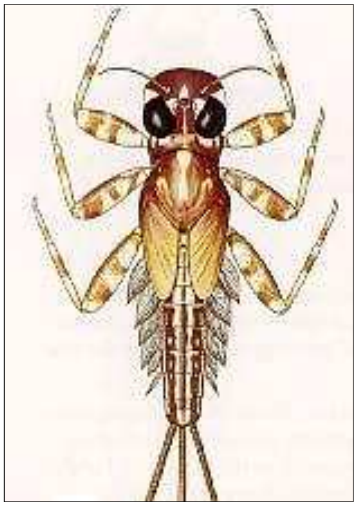
A BIOLOGICAL ASSESSMENT OF SELECTED STREAMS IN HAMILTON COUNTY, NY

2009 Stream Monitoring Report



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Biological Assessment
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Hamilton County, NY

2009 Stream Monitoring Report

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INTRODUCTION

Hamilton County

Hamilton County is situated in the center of the Adirondack Park. It is the third largest county in the state with an area of 1,118,080 acres. It is also the least populated county in the state with, according to the U.S. Census Bureau, a 2008 estimate of 5,021 people. Approximately three-quarters of the county is state owned land. This area is mandated by the State Constitution to be left unaltered by humans. Approximately 89% of the county is forested and over 5% of the land area is water, which includes 77 lakes. The remaining 6% consists of open areas, hamlets, rivers, streams and ponds.

The soils of the county are predominantly shallow, poorly drained, and highly acidic (Krawiecki, 1982). Peat and muck soils are also prevalent. The topography of the county ranges from a low elevation of approximately 780 feet in the southern end of the county to its highest point, Snowy Mountain, with an elevation of 1,188.4 meters.

The main enterprises are tourism and forestry. Tourism is generally confined to areas adjacent to highways, hamlets, and those lakes accessible by road. The forests on private lands are periodically harvested for timber and pulp. State owned timber land is not available for harvest (Krawiecki, 1982).

A History of Benthic Macroinvertebrate Studies in New York State

Benthic macroinvertebrates are defined as bottom-dwelling organisms lacking backbones which are large enough to be visible without a microscope and retained by a U.S. #30 sieve. They live either part or all of their lives in streams in the egg, nymph, larvae, pupae, or adult stages. The New York State Conservation Department conducted their first round of biomonitoring surveys from 1926 to 1939. These surveys proved very useful in documenting many cases of pollution in the state's rivers and streams. In 1972, the New York State Department of Environmental Conservation (NYS DEC) Stream Biomonitoring Unit began using benthic macroinvertebrates in streams to assess water quality and track changes over time (Bode, 1993). There are also a number of high schools, colleges, universities, volunteer organizations and local agencies throughout the state that perform macroinvertebrate studies as part of their educational and research programs.

Rapid Stream Assessment

Rapid stream assessment involves collecting benthic macroinvertebrates from the bottom of streams along with other physical and chemical parameters to assess water quality. Some advantages of using benthic macroinvertebrates as biological indicators of stream water quality include:

- macroinvertebrates are good indicators of site specific conditions because of their inability to migrate from an area,
- these communities are sensitive to conditions existent at the moment, therefore changes in the community will be immediate,
- different macroinvertebrate taxa have a range of pollution tolerances
- macroinvertebrates are present year-round in streams in the egg, nymph, larvae, pupae, or adult life stages,
- this method is relatively easy to complete, inexpensive, produces an abundance of useful information and is easily reproduced.

The stream assessment methods used in this study are based on methods described in Bode *et al*., 1996. This stream assessment approach is an easily reproduced method for assessing stream water quality that requires various types of data collection including physical, chemical and biological information from the stream. The Hamilton County Soil and Water Conservation District will use the results of this study as baseline data to be compared to future studies by the District and other agencies.

PURPOSE

The purpose of this project was to quickly and economically collect baseline data throughout the county using benthic macroinvertebrates as bioindicators of water quality. Since 1993, the Hamilton County Soil and Water Conservation District has been monitoring 21 lakes in the county during the summer months. Priority was given to streams that lead into these lakes, have substantial impacts by humans, and/or are easily accessible.

The purpose of this report is to focus on the data that was collected throughout the study period. This information will be presented in detail so that future water monitoring technicians can go back to the same sites, collect in the same manor and compare results.

METHODOLOGY

Equipment

The method of biological assessment used in this study involves the following equipment: hip waders or water shoes, camera, field data sheets, standard 24 x 46 cm opening kick net, tennis ball, stop watch, Yellow Springs Instrument (YSI) 610-DM multi-probe, meter tape, GPS, Kestrel wind meter, wide mouth sample jars, 99% isopropyl alcohol, rubber gloves, laboratory data sheets, examining pan, forceps, magnifying glass, taxonomic keys, and microscope.

Field Procedure

Before entering the field, potential site locations were chosen based on GIS maps queried for lakes, land use, and infrastructure. Stream depth and velocity were measured in the field to determine if the site met the sampling criteria of stream depth less than 1 m and stream flow of at least 0.4 m/s.

Stream depth was measured at three points in a cross section of the stream using the meter tape. A tennis ball was floated down a 5 m riffle and the time was recorded. This procedure was completed twice, and an average was taken to calculate stream velocity.

When it was determined that a site met the sampling criteria, current weather was noted, air temperature was determined using the Kestrel wind meter, and GPS coordinates were acquired. A YSI multi-probe was used to measure stream water temperature, conductivity, dissolved oxygen, and pH. A visual assessment was made to determine the percent substrate particle size for the sample site. Substrate categories were selected from Environmental Protection Agency (EPA) size categories listed below.

TYPE	**SIZE OR CHARACTERISTIC**
Boulders	> 256 mm
Rubble	64 – 256 mm
Gravel	2 – 64 mm
Sand	0.06 – 2.0 mm
Silt	0.004 – 0.06 mm
Clay	< 0.004 mm

The percent of vegetation covering the banks along the sample area was also determined by a visual assessment.

A kick sample was taken. Starting at the downstream end of the same 5 m riffle where stream flow was recorded, one individual held the kick net in place flush against the bottom of the stream. A second individual stood upstream of the net and disturbed the bottom of the stream by kicking and scraping benthic material with feet and hands. Rocks and logs were overturned and scraped. Dislodged organisms floated downstream into the kick net. The stream bottom was disturbed along the riffle for a distance of five meters for five minutes, working upstream. The contents of the net were then washed into an examining pan and transferred into a labeled wide mouth sampling jar containing 99% ethyl alcohol. Large debris were removed from the pan and inspected for organisms. Samples were then returned to the laboratory for identification.

Laboratory Procedure

In the laboratory, contents of the wide mouth jar were emptied into a sampling tray. To ensure all organisms were emptied into the tray, the jar was washed with water into tray. One hundred organism sub-samples were randomly chosen from each sample. Organisms were then identified to the lowest taxonomic level possible using the taxonomic keys of Peckarsky *et al*. (1990), Merritt and Cummins (1996) and McCafferty (1998). The organisms were returned to preservation jars and stored at the Hamilton County Soil and Water Conservation District office for future reference.

Percent Model Affinity (PMA), Ephemeroptera Plecoptera Trichopter Value (EPT Value), and Hilsenhoff Biotic Index (BI) were calculated. These equations focus on different aspects of stream water quality. PMA compares the sampled results to a model benthic macroinvertebrate community that is not impacted by pollution using percent composition of major taxonomic groups. EPT

is the total number of different mayfly (Ephemeroptera), stonefly (Plecoptera), and caddisfly (Trichoptera) groups. BI determines the degree of stream pollution based on pollution tolerance values of particular benthic macroinvertebrate taxa.

Percent Model Affinity

In order to calculate PMA, samples containing less than 100 organisms were extrapolated to fit into the model. The absolute difference between the number of individuals in the model community and the number of individuals in the sample was calculated for each benthic macroinvertebrate group. The absolute differences were summed, then multiplied by 0.5. This result was then subtracted from 100 in order to determine PMA. Streams were ranked as excellent (PMA greater than 64), good (PMA 50-64), fair (PMA 35-49) or poor (PMA less than 35).

PERCENT MODEL AFFINITY			
GROUPS	NUMBER OF INDIVIDUALS IN SAMPLE	NUMBER OF INDIVIDUALS IN MODEL COMMUNITY	ABSOLUTE DIFFERENCE
Mayflies		40	
Stoneflies		5	
Caddis flies		10	
Midges		20	
Beetles		10	
Worms		5	
All Others		10	
TOTALS	100	100	
PMA = 100 – (TOTAL X 0.5)			

Ephemeroptera, Plecoptera, Trichoptera

EPT value is equal to the sum of the number of different groups of Ephemeroptera, Plecoptera, and Trichoptera. These orders of macroinvertebrates are bioindicators of good water quality, and the greater the number of different EPT groups, the better the health of the stream.

EPT	
EPT GROUPS	NUMBER OF SPECIES (KINDS) IN SAMPLE
Ephemeroptera	
Plecoptera	
Trichoptera	
SUM OF EPT	

Biotic Index

BI is calculated by multiplying the number of individuals in each group by an assigned pollution

BIOTIC INDEX			
ORGANISM	COUNT (A)	BIOTIC VALUE(B)	GROUP BIOTIC VALUE(A x B)
Mayfly		10	
Stonefly		10	
Caddisfly		10	
Dobsonfly		10	
Riffle Beetle		10	
Water penny beetle larva		10	
Beetle larva (other)		8	
Crane fly larva		8	
Scud		6	
Clam		6	
Crayfish		6	
Dragonfly		6	
Damselfly		6	
Black fly		6	
Midge		5	
Snail		4	
Sow bug		2	
Leech		2	
Aquatic worm		0	
TOTAL	100	XXXXX	TOTAL
			INDEX (Total/10)=_____=Biotic Value

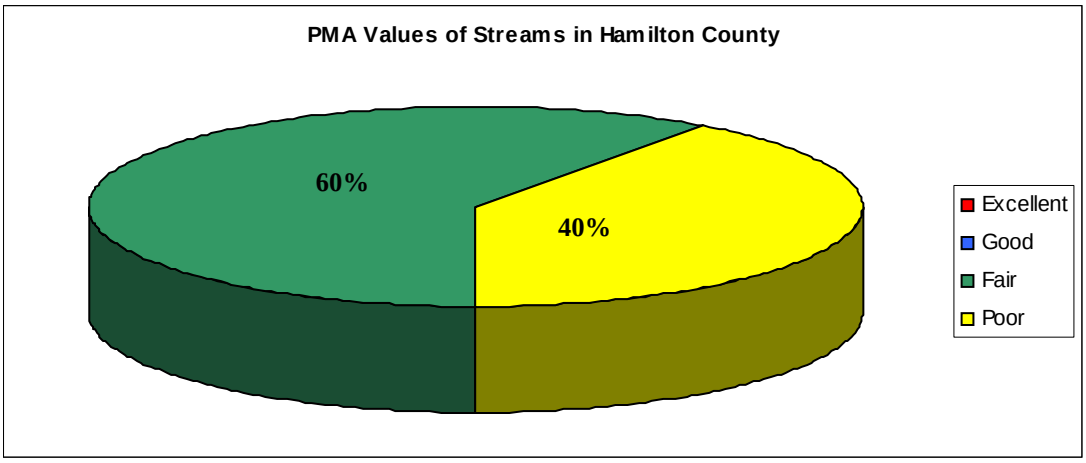
RESULTS

Refer to Figure 1 in the Appendix for a county map with stream site locations. Figure 2 lists all sites with detailed locations and sample dates. Figures 3, 4, and 5 detail the physical and chemical parameters collected at each site. Figure 6 shows the results of the taxa tally as identified in the laboratory. Figure 7 shows extrapolated values. Figure 8 shows EPT results. Figure 9 shows the PMA value, EPT value, and Biotic Index for each stream. Figure 10 shows the ranges for EPT, BI, and PMA values.

Percent Model Affinity

The PMA model compares an actual stream community with an ideal (model) stream community (in New York State) expected to have excellent water quality. This simply compares the percent contribution of 7 major groups of organisms. Hamilton County's PMA values indicate (Figure A):

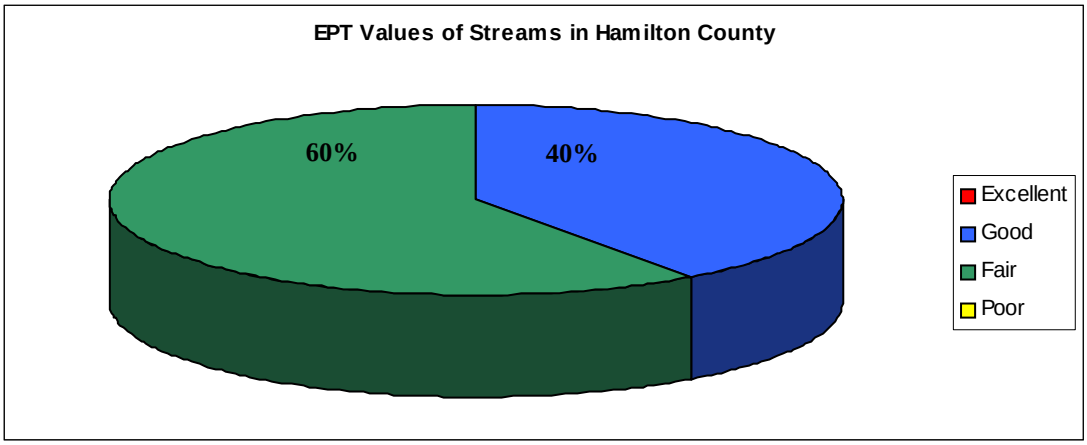
- 0% of streams have excellent water quality
- 0 % of streams have good water quality
- 60 % of streams have fair water quality
- 40 % of streams have poor water quality



Ephemeroptera, Plecoptera, Trichoptera

The EPT value indicates the number of different taxa of mayflies, stoneflies, and caddisflies in each sample. These orders of macroinvertebrates indicate good water quality because they cannot tolerate pollution. Hamilton County's EPT values indicate (Figure B):

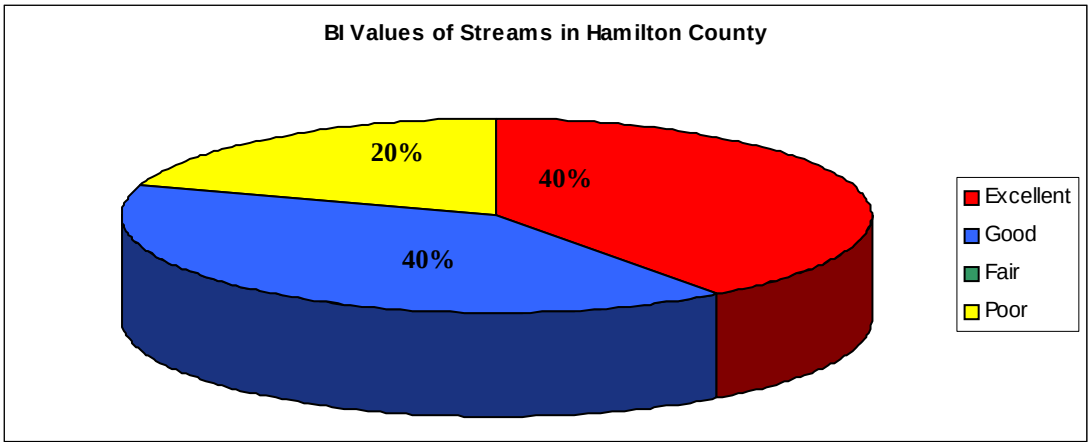
- 0 % of streams have excellent water quality
- 40 % of streams have good water quality
- 60 % of streams have fair water quality



BI

The biotic index values are based on the tolerances of different organisms to pollution. Since some organism are more tolerant than others they are assigned different biotic values (higher values to more sensitive organism). Then it averages all the scores together. Hamilton County's Biotic Index values indicate (Figure C):

- 40 % of streams have excellent water quality



DISCUSSION

The 2009 sampling season was conducted as a continuation of the biological assessment of selected streams within Hamilton County. Sampling was conducted to collect baseline data to be compared with future years. The results of this study are not meant to represent the county as a whole as sites were not chosen to be representative of the county.

The overall macroinvertebrate count for Elbow Creek was significantly down from the average of the three previous years' counts. This may be due to the face that Natural Channel Design was implemented on this stretch of river in 2008. Elbow Creek is a major tributary that enters Lake Algonquin, Wells, NY. In 1996, a severe storm event washed out a section of Glimantown Road. Beadload was carried to flat sections of Elbow Creek where velocity decreased, and cobble and pavement were deposited in the streambed while smaller sediment was deposited in Lake Algonquin. Since then, other storm events have further increased bank erosion as water is deflected off the deposited material in the channel to stream banks. Local landowners suffer from soil erosion, tourism is impacted with decreased fish populations, and the Elbow Creek ecosystem has been adversely impacted. NCD is a fairly new concept to stream restoration that utilizes the natural fluvial geomorphology of a stream to promote stabilization and to reconstruct aquatic and flood plain habitat. NCD was implemented on Elbow Creek, with the restoration goal of decreasing erosion and sediment transport during a bank full event. J-hooks and cross vanes are rock structures that, when placed in a stream and along the bank, diffuse and redirect the energy of the stream to the middle of the channel, reducing bank erosion. This reestablishes the flow of the stream to a more stable, non-erosive state. Pools behind these structures create superb habitat for aquatic life. Structures were installed along a 1900-foot stretch of Elbow Creek. A number of trees that were falling into the channel were re-erected and newly established flood plains were hydroseeded. It is no surprise that macroinvertebrate counts were low following NCD as the ecosystem needs time to recover and stabilize. It is essential to continue to monitor Elbow Creek for benthic macroinvertebrates at the location where NCD was implemented in order to track the health of the stream.

The West Branch of the Sacandaga River was sampled in previous years but at different locations. 2009 yielded 100 organisms for this sample site. 2009 was the first year the Raquette River and the Miami River were monitored, and both streams produced 100 organisms. Sixth Lake Outlet was monitored at the same site location in 2001 and the 2009 overall count was up from 34 to 76. Baseline tally results will be used to draw conclusions in the future.

PMA, EPT, and BI values spanned all categories, however, the majority of streams were classified as excellent, good, or fair, while the minority fell under poor. The majority of streams in the 2009 sampling season showed caddisflies as the dominant taxa. This corresponds well to past data that also showed caddisflies to be the dominant taxa in the majority of streams sampled. All Hamilton County streams sampled over the years showed caddisflies to compose 38% of the benthic macroinvertebrate community, followed by stoneflies (15%) and mayflies (12%).

The 2009 data is a small piece of the big picture for stream conditions in Hamilton County. Streams will be monitored yearly in order to develop a continual, comparative history. This year's base line data will help to establish stream conditions in Hamilton County so that conclusions may be drawn in the future.

REFERENCES

Bode, R.W., Novak, M.A. and Abele, L.E. 1991. Methods for rapid biological assessment of streams. Albany: NY. NYS DEC Stream Biomonitoring Unit.

Bode, R.W., Novak, M.A. and Abele, L.E. 1993. 20 year trends in water quality of rivers and streams in New York state based on macroinvertebrate data 1972-1992. Albany: NY. NYS DEC Stream Biomonitoring Unit.

Bode, R.W., Novak, M.A. and Abele, L.E. 1996. Quality assurance work plan for biological stream monitoring in New York state. Albany: NY. NYS DEC Stream Biomonitoring Unit.

Bode, R.W., Novak, M.A. and Abele, L.E. 1997. Biological stream testing: methods for use in schools. Albany: NY. NYS DEC Stream Biomonitoring Unit.

Edmunds, G.F. Jr. and R.D. Waltz. 1996. Ephemeroptera. In R.W. Merritt and K.W. Cummins, (Eds.), An introduction to the aquatic insects of North America third edition (pp. 126-163). Dubuque, Iowa: Kendall/Hunt Publishing Company.

Fiske, S. and J. Byrne. 1988. Key to the freshwater macroinvertebrate fauna of New England. Montpelier: Vermont. River Watch Network.

Hamilton County, NY. State & County Quickfacts. Retrieved February 24, 2010 from the U.S. Census Bureau website: http://quickfacts.census.gov/qfd/states/36/36041.html

Krawiecki, V.J. 1982. Soils report for selected areas in Hamilton County, New York. New York. Soil Conservation Service.

McCafferty, W.P. 1998. Aquatic entomology, the fishermen's and ecologists' illustrated guide to insects and their relatives. Sudbury: Massachusetts. Jones and Bartlett Publishers.

Morse, J.C. and R.W. Holzenthal. Tricoptera genera. In R.W. Merritt and K.W. Cummins, (Eds.), An introduction to the aquatic insects of North America third edition (pp. 350-386). Dubuque, Iowa: Kendall/Hunt Publishing Company.

Novak, M. A., and Bode, R. W.. 1992. Percent model affinity: a new measure of macroinvertebrate community composition. *Journal of the North American Benthological Society*, 11(1): 80-85.

Seargent, M., M. DeAngelo, and M. R. Martin. 1999. Franklin County water quality assessment. Paul Smiths, New York: The Adirondack Aquatic Institute at Paul Smith's College.

APPENDIX

Figures 1-10

Figure 1
Stream Site Locations

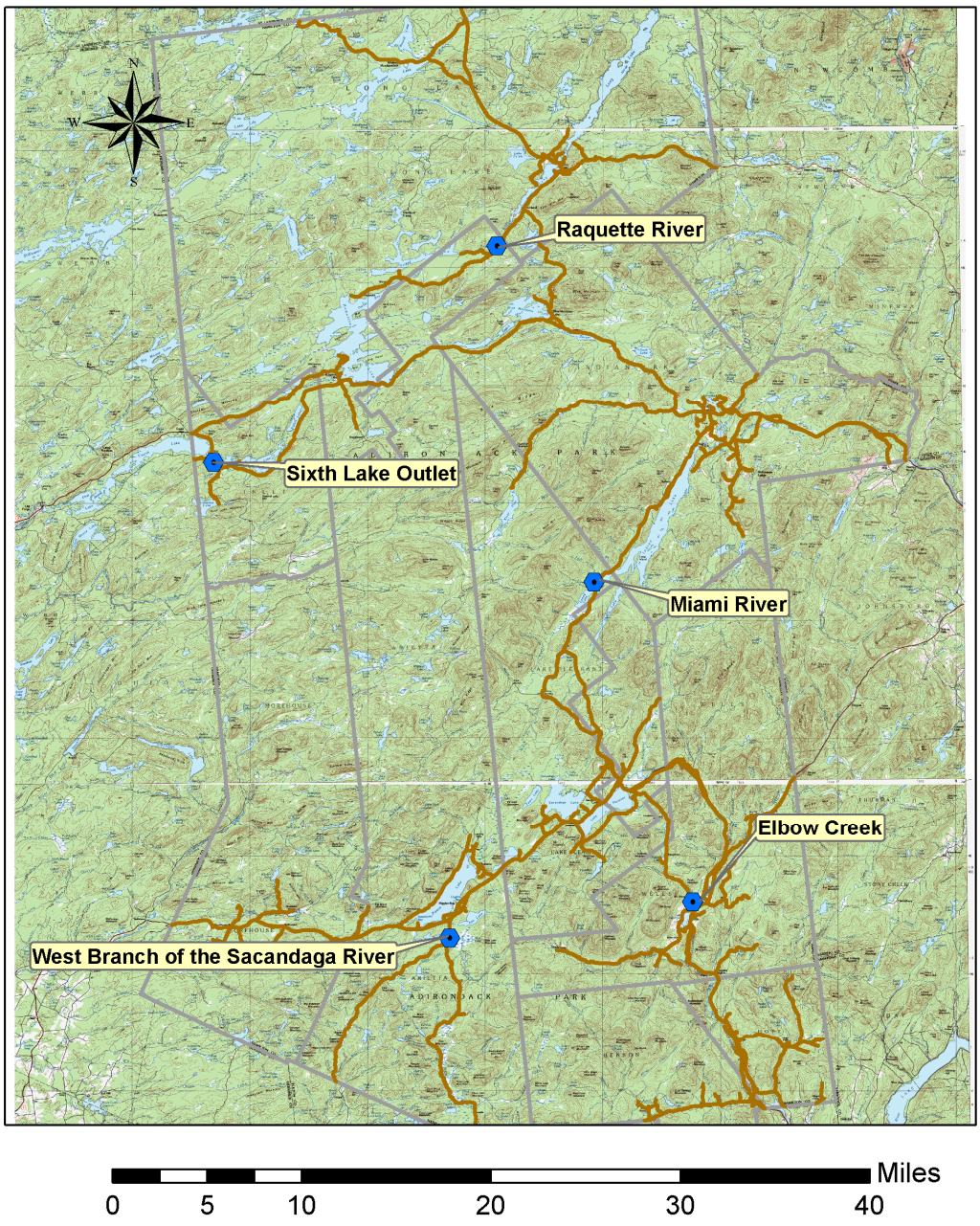


Figure 2

Stream Locations			
Stream Name	**Town**	**Date**	**Site Location**
West Branch of the Sacandaga River	Piseco	7/29/09	Off Rt. 10. A quarter of a mile from the parking lot. Stream accessed via woods.
Elbow Creek	Wells	8/3/2009	Stream accessed 400 feet off Sunset Circle on the southwest side.
Raquette River	Indian Lake	8/18/09	Off North Point Road, woods access, a quarter mile downstream of Buttermilk Falls.
Sixth Lake Outlet	Inlet	8/18/09	Southwest of Rt 28, 500 feet before 5th lake.
Miami River	Indian Lake	8/18/09	Directly off Route 30 under dam footers of bridge

Figure 3

Chemical Water Quality Parameters				
Stream Name	**Water Temperature (^{o}C)**	**DO (mg/L)**	**pH**	**Conductivity**
West Branch of the Sacandaga River	23.08	7.79	7.80	.037
Elbow Creek	15.09	11.05	7.91	.023
Raquette River	N/A	N/A	N/A	N/A
Sixth Lake Outlet	N/A	N/A	N/A	N/A
Miami River	N/A	N/A	N/A	N/A

Figure 4

Physical Water Quality Parameters									
Stream Name	**Average Velocity (m/s)**	**Average Depth (m)**	**Width (m)**	**Substrate Particle Size**					
				Boulders	Rubble	Gravel	Sand	Silt	Clay
West Branch of the Sacandaga River	6.89	0.27	18	20	40	10	10	10	10
Elbow Creek	2.85	0.34	7.7	5	70	10	5	5	5
Raquette River	N/A	0.77	27	30	30	10	10	10	10
Sixth Lake Outlet	N/A	0.21	9.4	5	70	10	5	5	5
Miami River	N/A	0.39	14.1	50	10	10	10	10	10

Figure 5

Left Bank Vegetation (%)					
Stream Name	**Left bank shrubs**	**Left bank grass**	**Left bank softwood**	**Left bank hardwood**	**Left bank unvegetated**
West Branch of the Sacandaga River	20	10	30	20	20
Elbow Creek	10	10	0	20	60
Raquette River	20	20	30	20	10
Sixth Lake Outlet	50	20	20	5	5
Miami River	0	0	0	0	100

Right Bank Vegetation (%)					
Stream Name	**Right bank shrubs**	**Right bank grass**	**Right bank softwood**	**Right bank hardwood**	**Right bank unvegetated**
West Branch of the Sacandaga River	20	10	10	50	10
Elbow Creek	10	10	0	40	40
Raquette River	20	20	10	40	10
Sixth Lake Outlet	5	5	50	20	20
Miami River	0	0	0	0	100

Figure 6

Benthic Macroinvertebrate Tally Results					
Taxa	West Branch of the Sacandaga River	Elbow Creek	Raquette River	Sixth Lake Outlet	Miami River
Mayfly	0	0	5	1	4
Stonefly	5	4	5	2	0
Caddisfly	62	2	62	64	38
Dobsonfly	1	0	1	0	0
Riffle Beetle	0	0	6	1	0
Water Penny	0	0	0	0	0
Beetle Larva	0	0	0	0	0
Cranefly Larva	0	0	0	1	0
Scud	0	0	0	0	0
Clam	0	0	0	0	10
Crayfish	0	0	0	0	0
Dragonfly	0	0	17	1	0
Damselfly	0	0	0	0	0
Black flies	20	0	1	0	9
Midge	12	0	3	1	34
Snail	0	0	0	0	0
Sow bug	0	0	0	0	0
Leech	0	0	0	0	0
Aquatic Worm	0	0	0	5	0
Other	0	0	0	0	5
Total	100	6	100	76	100

Figure 7

Extrapolated Benthic Macroinvertebrate Tally Results					
Taxa	West Branch of the Sacandaga River	Elbow Creek	Raquette River	Sixth Lake Outlet	Miami River
Mayfly	0	0	5	1	10
Stonefly	5	67	5	3	10
Caddisfly	62	33	62	85	42
Dobsonfly	1	0	1	0	2
Riffle Beetle	0	0	6	1	4
Water Penny	0	0	0	0	18
Beetle Larva	0	0	0	0	2
Cranefly Larva	0	0	0	1	0
Scud	0	0	0	0	0
Clam	0	0	0	0	0
Crayfish	0	0	0	0	0
Dragonfly	0	0	17	1	3
Damselfly	0	0	0	0	0
Black flies	20	0	1	0	1
Midge	12	0	3	1	5
Snail	0	0	0	0	0
Sow bug	0	0	0	0	0
Leech	0	0	0	0	0
Aquatic Worm	0	0	0	7	0
Other	0	0	0	0	4
Total	100	100	100	100	100

Figure 8

EPT Results			
Stream Name	**Ephemeroptera**	**Plecoptera**	**Trichoptera**
West Branch of the Sacandaga River	0	2	3
Elbow Creek	0	2	2
Raquette River	3	1	5
Sixth Lake Outlet	1	1	4
Miami River	1	0	1

Figure 9

Stream Water Quality						
Stream Name	PMA Value	PMA	EPT Value	EPT	BI Value	BI
West Branch of the Sacandaga River	42.0	Fair	5	Fair	90.0	Excellent
Elbow Creek	15.0	Poor	4	Fair	6.0	Poor
Raquette River	39.0	Fair	9	Good	91.3	Excellent
Sixth Lake Outlet	24.2	Poor	6	Good	69.9	Good
Miami River	46.5	Fair	2	Fair	70.4	Good

Figure 10

PMA Value Range

> 64 : excellent water quality
50-64 : good water quality
35-49 : fair water quality
< 35 : poor water quality

EPT Value Range

> 10 : excellent water quality
6-10 : good water quality
2-5 : fair water quality
< 2 : poor water quality

BI Value Range

> 79 : excellent water quality
60-79 : good water quality
40-59 : fair water quality
> 40 : poor water quality