

2013

**Volunteer Biological
Stream Data Collection Report
For the Ossipee Watershed**



**Green Mountain Conservation Group
P.O. Box 95
196 Huntress Bridge Road
Effingham, NH 03882
(603)539-1859
www.gmcg.org**

Prepared by:
Corey Lane – Water Quality Coordinator
Barbara Bald - Naturalist



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School Participants:

Sarah Olkkola and Kyra Dulmage, Effingham Elementary School students;
Lori Palmer, Carol Foord & the Freedom Elementary School students;
Erin Dyer, Jessica Mason, and the Ossipee Central School 6th grade students and parents;
Justin Chapman & Sandwich Elementary School 4th and 5th graders; and
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1. INTRODUCTION

The New Hampshire Department of Environmental Services (DES) has conducted stream surveys to determine the health of aquatic communities since 1997. As part of these efforts DES has developed a preliminary screening protocol for 1st through 4th order streams that is appropriate for volunteers and untrained professionals to evaluate the biological condition of aquatic macroinvertebrate communities. The goals are to supplement biological data collected by DES, educate the public about water quality issues as interpreted through biological assessments, build a constituency of individuals to practice sound water quality management at the local level, and build public support for water quality protection.

Since 2004, the DES has coordinated efforts with several local organizations to develop the Volunteer Biological Assessment Program (VBAP). In 2006, the DES began working with the Green Mountain Conservation Group (GMCG), a non-profit charitable organization concerned with natural resource conservation in the Ossipee Watershed, to; (1) determine the level of volunteer interest and ability to collect biological data (2) evaluate the effectiveness of the VBAP protocol and associated biotic index, and (3) initiate and complete biological sampling of macroinvertebrates in several streams within the Ossipee watershed.

During the fall of 2013, GMCG continued this work with students and teachers from four local schools and with the help of VBAP volunteers, they sampled four sites in the Ossipee watershed.

2. METHODS

2.1 Sampling sites and data collection

All sites were accessible, wadeable, and usually a minimum of 50 yards upstream from major human influences on the stream, approximately 50 to 200 feet in length, and contained appropriate sampling habitat (at least one riffle with mixed cobble substrate). Due to high water levels, some sites were sampled farther upstream or downstream. Sampling was scheduled throughout September and required three to four hours per site. Not all sites were equally accessible by students because of varying stream levels, but students were included in sampling and taking measurements whenever possible.

Prior to any sampling, a training session was held during a scheduled pre-visit and consisted of three major components; (1) macroinvertebrate sampling techniques, (2) basic macroinvertebrate identification skills, and (3) biotic index computation. Volunteers were also trained to collect and record supplementary data which consisted of basic physical and chemical parameters.

2.2 Macroinvertebrate sampling

Before collecting macroinvertebrates, site information was recorded and a representative sample reach was identified and sketched on the Volunteer Biomonitoring Habitat Data Sheet. Students recorded results, answers to questions, and measurements on the data sheets when appropriate. Volunteers were careful not to walk in the stream to avoid disturbing biological communities. After site information was recorded and sampling locations were identified, macroinvertebrates were collected by placing a 500 micron mesh kicknet perpendicular to stream flow and firmly against the streambed with the opening of the net faced upstream to promote macroinvertebrate collection. Another person stood upstream of the net and disturbed the sample area (1/5 m²) for a total of 60 seconds (30 second hand-scrub followed by a 30 second kick). Subsequently, the

kicknet was carefully lifted out of the water and the same process was repeated four additional times with each sample collected further upstream. Collectively, active sampling time approximated five minutes within one square meter area at each sampling station (i.e. stream).

Once the collection process was complete, the contents of the net were transferred into a container fitted with 500 micron wire mesh and all organisms remaining on the net were carefully removed and added to the sample. The sample was mixed for approximately 15 seconds and divided into 4 approximately equal portions. This year, all four quarters were sorted by the students. In the past, following protocol, one portion of the sample was randomly selected for sorting and transferred to a separate tray(s).

2.3 Macroinvertebrate sorting and identification

For approximately 30 minutes, volunteers removed macroinvertebrates from the selected portion of the sample with spoons, forceps, or pipettes and placed them into separate containers. Students groups rotated among the sample portions to more completely examine each sample portion. After sorting, specimens were identified to various coarse taxonomic groups (Table 1). This year, the time that volunteers spent sorting was not recorded in every case. According to protocol, the number of people sorting, cumulative sorting effort (0.5 hour x # people sorting), and approximate fraction of the total sample sorted should be recorded.

Recommendation: For 2014, have a more exact sign-in sheet and have students in the field for at least three hours to allow time for collection and sorting for one hour by students.

Table 1. The taxonomic order and common name of aquatic macroinvertebrates identified in the VBAP.

Order	Common Name	Tolerance value
Ephemeroptera	Mayfly nymph	3
Plecoptera	Stonefly nymph	1
Trichoptera	Caddisfly larvae	4
Odonata	Dragonfly nymph	3
	Damselfly nymph	7
Diptera	Black fly larvae	7
	Midge larvae	6
	Most true flies	4
Megaloptera	Alderfly	4
	Fishfly or hellgrammite	0
Coleoptera	Riffle beetle	4
	Water penny	4
	Beetle and beetle-like	7
Others	Crayfish	6
	Snails	7
	Aquatic worms	8
	Scuds	8
	Sowbugs	7
	Clams and mussels	7

The number of macroinvertebrates within each taxonomic group and the total number of individuals sorted was calculated and recorded. Due to a transition in staffing this year, a quality control (QC) sample was not taken at one site to evaluate the ability of volunteers to correctly identify and enumerate macroinvertebrates. However, at every site there was a trained biologist and/or naturalist to help identify the samples. According to protocol, in the future, a sample should be preserved and sent to DES or a trained biologist.

2.4 Biotic index and accessory metric computation

Biotic scores were computed for each sample station using a standardized computational worksheet. Biotic scores are based on tolerance values ranging from 0 to 10 that are assigned to individual taxonomic groups. More tolerant groups have higher tolerance values and less tolerant groups have lower values. Taxonomic-specific biotic scores for individual samples were computed by multiplying the number of individuals by their respective tolerance value. Final biotic scores were calculated by summing the taxonomic-specific biotic scores and dividing the sum by the total number of individuals identified in the respective sample. Final biotic scores correspond to three interim narrative categories: excellent (0 to 3.5), good (3.5 to 4.8), or fairly poor (greater than 4.8).

2.5 Supplementary data

The water chemistry and physical parameters of the stream were also recorded. Basic water chemistry data was collected using a YSI 556 multi-parameter submersible water quality probe and included pH, dissolved oxygen, conductivity, and water temperature.

3. RESULTS

3.1 Water Quality

Basic water quality measures were collected at each of the sampling locations (Appendix A). All measures were within the range of expectation for streams in this area of New Hampshire. For more detailed water quality data on the water bodies in the Ossipee watershed, refer to the annual reports published by GMCG available at <http://www.gmcg.org/water-quality-data.php>

3.2 Biological Assessment

Macroinvertebrate samples from each site were evaluated using the VBAP biotic score index utilizing taxa-specific tolerance values. A cumulative biotic score for all sites and individual site-specific biotic scores were computed. The cumulative biotic score for all sites was 2.47 and corresponds to the “excellent” narrative category (Table 2). Overall, stonefly nymphs were the most dominant taxon (45%), followed by mayfly nymph (22%), caddisfly nymphs (10%) and aquatic worms (10%). (Figure 1). Together, these four taxa comprised 87% of all individuals. In completing the sampling effort, volunteers collected and identified 220 macroinvertebrates, significantly lower than the number of macroinvertebrates collected at various sites throughout the watershed in other years.

Table 2. Cumulative of results of macroinvertebrate samples collected at 4 sites in the Ossipee watershed during fall 2013.

Order	Common Name	Tolerance Value	Individuals Found	Group Biotic Score	Biotic Score	VBAP Category
Ephemeroptera	Mayfly Nymph	3	49	147	2.47	Excellent!
Plecoptera	Stonefly Nymph	1	100	100		
Trichoptera	Caddisfly Larvae	4	23	92		
Odonata	Dragonfly Nymph	3	10	30		
	Damselfly Nymph	7				
Diptera	Black fly larvae	7	4	28		
	Midge larvae	6				
	Most True flies	4				
Megaloptera	Alderfly	4	7	0		
	Fishfly or Helgrammite	0				
Coleoptera	Riffle beetle	4				
	Water Penny	4				
	Beetle & Beetle-like	7				
Others	Crayfish	6	23	184		
	Snails	7				
	Aquatic Worms	8				
	Scuds	8				
	Sowbugs	7			1	7
	Clams and Mussels	7				
Totals			221		2.47	Excellent!

Figure 1. Cumulative taxonomic composition of macroinvertebrate samples collected at 4 sites in the Ossipee watershed in fall 2013.

Biotic scores from individual sites ranged from 1.68 to 3.7 in 2013 (Table 3). Of the 4 sites sampled (Cold River sampled upstream and downstream by Sandwich students), three were placed in the “Excellent” category and one was placed in the “Good” category.

Table 3. Biotic scores and VBAP narrative categories of macroinvertebrate samples collected at 4 sites in the Ossipee watershed during fall 2013.

Site Number	Stream Name	Town	Biotic Score	VBAP Narrative Category
1	Cold Brook	Freedom	1.68	Excellent
2	South River	Parsonsfield	2.0	Excellent
3	Cold River	Sandwich	3.7	Good
4	Swift River	Tamworth	2.5	Excellent

Cumulative 2013 macroinvertebrate results

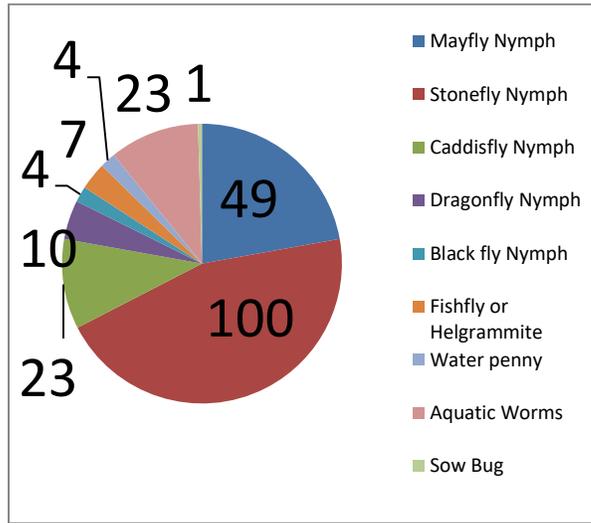
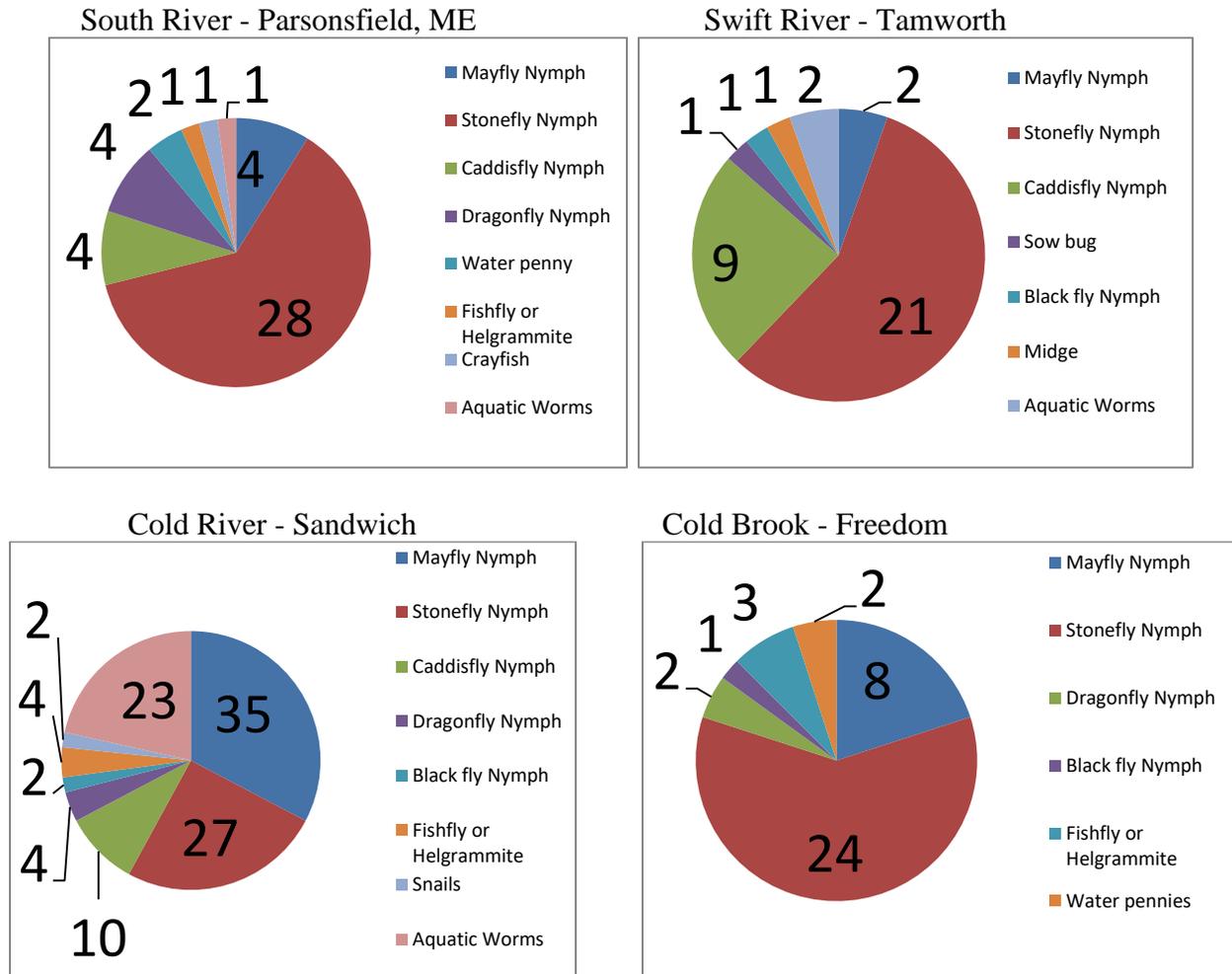


Figure 4: Taxonomic composition of macroinvertebrate samples collected at 4 sites in the Ossipee watershed in fall 2013.



4. SUMMARY AND FUTURE RECOMMENDATIONS

The documentation by volunteers of the macroinvertebrate communities using the VBAP protocol during fall 2013 in the Ossipee watershed represented the eighth consecutive year of ‘screening’ efforts to evaluate the status of aquatic communities. The sampling efforts included 4 sites in the Ossipee watershed. The VBAP protocol was designed by DES to provide volunteers and water quality professionals without formal training in biological sampling an avenue to complete “coarse” level investigations of the types and quantities of macroinvertebrates living in streams and rivers. Macroinvertebrates are widely used as indicators of water quality that integrate the effects of multiple pollutants over time. It is important to recognize that the results obtained from the VBAP protocol are not intended to represent formal water quality assessments, but rather, a basic indicator of aquatic community condition.

The VBAP protocol also provided volunteers with an opportunity to become familiar with aquatic fauna in the streams and rivers in the Ossipee watershed. The collection of macroinvertebrates using the VBAP protocol, in addition to the usual chemical parameters collected by GMCG, proved to be a fairly simple, yet informative method for identifying sites in excellent, good, or fairly poor condition. With adequate training volunteers became familiar with the most common macroinvertebrate types and their respective tolerance to pollution.

The results obtained by volunteers using the VBAP protocol indicated that the majority of sites sampled appeared to be in good condition. Three of the streams fell into the “excellent” category and one was in the “good” category. Most of the communities were dominated by less tolerant macroinvertebrates, such as the mayflies, stoneflies, and caddis flies. Due to a transition in staffing at Green Mountain Conservation Group and high water, the full protocol regarding sample size and percentage of sample sorted was not followed at each site. In those cases, the activity was a successful educational opportunity for volunteers.

While the biotic index provided a method for relative comparisons of the sites sampled, the tolerance values and narrative categories are still under development and must be calibrated to a set of reference sites before statewide application is possible. The data collected builds upon a baseline to compare future VBAP sampling efforts against and highlights the general lack of major impacts to the macroinvertebrate communities at the points where samples were collected.

While the sampling efforts were effective at documenting the status of the macroinvertebrate communities at a coarse level, it is important to recognize that the project represented the effort by GMCG to refine and build upon the VBAP protocol. The DES Biomonitoring program developed the VBAP protocol and is continually refining the training provided to volunteers, field sampling techniques, and biotic index applicability. Therefore, more detailed investigations would need to be made in order to make a formal determination of biological community condition.

Ultimately, the results from the VBAP program for 2013 build upon the efforts conducted by GMCG and NH DES from the past several years. The results of the program serve as a basis for further monitoring and management practices to be put into use throughout the watershed. The Ossipee watershed has a great reputation for having great water quality overall and the VBAP results further that reputation. The VBAP results provide objective information to the public so that informed citizens have the ability to make good decisions regarding the Ossipee watershed’s unique water resources.

5. APPENDIX

Maps of 2013 macroinvertebrate sampling locations:

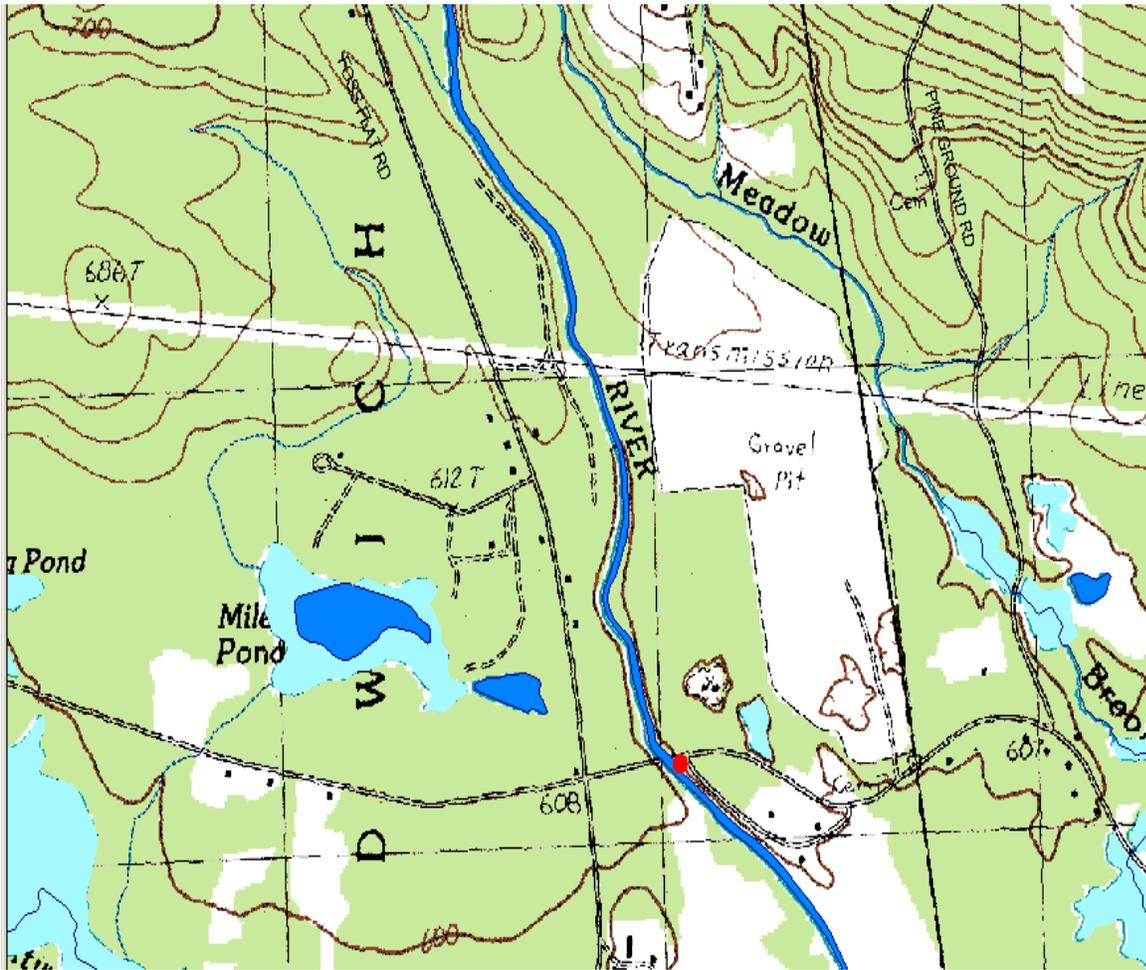
Site 1: Cold Brook, Freedom



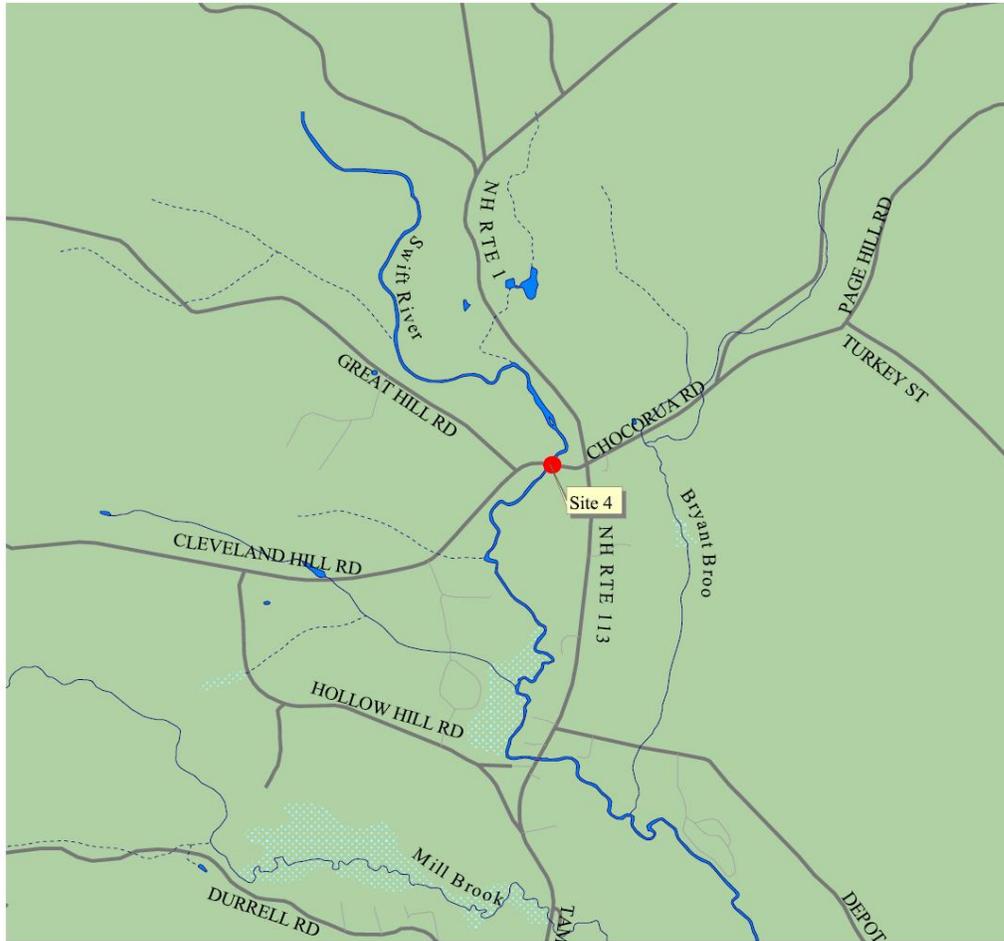
Site 2: South River, Parsonsfield, Maine



Site 3: Cold River, Sandwich



Site 4: Swift River, Tamworth



The coverages presented in this program are under constant revision as new sites or facilities are added. They may not contain all of the potential or existing sites or facilities. The Department is not responsible for the use or interpretation of this information, nor for any inaccuracies.

Map Prepared October 26, 2006.



LEGEND

- River, stream
- Intermittent stream
- Lake, pond
- Marsh, wetland
- Roads-private (NHDOT)
- Roads-fixes (NHDOT)
- Roads (NHDOT)



Appendix A. Basic water quality parameter results collected at VBAP sampling sites in the Ossipee watershed during fall 2013.

Site Number	Stream Name	pH (units)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	Temperature (°C)	Conductivity (µS/cm)	Turbidity (NTU)
1	Cold Brook	7.02	105.5	11.56	11.24	60	.61
4	Swift River	7.05	85.2	9.60	10.0	31	.36
5b	Cold River	7.04	90.5	10.19	10.13	24	.42
6	South River	6.59	84.9	9.51	10.3	47	.83
Averages		6.92	91.52	10.21	11.17	40	.55

Note: na = not available

Appendix B. Macroinvertebrate sampling results from individual stream sites sampled in the Ossipee watershed during fall 2013

Site 1: Cold Brook, Freedom tested by Freedom Elementary

Order	Common Name	Tolerance Value	*	Totals Found	=	Biotic Score	Final Biotic Score	VBAP Narrative Category
Ephemeroptera	Mayfly Nymph	3	*	8		24	1.72	Excellent!
Plecoptera	Stonefly Nymph	1	*	24		24		
Trichoptera	Caddisfly Larvae	4	*		=			
Odonata	Dragonfly Nymph	3	*	2	=	6		
	Damselfly Nymph	7	*		=			
Diptera	Black fly larvae	7	*	1	=	7		
	Midge larvae	6	*		=			
	Most True flies	4	*		=			
Megaloptera	Alderfly	4	*		=			
	Fishfly or Helgrammite	0	*	3	=	0		
Coleoptera	Riffle beetle	4	*		=			
	Water Penny	4	*	2	=	8		
	Beetle & Beetle-like	7	*		=			
Others	Crayfish	6	*		=			
	Snails	7	*		=			
	Aquatic Worms	8	*		=			
	Scuds	8	*		=			
	Sowbugs	7	*		=			
	Clams and Mussels	7	*		=			
Totals						69	1.72	Excellent!

Appendix B (con't). Macroinvertebrate sampling results from individual stream sites sampled in the Ossipee watershed during fall 2013.

Site 2. Cold River, Sandwich tested by Sandwich Central School 2013

Order	Common Name	Value	*	Found	=	Score	Score	Category
Ephemeroptera	Mayfly Nymph	3	*	35	=	105		
Plecoptera	Stonefly Nymph	1	*	27	=	27		
Trichoptera	Caddisfly Larvae	4	*	10	=	40		
Odonata	Dragonfly Nymph	3	*	4	=	12		
	Damselfly Nymph	7	*		=			
Diptera	Black fly larvae	7	*	2	=	14		
	Midge larvae	6	*		=			
	Most True flies	4	*		=			
Megaloptera	Alderfly	4	*		=			
	Fishfly or Helgrammite	0	*	4	=	0		
Coleoptera	Riffle beetle	4	*		=			
	Water Penny	4	*		=			
	Beetle & Beetle-like	7	*		=			
Others	Crayfish	6	*		=			
	Snails	7	*	2	=	14		
	Aquatic Worms	8	*	23	=	184		
	Scuds	8	*		=			
	Sowbugs	7	*		=			
	Clams and Mussels	7	*		=			
Totals				107		396		

Site 3. Swift River, Tamworth tested by Ossipee Central School

Order	Common Name	Value	*	Found	=	Score	Score	Category
Ephemeroptera	Mayfly Nymph	3	*	2	=	6		
Plecoptera	Stonefly Nymph	1	*	21	=	21		
Trichoptera	Caddisfly Larvae	4	*	9	=	36		
Odonata	Dragonfly Nymph	3	*		=			
	Damselfly Nymph	7	*		=			
Diptera	Black fly larvae	7	*	1	=	7		
	Midge larvae	6	*	1	=	6		
	Most True flies	4	*		=			
Megaloptera	Alderfly	4	*		=			
	Fishfly or Helgrammite	0	*		=			
Coleoptera	Riffle beetle	4	*		=			
	Water Penny	4	*		=			
	Beetle & Beetle-like	7	*		=			
Others	Crayfish	6	*		=			
	Snails	7	*		=			
	Aquatic Worms	8	*	2	=	16		
	Scuds	8	*		=			
	Sowbugs	7	*	1	=	7		
	Clams and Mussels	7	*		=			
Totals				37		99		

Site 4. South River, Parsonsfield -Effingham Elementary School 2013

Order	Common Name	Value	*	Found	=	Score	Score	Category
Ephemeroptera	Mayfly Nymph	3	*	4	=	12		
Plecoptera	Stonefly Nymph	1	*	28	=	28		
Trichoptera	Caddisfly Larvae	4	*	4	=	16		
Odonata	Dragonfly Nymph	3	*	4	=	12		
	Damselfly Nymph	7	*		=			
Diptera	Black fly larvae	7	*		=			
	Midge larvae	6	*		=			
	Most True flies	4	*		=			
Megaloptera	Alderfly	4	*		=			
	Fishfly or Helgrammite	0	*	1	=	0		
Coleoptera	Riffle beetle	4	*		=			
	Water Penny	4	*	2	=	8		
	Beetle & Beetle-like	7	*		=			
Others	Crayfish	6	*	1	=	6		
	Snails	7	*		=			
	Aquatic Worms	8	*	1	=	8		
	Scuds	8	*		=			
	Sowbugs	7	*		=			
	Clams and Mussels	7	*		=			
Totals				45		90	2.0	Excellent!



