Community Science Institute www.communityscience.org
Volunteer Monitoring Watershed Science Risk Communication

Volunteer Monitoring in the Six Mile Creek Watershed

2005 Monitoring Proposal to the Towns of Caroline, Dryden and Ithaca
and the City of Ithaca

Introduction

In 2004, the Towns of Caroline, Dryden and Ithaca and the City of Ithaca jointly funded a proposal entitled "Volunteer Monitoring in the Six Mile Creek Watershed." This proposal aimed to develop a water quality monitoring program that was spearheaded by citizen volunteers and supported by three agencies: the Community Science Institute (CSI), Cornell Cooperative Extension of Tompkins County (CCETC) and the Tompkins County Soil and Water Conservation District (TCSWCD). The 2004 program has been a success, thanks largely to the interest of Six Mile Creek residents and their willingness to donate time for monitoring activities. A core group of some 15 volunteers took part in workshops on surveying, sampling and analysis techniques. Volunteers performed a total of three monitoring events in 2004, two for chemical, physical and bacteriological indicators at 13 sampling sites and one for biological indicators at six sampling sites. All sampling sites were selected by volunteers with input from agency personnel. Certified analyses of chemical, physical and bacteriological indicators were performed by the CSI lab. Biological indicators (benthic macroinvertebrates, or BMI) were analyzed by the volunteers themselves using the Tier 2 protocol in the Hudson Basin River Watch Guidance Document. In December 2004, a Six Mile Creek Volunteer Monitoring Symposium was held at which monitoring data were presented and discussed by volunteers and agency staff. First-year program activities and results are described in the Six Mile Creek Volunteer Monitoring Program 2004 Final Report, which is available separately.

At their regular monthly meeting on 31 January 2005, Six Mile Creek volunteers discussed the 2005 monitoring program. Volunteers were also given an opportunity to comment on a draft of this proposal. Thus, the program proposed for 2005 is based on mutual goals and objectives shared by volunteers and the agencies submitting this proposal (CSI, CCETC and TCSWCD).

284 Langmuir Lab/Box 1044 95 Brown Road Ithaca NY 14850 Voice/Fax 607 257 6606
Certified Water Testing NYSDOH-ELAP #11790 EPA Lab Code NY01518
Stephen Penningroth Executive Director <director@communityscience.org>

Goals and Objectives

The general goals for 2005 are similar to those for 2004: continue building a volunteer monitoring program and collecting water quality data that can be used to characterize Six Mile Creek watershed health and to manage water resources over the long term; and continue to offer water quality monitoring as an opportunity for the public to learn more about water resource management issues. Specific 2005 program objectives include:

1. Continue outreach and recruitment of new volunteers to the monitoring program;
2. Continue hosting and facilitating monthly meetings of Six Mile Creek volunteers;
3. Determine the water quality of surface water during base flow and storm runoff events. Provide laboratory support for volunteers on five chemical/physical/bacteriological monitoring events, including two under base flow conditions in the spring and summer and three under high flow conditions in the spring, summer and fall;
4. Support flow measurements by volunteers during chemical sampling events in the spring, summer and fall;
5. Provide technical support for volunteers on one benthic macroinvertebrate sampling event in the summer;
6. Archive all certified monitoring data from 2004 and 2005 in an MS Excel database and make the database available to interested parties; and
7. Hold a Six Mile Creek volunteer monitoring symposium in November or December 2005.

These objectives are described in detail below.

Volunteer outreach and recruitment

Volunteers are the foundation of the Six Mile Creek monitoring program. While the response and commitment of volunteers has been nothing short of spectacular, some attrition is inevitable. An ongoing infusion of new volunteers will help sustain the program while extending its educational benefits to greater numbers of people. New volunteers can learn from those with more experience. Thus, additional training workshops should not be necessary.

Monthly meetings

Six Mile Creek volunteers have established a meeting time of 6 - 8 PM on the fourth Monday of the month at Cooperative Extension at 615 Willow Ave., Ithaca. These monthly meetings, which are facilitated by Tania Schusler from CCETC and Steve Penningroth from CSI, provide a forum for volunteers to plan monitoring events and discuss results. Monthly meetings provide important organizational and conceptual continuity for the volunteer program and should be continued.

Chemical monitoring events

Rationale: A generally recommended minimum monitoring frequency is twice per season, once under base flow and once during storm runoff (high-flow conditions). Under base flow conditions, water quality is determined primarily by the hydrogeology of

groundwater. When flow is elevated after a rain or snow melt event, water quality is characterized by a mixture of groundwater and runoff. One reason monitoring under elevated flow conditions is important is that comparison of water quality under base and elevated flow conditions can provide evidence of impacts on specific monitoring sites. Another reason monitoring under elevated flow conditions is important is that, while elevated flow prevails only on a limited number of days during a year, this is when approximately 90% of phosphorus, nitrogen, sediment and bacterial loadings to Six Mile Creek and Cayuga Lake are expected to occur.

Frequency: A total of five chemical sampling events are proposed for 2005:

Spring: Two monitoring events: One base flow and one storm runoff;
Summer: Two monitoring events: One base flow and one storm runoff; and
Fall: One storm runoff event.

This schedule builds on the 2004 program when two sampling events were conducted in September and November under base flow and near base flow conditions (see 2004 Final Report). Volunteers decided it was not necessary to repeat a base flow sampling event in the fall of 2005. With regard to the lack of winter sampling, volunteers decided that in view of limited financial resources, sampling in spring, summer and fall should take priority.

Sample collection: Volunteers will continue to collect grab samples. Recently, CSI and TCSWCD collaborated to evaluate the representativeness of grab samples compared to width- and depth-integrated samples collected at the same locations. TCSWCD staff collected one width- and depth-integrated sample and one grab sample from each of four locations on Salmon Creek, Fall Creek, the Cayuga Inlet and Taughannock Creek under somewhat elevated flow conditions on January 12, 2005. CSI analyzed each pair of samples for nitrite- + nitrate-nitrogen. Differences ranged from 1% to 6%, well within the error of the analytical method. These results suggest that grab samples collected by volunteers are representative of water quality.

Certified laboratory tests: It is proposed that samples be analyzed for a set of nutrient, solid, mineral and bacteriological water quality parameters that is similar to those tested in 2004 with the exception of four parameters: ammonia-nitrogen, chemical oxygen demand, total solids and dissolved oxygen. Volunteers, in consultation with agency staff, decided to exclude these parameters for the following reasons. Ammonia-nitrogen and chemical oxygen demand were found to be at or near background level in the September 2004 monitoring event. Moreover, total nitrogen, not ammonia, is of principal concern with regard to tracking nutrient levels. Total nitrogen is equal to the sum of two measurements: nitrite/nitrate-nitrogen and Total Kjeldahl Nitrogen. Total Kjeldahl Nitrogen, in turn, is the sum of organic nitrogen plus ammonia-nitrogen. Thus, a separate test for ammonia is not necessary in order to determine total nitrogen. Also eliminated was a determination of total solids, because volunteers considered the salient parameter for estimating sediment loads to be total suspended solids; turbidity was retained as an indirect measure of total suspended solids. Finally, volunteers dropped dissolved oxygen from the list of analytes because the BMI results they obtained at six locations in 2004

indicated oxygen concentrations were good throughout the Six Mile Creek watershed. They decided to wait to measure dissolved oxygen until such time as BMI results suggested water quality might be impaired. The final proposed list of 14 water quality parameters is as follows:

Minerals: pH, conductivity, alkalinity, total hardness, chloride, sulfate
Solids: Total suspended solids, turbidity
Nutrients: Total phosphorus, soluble reactive phosphorus, nitrate- + nitrite-nitrogen, total Kjeldahl nitrogen
Bacteria: Total coliform, E. coli

Possible cost savings on mineral analyses: Volunteers and agency staff recommend that six mineral parameters be determined under base flow conditions in spring and summer 2005 monitoring events. Taken together with the monitoring event in November 2004, this will round out the characterization of groundwater hydrogeology in every season except winter. It is recommended that mineral parameters also be determined for the first elevated flow event in spring 2005. However, if these parameters behave generally as predicted, i.e., if their concentrations are reduced due to dilution by soft water in runoff, then a decision will be made as to whether it is worth the expense of $1,352 to measure minerals again in the two high flow events proposed for summer and autumn.

Assuming a decision is made to measure mineral concentrations in the high flow events proposed for summer and autumn, field measurements have the potential of reducing laboratory costs if volunteers and agency staff perform some analyses at the time of sample collection. For example, volunteers might measure pH using the wide range pH test kit from LaMotte, which is accurate within 0.5 pH units. In addition to pH, some volunteers may also choose to measure alkalinity using a LaMotte test kit. (Note: It is assumed that volunteers will measure water temperature at all sampling locations.)

A second strategy for performing field measurements and saving on lab costs is use of a Hydrolab. The advantage of the Hydrolab is that it performs several measurements simultaneously, including temperature, pH, conductivity and dissolved oxygen. A disadvantage is that there is only one Hydrolab, and it needs to be operated by qualified agency personnel. Thus, the Hydrolab can generally be used at only a subset of the 13 sampling sites during a monitoring event.

If volunteers and agency staff are able to perform field measurements of some mineral parameters, quality control will be accomplished by splitting a small number of samples with CSI's certified lab.

Possible collaboration with USGS: Todd Miller of the USGS office in Ithaca is currently performing a study of groundwater hydrogeology at five sites in upper Six Mile Creek in 2005. Groundwater/surface-water interactions are being investigated as part of that study and USGS will also be sampling five stream sites in 2005 during three events in Upper Six Mile Creek basin. Two of the five USGS sampling sites overlap with the volunteer sampling network (sites #6 and #10). USGS is willing to collaborate sampling efforts and

conduct their sampling at the same time when the volunteers collect their samples during three events. USGS samples are shipped to the USGS lab in Colorado for analysis. Analytes include the four nitrogen and phosphorus nutrients proposed here. Thus, it is possible that $116 could be saved for each volunteer monitoring event in which USGS collects samples from overlapping sites #6 and #10. Logistical considerations may make coordination challenging. Moreover, the two sampling programs have different emphases, i.e., elevated flow events in the volunteer program and base flow conditions in the USGS program. That said, an effort will be made to piggy-back on USGS' nutrient analyses at the two overlapping sites.

Flow Measurements

Dan Karig, a Six Mile Creek volunteer, has taken the lead in measuring flow at five of the 13 sampling locations (see 2004 Final Report, Appendix 3). Dan has indicated that he will continue to measure flow at as many sampling locations as practical during each monitoring event in 2005. These measurements will make it possible to estimate nutrient, sediment and bacterial loadings for specific reaches of Six Mile Creek. USGS personnel may also be available to conduct streamflow measurements during three of the events.

Benthic Macroinvertebrate Sampling and Analysis

Volunteers have expressed satisfaction with the results of the BMI sampling event in November, 2004, as an indication that Six Mile Creek water quality offers good habitat for aquatic life. They have recommended performing a single BMI sampling event in the summer of 2005 as being sufficient. Recognizing the importance of QA/QC and also the limits on the time they are able to commit to this project, volunteers have discussed the possibility of consolidating the efforts of the six BMI teams and reducing the number of BMI sampling locations from six to three. Two teams might each collect and analyze one BMI sample at the same location, and in this way their samples would serve as replicates for QA/QC purposes. Adopting this approach would save volunteer time by avoiding the need for a single team to collect and analyze two replicate samples from a monitoring location.

Archiving and Communication of Monitoring Data

CSI proposes to take responsibility for storing raw data from the volunteer monitoring program in an MS Excel database using the format created by Mr. Pat Reidy, Cortland County Soil and Water Conservation District, for the volunteer monitoring program spearheaded by the Fall Creek Watershed Committee in the Virgil and Fall Creek watersheds. CSI will provide copies of the electronic database to interested parties upon request. It is anticipated that different agencies will find various uses for the Six Mile Creek database. CSI plans to use the database as an aid in highlighting water quality trends and communicating them to volunteers and the general public.

Volunteer Monitoring Symposium

The Six Mile Creek volunteer monitoring symposium held on December 15, 2004 was attended by 22 volunteers, agency staff, and members of the general public. It provided a

forum for volunteers to present their results, to hear feedback from each other and from water quality professionals, and to reflect on what they had accomplished during the year. The symposium was generally regarded as a success. It is proposed that a second Six Mile Creek volunteer monitoring symposium be held in November or December 2005. In addition to volunteers and agency staff, we propose that the general public again be invited as a way of publicizing the program and recruiting new volunteers.

2005 SIX MILE CREEK VOLUNTEER MONITORING PROGRAM BUDGET

COMMUNITY SCIENCE INSTITUTE			
Item	**Cost**	**In-kind**	**Total**
S. Penningroth, Executive Director	$ 3,750		$ 3,750
Fringe on salary (11.25%)	$ 422		$ 422
Student intern		$ 500	$ 500
Consultants		$ 1,250	$ 1,250
Certified analyses of water samples (5 events x 13 sites x 14 parameters x $12.64)	$ 9,360	$ 2,142	$11,502
Thermometers, chemical supplies for pH kits for field measurements by volunteers	$ 100		$ 100
Bookkeeper (12 hours @ $30)	$ 360		$ 360
Travel (10 mi/mtg x 9 mtgs x $0.36/mi)	$ 32		$ 32
Phone	$ 20		$ 20
TOTAL DIRECT COSTS	$14,044	$ 3,892	$17,936
Indirect costs (15%)	$ 2,106	$ 584	$ 2,690
TOTAL COST	$16,150	$ 4,476	$20,626

CORNELL COOPERATIVE EXTENSION OF TOMPKINS COUNTY			
Item	**Cost**	**In-kind**	**Total**
Tania Schusler, Environmental Issues Educator	$ 1,200		$ 1,200
Fringe benefits (In-kind)		$ 480	$ 480
Travel	$ 20		$ 20
Printing and postage for publicity	$ 100		$ 100
Volunteer monitoring symposium	$ 200		
TOTAL DIRECT COSTS	$ 1,520	$ 480	$ 2,000
Indirect costs (15%)	$ 228	$ 72	$ 300
TOTAL COST	$ 1,748	$ 552	$ 2,300

TOMPKINS COUNTY SOIL AND WATER CONSERVATION DISTRICT			
Item	**Cost**	**In-kind**	**Total**
Craig Schutt, Director		$ 1,200	$ 1,200
Gordie Morgan, Conservation Technician		$ 1,250	$ 1,250
TOTAL DIRECT COSTS		$ 2,450	$ 2,450
Indirect costs (15%)		$ 368	$ 368
TOTAL COST		$ 2,818	$ 2,818

BUDGET SUMMARY	
Item	**Total**
Total Agency Cost	$25,744
Less Agency In-kind	$ 7,846
Less TCSWCD contribution toward certified analyses costs (from FL-LOWPA)	$ 5,000
Net Program Cost	$12,898
2005 Municipal Cost (Distributed evenly among T. Caroline, T. Dryden, T. Ithaca, and City of Ithaca)	$ 3,225

Budget Explanation

The proposed budget includes expected staff commitments from involved agencies and significant agency contributions to reduce net program costs. These include consulting, analyses and student intern cost contributions from CSI; fringe contributions from CCETC; and staff time, analyses costs and indirect costs from TCSWCD. TCSWCD analyses cost contributions are funded through a grant from the Finger Lakes - Lake Ontario Watershed Protection Alliance (FL-LOWPA).

Major budget items

CSI Executive Director (Stephen Penningroth): As Project Director, the CSI Executive Director will be responsible for overall project leadership and coordination as well as for the administration of project funds. He will team with Tania Schusler from CCETC to facilitate monthly meetings of the Six Mile Creek volunteer monitoring group. He will respond to all questions from volunteers regarding monitoring techniques and procedures as well as data interpretation. He will assure that volunteer data comply with relevant QA/QC requirements; archive Six Mile Creek volunteer monitoring data in an MS Excel database; and make the database available to collaborating agencies, volunteers and other interested parties upon request. Following the Six Mile Creek Volunteer Monitoring Symposium in December, he will author a final report of volunteer monitoring activities and accomplishments in 2005, including highlights of water quality trends and specific recommendations for future monitoring acivities.

Student intern: CSI is actively recruiting up to two student interns to assist with certified testing, data management and routine lab work. CSI will assume all costs associated with student interns who work on this project.

CSI Consultants: Mr. Pat Reidy, Senior Water Quality Specialist, Cortland County SWCD, will advise CSI and TCSWCD on strategies for creating and managing MS Excel databases of volunteer results and approaches for analyzing trends in water quality data. Mr. Reidy currently advises the Fall Creek Watershed Committee free of charge, and he has generously offered to contribute a limited amount of his time to advising the Six Mile Creek volunteer project, as well. Mr. Eric Evans is network administrator for the Phonetics Lab in the Department of Linguistics, Cornell University, and Secretary of the CSI Board of Directors. He manages CSI's website. Mr. Evans has offered his time to work with the Project Director to develop approaches for presenting and explaining water quality data to diverse audiences, such as creating tables, graphs and other visuals and posting them on CSI's website together with explanatory narratives.

CSI Certified analyses of water samples: As noted above, volunteers decided at their monthly meeting on January 31, 2005 to request that participating municipalities and agencies provide funds for a total of five monitoring events, including two base flow and three storm runoff events. They decided further to eliminate four water quality parameters: chemical oxygen demand, ammonia-nitrogen, total solids and dissolved oxygen as being not directly relevant to the issues of nutrient and sediment loading, bacterial contamination, and hydrogeology that they wish to address.

The market value of the reduced set of 14 water quality parameters is $11,502. This does not include the customary 100% surcharge for evening and weekend work in a lab, which is projected to be approximately $1,300 and which CSI waives for this volunteer-based project. In addition to waiving surcharges, CSI will discount test fees by an in-kind contribution of $2,142 (about 19%) to $9,360. It is proposed that municipalities contribute $4,360 of the discounted analytical costs, while TCSWCD contributes the remaining $5,000 from FL-LOWPA funds. It should be noted that measurement of phosphorus nutrients in the 1 - 10 ppb range is included in the analytical costs.

As noted above, it is possible that volunteers and agency staff will act to reduce the cost of mineral analyses by performing field measurements using test kits and the Hydrolab. Volunteers may also decide to forego some mineral analyses for the summer and autumn high water monitoring events, depending on the results of the high water event in the spring. A small amount of savings on nutrient analyses might also be realized if it proves feasible to coordinate with USGS at two monitoring sites. Any savings in analytical costs will be divided equally among the four participating municipalities.

CCETC Environmental Issues Educator (Tania Schusler): The Environmental Issues Educator will take primary responsibility for identifying and recruiting additional volunteers, coordinating monthly meetings, and assisting with coordination of the volunteer monitoring symposium. She will also assist volunteers, in cooperation with other project staff, with group organization and communication.

TCSWCD Director and Conservation Technician (Craig Schutt and Gordie Morgan): TCSWCD personnel will attend group meetings and collaborate with CSI in helping Six Mile Creek volunteers interpret water quality data. TCSWCD personnel will provide technical assistance to volunteers in the field, as needed, with collecting and preserving samples for analysis and performing measurements with the Hydrolab. TCSWCD has two chemical test kits and will provide those for use by the volunteers if they so desire. TCSWCD will also provide assistance with flow measurements through the use of its flow meter whenever possible. A pilot project to make data accessible to the general public in a web based, GIS format will begin this year in coordination with Dr. Art Lembo at Cornell University. Data from both Sixmile and Fall Creek citizen monitoring groups will be used in the project. TCSWCD will assist with these efforts and obtain the software necessary to accomplish the proposed project. Fall Creek volunteer monitoring data is compiled, managed and stored at the TCSWCD in the MS Excel format described above and it is anticipated that TCSWCD will manipulate that data and the Sixmile Creek data to make it more useable for the web based project.