08 ± 0.52 (0.02 - 13.91)	4.3 ± 1.7 (<0.1 - 52.3)	61.7 ± 6.3 (28.5 - 177.9)	435 ± 49 (25 – 980)
T4 - Fisher Gully	27.0 ± 5.3 (4.4 – 113.5)	0.41 ± 0.07 (ND – 1.33)	4.7 ± 1.5 (<0.1 - 29.5)	19.6 ± 5.8 (4.8 – 138.4)	317 ± 62 (25 - 1150)
T5 - Upper Vine Valley	39.4 ± 6.2 (3.5 - 143.0)	1.12 ± 0.20 (ND - 3.77)	3.9 ± 1.0 (<0.1 - 21.8)	24.6 ± 2.4 (0.8 – 47.4)	515 ± 79 (70 - 2120)
T6 - Lower Vine Valley	23.9 ± 1.9 (3.2 - 49.0)	0.57 ± 0.11 (0.02 - 2.16)	4.3 ± 1.7 (<0.1 - 55.0)	26.5 ± 1.4 (15.2 - 47.3)	377 ± 47 (25 - 1220)
T7 - Upper West River	68.1 ± 11.6 (2.5 – 262.0)	0.87 ± 0.17 (ND – 3.48)	11.2± 1.8 (<0.1 – 44.7)	47.3 ± 2.4 (26.4 – 79.4)	640 ± 75 (70 - 1650)
T8 - Lower West River	72.5 ± 9.2 (3.2 - 223.5)	0.38 ± 0.09 (ND - 1.64)	12.4 ± 2.9 (1.0 - 90.3)	35.2 ± 1.3 (20.8 - 52.6)	782 ± 79 (70 - 2070)
T9 - Clark Gully	9.4 ± 1.4 (3.8 – 26.9)	0.09 ± 0.02 (ND - 0.23)	3.7 ± 1.4 (0.1 - 20.4)	4.2 ± 0.4 (1.7 – 8.0)	210 ± 53 (25 - 660)
T10 - Conklin Gully	8.3 ± 0.8 (1.2 – 23.3)	0.18 ± 0.04 (ND - 0.66)	2.4 ± 0.4 (0.1 - 8.3)	9.7 ± 0.9 (3.7 – 25.2)	203 ± 41 (25 - 1100)
T11 - Naples Creek	7.6 ± 1.4 (0.6 – 38.1)	0.69 ± 0.04 (0.25 - 1.27)	2.5 ± 0.5 (<0.1 - 12.3)	25.4 ± 1.1 (17.3 - 51.1)	203 ± 35 (25 - 1030)
T13 - Cooks Point	13.7± 1.7 (1.2 – 52.8)	0.37 ± 0.03 (0.05 - 0.92)	8.0 ± 3.2 (<0.1- 109.4)	92.4 ± 4.0 (47.4 – 146.8)	302 ± 61 (25 - 1920)
T14 - Hicks Point	11.4 ± 2.2 (2.9 – 35.2)	0.24 ± 0.03 (0.08- 0.50)	1.6 ± 0.4 (0.1 - 6.2)	41.7 ± 2.8 (23.9 - 69.8)	191 ± 41 (25 - 590)
T15 - Seneca Point	92.5 ± 21.7 (5.8 - 616.3)	0.43 ± 0.08 (0.05 -2.24)	4.8 ± 1.1 (0.1 - 26.6)	53.7± 3.7 (24.9 – 113.2)	369 ± 54 (25 – 1160)
T16 - Barnes Gully	16.2 ± 3.2 (4.7 – 112.5)	0.31 ± 0.06 (<0.02 – 1.79)	3.8 ± 1.0 (0.1 - 22.0)	78.7 ± 6.2 (36.0 – 170.6)	323 ± 46 (25 - 1120)
T17 - Menteth Gully	7.2 ± 0.8 (1.2 – 27.5)	0.36 ± 0.04 (0.02 - 0.98)	2.5 ± 0.5 (<0.1- 10.7)	61.0 ± 3.1 (35.0 – 101.5)	314 ± 49 (25 - 1130)
T18 - Tichenor Gully	19.2 ± 1.9 (8.5 - 64.0)	0.59 ± 0.10 (<0.02 – 2.19)	7.5 ± 3.2 (0.1 – 99.4)	47.8 ± 3.4 (19.8 – 99.0)	457 ± 57 (60 - 1200)
T19 - Upper Sucker Brook West Branch	50.1 ± 6.1 (5.4 -112.4)	1.39 ± 0.31 (0.02 – 6.18)	7.1 ± 1.6 (1.0 – 33.2)	208.9 ± 78.7 (47.5 - 1849.5)	663 ± 61 (<25- 1280)
T24 - Tannery Creek	22.4 ± 4.4 (9.0 - 98.8)	0.15 ± 0.03 (ND - 0.46)	12.2 ± 5.7 (0.1 - 111.0)	16.3 ± 0.9 (9.5 – 29.8)	245 ± 41 (25 - 710)
T25 - Eelpot Creek	16.0 ± 6.4 (3.3 - 144.9)	0.90 ± 0.08 (ND - 1.45)	3.9 ± 0.9 (0.1 – 17.7)	18.9 ± 0.7 (13.4 - 28.7)	245 ± 59 (25 - 1030)
T26 - Reservoir Creek	11.0 ± 2.8 (2.4 – 64.1)	0.47 ± 0.07 (0.03 – 1.17)	3.2 ± 0.7 (0.1 - 11.8)	25.2 ± 1.4 (12.8 – 35.8)	197 ± 59 (25 - 1140)
T27 – Grimes Creek	7.4 ± 1.8 (1.2 – 38.2)	0.88 ± 0.06 (ND - 1.29)	1.6 ± 0.4 (0.1 - 5.3)	18.7 ± 0.7 (12.2 - 23.8)	168 ± 46 (25 - 1000)
TSB - Sucker Brook Station	87.8 ± 9.5 (24.6 – 242.0)	0.99 ± 0.19 (<0.02 – 5.06)	7.6 ± 1.8 (0.7 – 58.8)	121.9 ± 6.7 (11.9 - 187.6)	687 ± 62 (40 - 1820)
Cratsley Gully	**29.4±7.4** **(9.6-67.4)**	**0.26±0.11** **(0.02-1.15)**	**20.8±6.0** **(0.8-52.0)**	**No data**	**230±65** **(25-550)**
Honeoye Inlet	**17.4±1.7** **(4.3-20.2)**	**0.12±.08** **(0.02-0.28)**	**8.0±3.1** **(2.6-13.4)**	**No data**	**280±130** **(50-490)**

Table 7. Comparison of phosphorus loading in subbasins of Honeoye Lake, the Irondequoit Bay watershed, other Monroe County creeks, tributaries of Sodus and Port Bays, and Lake Neatahwanta tributaries. Irondequoit basin data are from 1980-81 (O'Brien and Gere 1983). Data from other Monroe County creeks are from 1987-88 (Makarewicz 1988). Wayne County creek data from 1991-93 are from Makarewicz et al. (1991, 1992, 1993, 1998 and 1998a), and Makarewicz and Lewis (1998, 1999). All data except for this study are for an annual period (i.e., mean annual daily loading).

Subbasin or Creek	Land Use	Total Phosphorus Loading	
		Annual Daily Average (g P/ha/d)	
Cratsley Gully	**90% forested**	**2.01**	
Sucker Brook	Agriculture/Urban	7.66	
Irondequoit Creek at Browncroft Blvd. 1975-77 (pre-diversion)	Several Sewage Plants	5.60	
1978-79 (post-diversion)		2.00	
Larkin	Suburban	0.70	
Buttonwood	Suburban	1.58	
Lower Northrup	Sewage Plant	6.64	
Upper Northrup	Urban	3.23	
First	Forested	0.11	
Clark	Forested	0.22	
Sodus East	Agriculture	8.57	
Wolcott	Agriculture	5.01	
Bobolink	Forested	0.02	
Sheldon	Muckland	27.41	
Summerville	Suburban	5.47	
		1997-98	1998-99
Oak Orchard		3.48	2.86
Johnson		1.81	1.17
Sandy		0.98	0.77
		1998-99	1999-00
Twelvemile Creek East	Agriculture	0.5	0.26

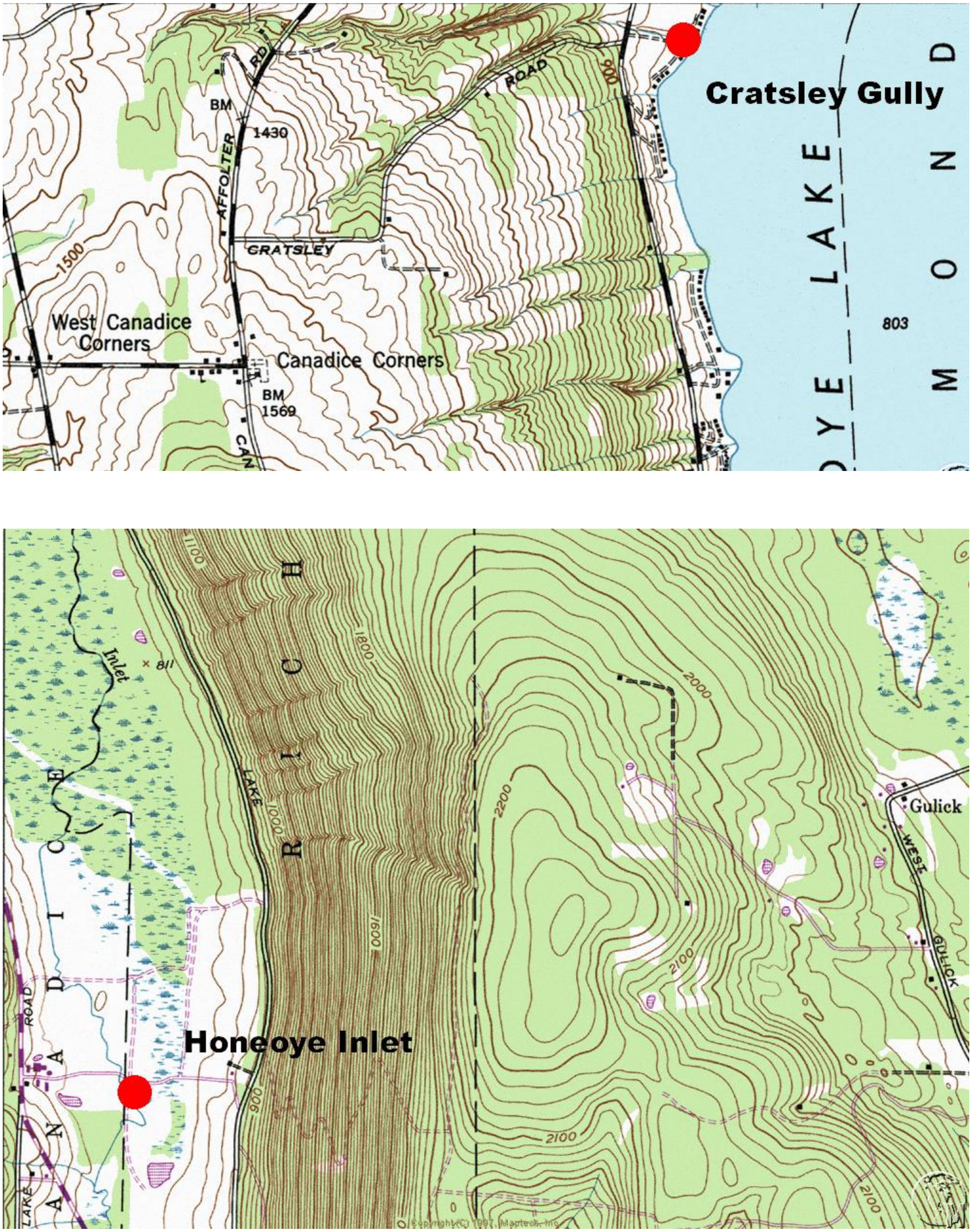
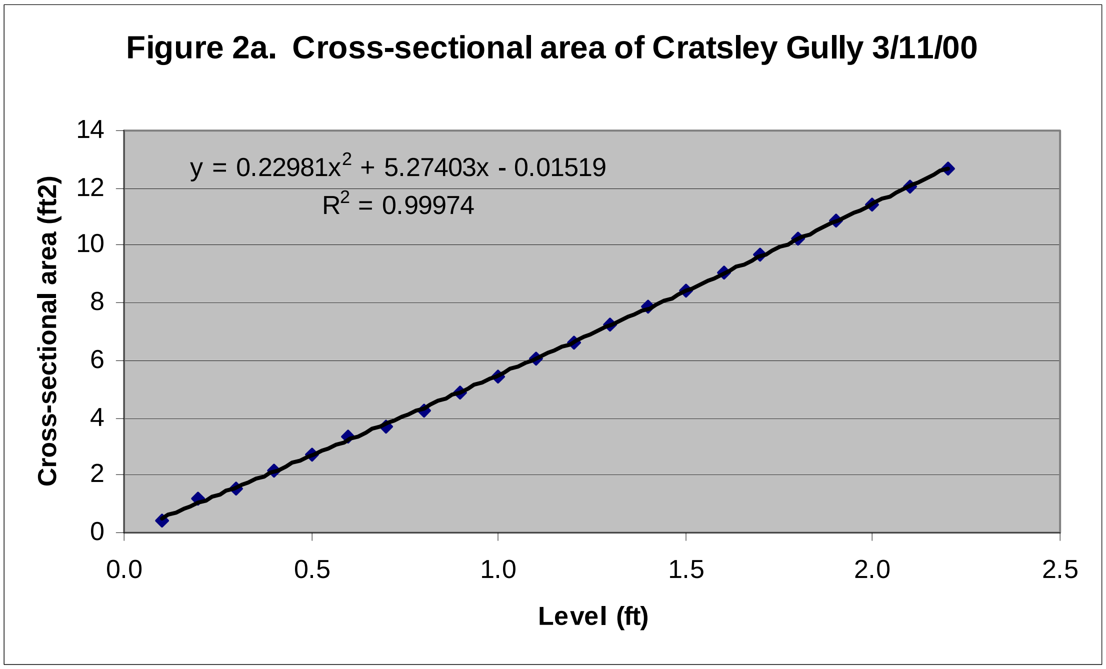


Figure 1. Maps showing the locations of the sampling sites on Cratsley Gully and Honeoye Inlet.



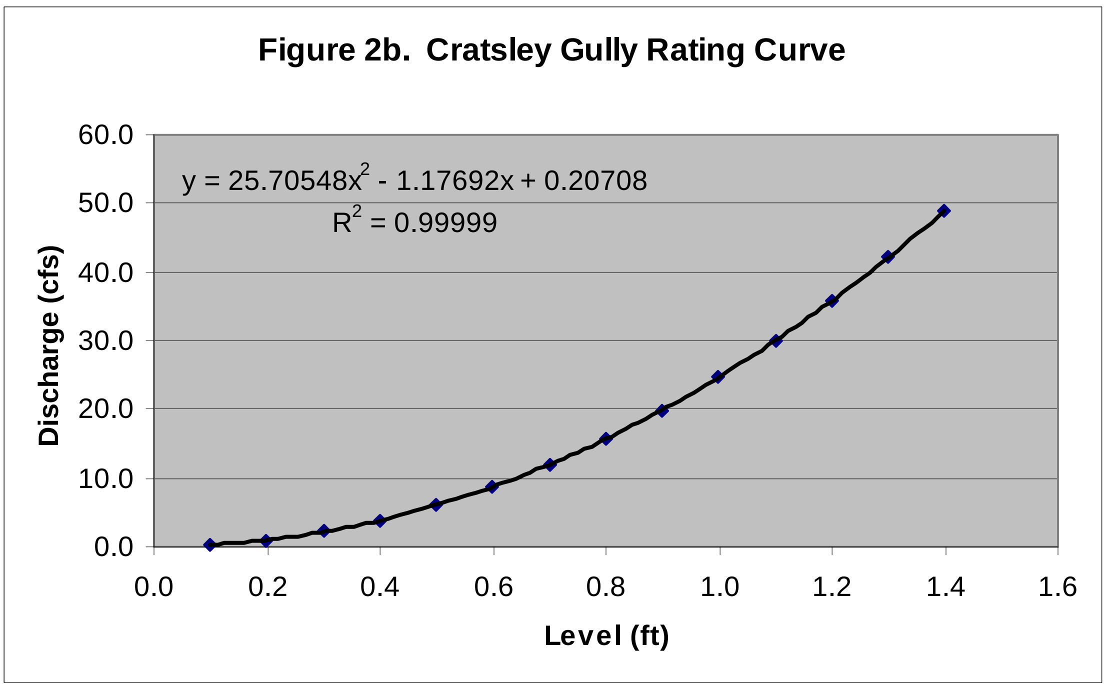


Figure 2. (a) The cross-sectional area of Cratsley Gully on 11 March 2000 and the rating curve (b) of Cratsley Gully used in the determination of discharge. Data for these curves were provided by the Ontario County SWCD.