BONNECHERE RIVER WATHERSHED PROJECT

Smith's Creek

Water Quality

BRWP

10/1/2008

Smith's Creek flows from Hurd's Lake to the Bonnechere River and passes through a diverse area. The Bonnechere River Watershed Project (BRWP) has been monitoring the water quality of Smith's Creek at Stewart Park in Renfrew since 2003. In the years of testing it has been found that the water quality in Smith's Creek has been mostly unimpaired. However, there is a concern of proximity of a site historically used as Snow Dump to Smith's Creek and the increased levels of silt North and West of the sampling location. The BRWP recommends further monitoring of the creek and possibly remediation to rectify silt situations within Smith's Creek.

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The Bonnechere River Watershed Project

The Bonnechere River Watershed Project (BRWP) was initiated in 1998 by the Renfrew County Stewardship Council. The BRWP is a community-based volunteer organization with a mandate to influence environmental enhancement throughout the Bonnechere River watershed in Renfrew County. It achieves this through youth and landowner education and habitat enhancement and restoration projects. A partnership approach to these projects provides shared resources and enhances the ability to focus on local solutions and achieve greater local initiative.

Citizen's Environment Watch Protocol

The BRWP uses the Citizen's Environment Watch (CEW) to assess various streams on the Bonnechere River Watershed. CEW was founded in 1996 by a number of concerned scientists and university professors in response to government cuts to the provincial level environmental staff and inspectors. As a result of these cuts there was an immediate recognition of a need to maintain monitoring of the local environment through grassroots initiatives.

CEW is an organization that provides a variety of educational tools, equipment, and support for community based organizations, like the BRWP, to carry out ecological monitoring of the local environment. The CEW works towards raising awareness about the local environment through monitoring, to influence decision-making through local initiatives.

The BRWP has been participating in the CEW Benthic Macroinvertebrate Analysis for Water Quality since 2003. Several different streams have been tested through these years but five main streams have been studied consistently.

The protocol has been divided into two sections: sample collection (Appendix 1, CEW Field Manual) and analysis (Appendix 2, CEW Data Manual). The protocol survey's the benthic macroinvertebrate population and uses indexes to determine the water body health based on the numbers of certain macroinvertebrates found.

What are benthic macroinvertebrates?

Benthic macroinvertebrates are organisms found at the bottom of a waterbody. They lack a backbone or internal skeleton and are visible to the naked eye. They have varying tolerance levels for a variety of factors that can influence water quality.

Smith's Creek

Smith's Creek represents a waterway that flows through a diverse area. From Hurd's Lake to the Bonnechere River, Smith's Creek flows through a cottage area, agricultural land and finally through the town of Renfrew.

The test site used to complete the CEW protocol on this waterway is located at the lower end of Stewart's Park. After the stream cascades by the old Mill it splits into two sections for approximately 100m (Figure 1). Historically the section of creek sampled has been the waterway to southeast. The Northwest shoreline of the creek consists of a wetland and a steep embankment that has historically been used as place to put snow. The southeast shoreline is for the most part a mowed lawn with some meadow and shrubs. As the creek flows south through the park it joins and becomes one waterway again. The western shoreline after the two sections join has a very steep embankment.

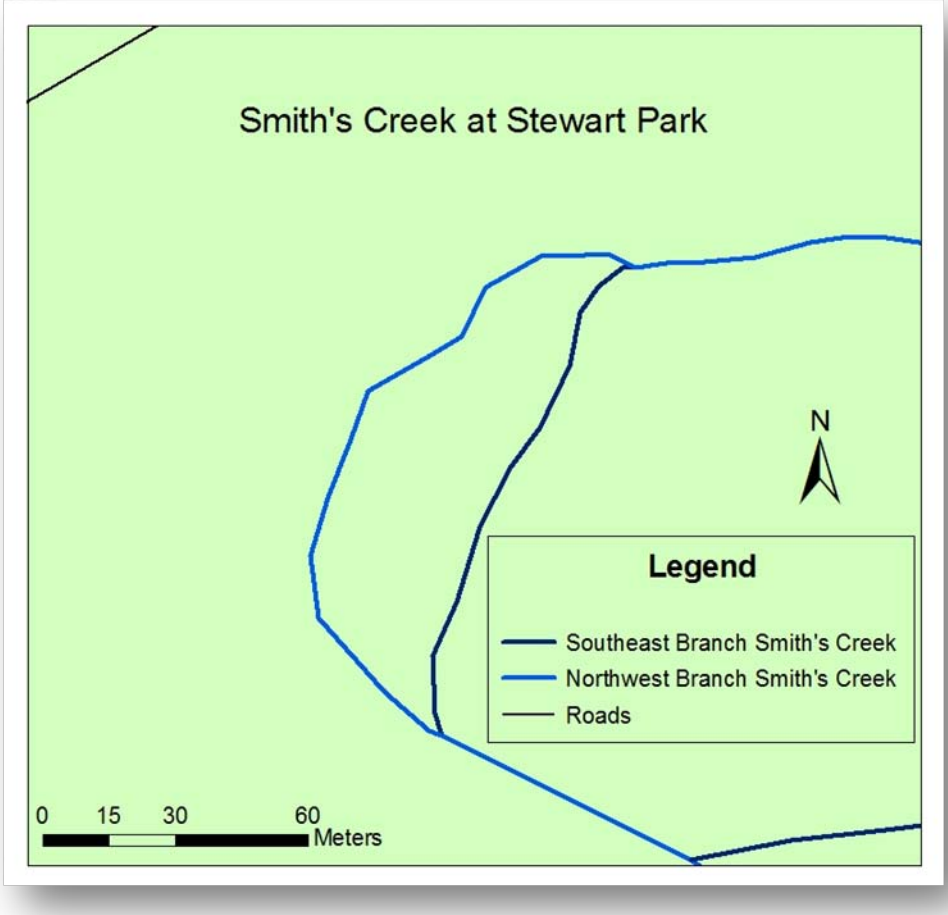

Figure 1: Map of Sampling Location of Smith's Creek at Stewart Park in Renfrew, ON

The Ontario Stewardship Rangers began an initial study of the length of Smith's Creek in the summer of 2003. They made observations on locations within all of the land use types: cottagers, agricultural users and within the town of Renfrew. Since 2003 the Rangers as well as local students have continued to monitor the creek.

The observations indicated and the attached map shows that the creek has been for the most part left in a natural state as it flows from Hurd's Lake through the cottage areas. Once the creek enters the agricultural area the land has been cleared for that purpose with varying widths of buffer zones remaining. There are some cattle watering in the creek and the substrate changes from sand, gravel and rocks to silt. As the creek enters the town the land that surrounds it has some shrubs and trees surrounding it. There are obvious signs of beaver activity that begin here and continue through the town.

Results

Southeastern Branch

The Southeastern section of Smith's Creek located in the lower part of Stewart Park Renfrew is approximately 3-6m wide and the water typically flows at a moderate rate. The creek substrate consists of large rocks, pebbles, sand and some silt. The creek at this point is fairly shallow except in a pooling area which can be approximately 1m deep depending on the local water table. This section is approximately 10% shaded by trees and is surrounded by grass meadow with grasses up to 1.5m in height. Multiple stream assessments have turned up a moderate amount of refuse in this area including glass, parking meters, toys and miscellaneous household waste.

Several sampling events have been completed on the creek (Appendix 3). All of the aggregate results found during these sampling events were found to be unimpaired with the exception of two. In October 2004 the number of taxa, % EPT, % diptera and HBI were determined to be impaired and the % snails were found to be possibly impaired. This meant that five or more of the ten indices examined in this protocol were outside of the unimpaired range. In May 2007 the % snail, % dominant taxon, % EPT and % Insect were determined to be impaired and the % aquatic sowbug and the HBI were determined to be possibly impaired. In 2007 a sample was completed in July and it was determined to be unimpaired.

% EPT

These include Mayflies, Stoneflies and Caddisflies. These insects require gravel stream bottoms and good dissolved oxygen levels. Lower numbers of % EPT can be linked to increased suspended solids.

% Dominant Taxon

The presence of a large number of one group can demonstrate that the water quality conditions are favouring the reproduction of this particular group. The idea of this index is that if there are many different taxon then the water quality can support a wide variety of species.

% Insect

This index includes Anisoptera (Dragonflies), Coleoptera (Beetles), Ephemeroptera (Mayflies), Hemiptera (True Bugs), Megaloptera (Fishflies, Alderflies), Plecoptera (Stoneflies), Trichoptera (Caddisflies) and Zygoptera (Damselflies). It compares the presence of these individuals in relation to the total sample population.

% Diptera

This includes the total number of Midges, Mosquitoes, Blackflies, Horseflies, and Craneflies. This index is deemed impaired if two few or too many of these types of benthics are found. The ideal range is between 20-45%. The percentage found in October 2004 was 8.67%

HBI

Hilsenhoff Biotic Index is used to give an indication of the nutrient status in the stream. This is calculated based on the number of each type of benthic and its associated tolerance value. In October of 2004 this value was found to be greater than 7 which implies excessive nutrient conditions.

Northwest Branch and Below Joining

In 2008 the BRWP tried to study the Northwest section of Smith's Creek but was unable to complete a sample due to low numbers of macroinvertebrates found. Also the BRWP attempted to sample the creek where it joins back together but was unable to complete a sample due to the large amount of silt located on the bottom of the stream. The substrate in these sections is varied with some areas containing large rocks and gravel, but a majority of this area is fine sand and silt. In the attempted samplings only 23 macroinvertebrates were found out of the needed 100.

Discussion

Southeastern Branch

The results of the nine assessments completed on this section of the creek indicate that Smith's Creek is unimpaired. The two possible impaired results may have been due to human error or recent weather conditions that may have led to a shift in the macroinvertebrates located in this section of the Creek. Human error may have occurred in the sampling method, which may have created conditions that allowed for the collection of one type of macroinvertebrate over another. Human error may also have occurred in the identification of the specimens or improper recording of these specimens.

Northwestern Branch

The BRWP is particularly interested in this branch of Smith's Creek due to its proximity to the lands used for a local Snow Dump. The assessment that was completed resulted in very low numbers of macroinvertebrates and this sample had to be discarded. The numbers may have been low due to the substrate in this section of the creek. Many of the macroinvertebrates prefer rockier substrates for their habitat. This extensive silt accumulation in this section and the section downstream from this area may be a result of a few things.

It is possible that this section of the stream was created through obstructions found at the base of the old mill. This could indicate that this area historically was terrestrial and the substrate is its natural form. The silt substrate could also be due to run off and erosion from both the Snow dump and the steep embankment located very close to the creek.

Recommendations

Smith's Creek has a variety of land use types and because of that it will have a variety of sources influencing water quality. Three factors were highlighted above:

1. Beaver activity
2. Agriculture
3. Snow dump

Tree planting would be beneficial in areas where trees have been removed. This can help to reduce the amount of residue (nutrients, salts, pesticides) from entering the waterbody. Beaver activity can have an impact on the water quality through a decrease in flow and sediment accumulation and should be monitored. There is a potential for the installation of beaver bafflers to help to reduce the effect of the beavers on the water quality.

The proximity of the snow dump and the topography of the area make it clear that the entire residue that melts in the area of the snow dump flows directly into the creek. It would be beneficial to monitor the sodium and sediment concentration in the water downstream from this area. Once a better understanding of the impact of that source can be found further discussion detailing potential remediation would be beneficial. In the interim it is recommended that in years that this particular area is used as a snow holding area the town install and maintain silt fencing which will help reduce the added amounts of silt entering Smith's Creek.

Appendix 1

Appendix 2

Appendix 3

Impaired
Possibly Impaired
Unimpaired

Results for Smith's Creek Sampling

	08/06/2003	08/07/2003	20/08/2003	21-22/10/2004
Acarina (water mites)			2	7
Amphipoda (scuds)		1	1	2
Anisoptera (dragonflies)	11		21	
Chironomidae (midges)	9	11	9	6
Coleptera (beetles)	12	19	24	1
Culicidae (mosquitoes)				1
Decapodae (crayfish)	4	25	5	1
Ephomeroptera (mayflies)	64	28	6	2
Gastropoda (snails)	3	24		92
Hemiptera (true bugs)				1
Hirudea (leeches)		3	1	
Isopoda (aquatic sowbugs)				
Megaloptera (helgrammites)	1		2	1
Oligochaeata (aquatic worms)		4		6
Pelecypoda (clams)	1	1	6	1
Plecoptera (stoneflies)	5	1	9	5
Simuliidae (blackflies)		5		
Tabanidae (horseflies)			2	1
Tipulidae (craneflies)		1		4
Tricoptera (caddisflies)	8	1	9	4
Turbellaria (flatworms)				1
Zygoptera (damselflies)		5		2
Unknown	1	4	4	
Total	**115**	**133**	**101**	**138**
% Aquatic Worm	0	3.007518797	0	5.072463768
% Midge	7.826086957	8.270676692	8.910891089	4.347826087
% Aquatic Sowbug	0	0	0	0
% Snail	2.608695652	18.04511278	0	66.66666667
Number of Taxa	11	15	14	18
% Dominant Taxon	55.65217391	21.05263158	23.76237624	66.66666667
% EPT	66.95652174	22.55639098	23.76237624	7.971014493
% Diptera	7.826086957	12.78195489	10.89108911	8.695652174
% Insect	87.82608696	40.60150376	70.2970297	11.5942029
HBI	5.017391304	5.646616541	4.396039604	7.094202899
Aggregate Assessment	Unimpaired	Unimpaired	Unimpaired	Potentially Impaired

	30/05/2005	31/05/2007	11/07/2007
Acarina (water mites)	9	6	
Amphipoda (scuds)	5		
Anisoptera (dragonflies)	2		2
Chironomidae (midges)	6	1	13
Coleptera (beetles)	4	2	16
Culicidae (mosquitoes)			
Decapodae (crayfish)	1	2	3
Ephomeroptera (mayflies)	19	1	49
Gastropoda (snails)		33	4
Hemiptera (true bugs)	2	1	
Hirudea (leeches)		4	
Isopoda (aquatic sowbugs)		2	
Megaloptera (helgrammites)		2	
Oligochaeata (aquatic worms)	14	1	5
Pelecypoda (clams)		1	
Plecoptera (stoneflies)	29		1
Simuliidae (blackflies)			
Tabanidae (horseflies)	1		
Tipulidae (craneflies)		3	
Tricoptera (caddisflies)	3	2	25
Turbellaria (flatworms)	2		3
Zygoptera (damselflies)	3	2	
Unknown			
Total	**100**	**63**	**121**
% Aquatic Worm	16	1.58730159	6.61157025
% Midge	6	1.58730159	10.7438017
% Aquatic Sowbug	0	3.17460317	0
% Snail	0	52.3809524	3.30578512
Number of Taxa	14	15	10
% Dominant Taxon	29	52.3809524	40.4958678
% EPT	51	4.76190476	61.9834711
% Diptera	7	6.34920635	10.7438017
% Insect	62	15.8730159	76.8595041
HBI	4.57	6.92063492	5.14049587
Aggregate Assessment	Unimpaired	Potentially Impaired	Unimpaired

	22/07/2008	13/10/2008
Acarina (water mites)		
Amphipoda (scuds)	1	
Anisoptera (dragonflies)	1	
Chironomidae (midges)	3	17
Coleptera (beetles)	37	24
Culicidae (mosquitoes)	1	
Decapodae (crayfish)	1	
Ephomeroptera (mayflies)	11	5
Gastropoda (snails)	1	10
Hemiptera (true bugs)		2
Hirudea (leeches)		
Isopoda (aquatic sowbugs)		
Megaloptera (helgrammites)	28	
Oligochaeata (aquatic worms)	3	5
Pelecypoda (clams)		4
Plecoptera (stoneflies)	11	
Simuliidae (blackflies)		3
Tabanidae (horseflies)		3
Tipulidae (craneflies)		
Tricoptera (caddisflies)	6	25
Turbellaria (flatworms)		
Zygoptera (damselflies)	13	1
Unknown		1
Total	**117**	**100**
% Aquatic Worm	2.56410256	5
% Midge	2.56410256	17
% Aquatic Sowbug	0	0
% Snail	0.85470085	10
Number of Taxa	13	12
% Dominant Taxon	31.6239316	25
% EPT	23.9316239	30
% Diptera	3.41880342	23
% Insect	91.4529915	57
HBI	4.4017094	5.34
Aggregate Assessment	Unimpaired	Unimpaired