Kemptville Creek Subwatershed Report 2013
North Branch Catchment

RIDEAU VALLEY CONSERVATION AUTHORITY

The RVCA produces individual reports for six catchments in the Kemptville Creek Subwatershed. Using data collected and analysed by the RVCA through its watershed monitoring and land cover classification programs, surface water quality conditions are reported for the North Branch of Kemptville Creek along with a summary of environmental conditions for the surrounding countryside every six years.

This information is used to help better understand the effects of human activity on our water resources, allows us to better track environmental change over time and helps focus watershed management actions where they are needed the most.

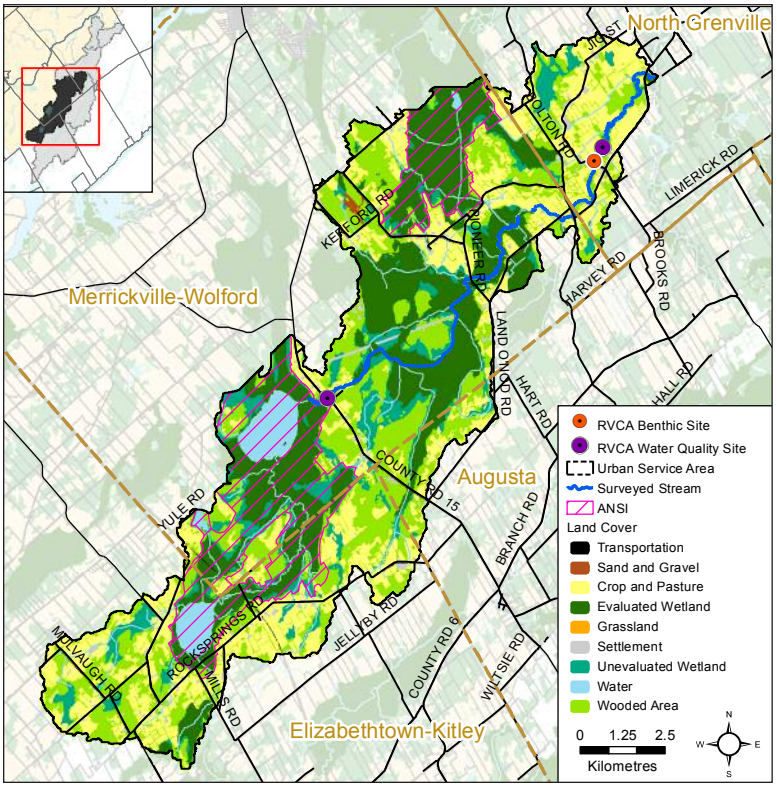
The following pages of this report are a compilation of that work. For other Kemptville Creek catchments and the Kemptville Creek Subwatershed Report, please visit the RVCA website at www.rvca.ca.

What's Inside

Catchment Facts

General Geography

- North Branch catchment is rural in character with agriculture being the predominant land use
- Fifty-six percent of the catchment lies within the Village of Merrickville-Wolford, 29 percent within the Township of Elizabethtown-Kitley, 11 percent within the Municipality of North Grenville and four percent within Augusta Township



Physical Geography

- Across the upper reaches of the catchment, the Smith Falls Limestone Plain consists of layers of quartz sandstone, sandy dolostone, and dolostone of the March Formation; across the lower reaches, the Oxford Formation consists of dolostone with thinner layers of shale and sandstone. In the large Wolford Bog Wetland Complex, bedrock is overlain only by thin soils or by organic muck and some peat
- The drainage area of 129 square kilometres is about 28 percent of the Kemptville Creek Subwatershed, three percent of the Rideau Valley Watershed and contains three municipal drains
- Dominant land cover is wetland (42 percent) followed by woodland (28 percent) and crop and pastureland (26 percent). Settlement areas and transportation (two percent each) occupy the rest of the landscape

Vulnerable Areas

- Flood plain mapping has been available along the North Branch of Kemptville Creek since 2009 and regulated since then
- Shallow bedrock is mapped as highly vulnerable to land use activities, especially in areas of very thin soils found in parts of the catchment

Development Trends

- Very limited development activity has taken place in recent years

Conditions at a Glance

- Water quality rating along the North Branch of Kemptville Creek is "Fair" and has declined at the site in Bishops Mills over a 12 year reporting period (2001–2006 vs. 2007–2012)

- Woodland cover proportion has changed/decreased by fifteen and a half percent (1995 hectares) from 2002 to 2008, due to a combination of changes in land cover and land use
- The riparian buffer (30 metres wide along both sides of North Branch and its tributaries) is made up of wetland (73 percent), crop and pastureland (15 percent), woodland (10 percent), transportation (one percent) and settlement areas (one percent)
- A warm/cool water baitfish and recreational fishery of 22 fish species is present
- Contains three municipal drains

Catchment Care

- Kemptville Creek Beaver Dam Management Pilot Project carried out to address uncontrolled beaver activity along the North and South Branch of Kemptville Creek and its main stem to the Oxford Mills Dam (2003 to 2007). Subsequent work carried out by the RVCA, including beaver dam survey work and beaver and dam removal, has had a positive effect on the aquatic ecosystem and is an effective and welcome response to landowners concerns about high water levels and its effect on land drainage. Benefits include reduction in damage to woodlots and improved agricultural drainage adjacent to the creek, along with improved aquatic habitat. Lessons learned from the pilot project have been subsequently used to assist Drain Wolford landowners and the municipalities of North Grenville and Merrickville-Wolford with land drainage issues associated with beaver activity along the North Branch of Kemptville Creek
- Nine stewardship projects (Rural Clean Water/Tree Planting) have been completed from 2002 to 2011
- Fish sampling conducted on the North Branch (RVCA, 2011)
- Annual benthic macroinvertebrate sampling downstream of Hurd Street/Mill Street in Bishops Mills since 2003 (RVCA)
- RVCA macro stream surveys in 2011, working upstream to the headwaters from the mouth of the creek where it empties into Kemptville Creek taking measurements and recording observations on instream habitat, bank stability, other attributes and preparing a temperature profile
- MOE well records show there are about 320 water wells in the catchment (12 percent of all wells in the Kemptville Creek Subwatershed)
- Watershed model developed by the RVCA in 2009 was used to study the hydrological function of wetlands in the Rideau Valley Watershed, including those found in the North Branch catchment of Kemptville Creek

1. North Branch Surface Water Quality Conditions

Assessment of streams in the Kemptville Creek watershed is based on 22 parameters including nutrients (total phosphorus, total Kjeldahl nitrogen, and ammonia), *E. coli,* metals (like aluminum and copper) and additional chemical/physical parameters (such as alkalinity, chlorides, pH and total suspended solids). Each parameter is evaluated against established guidelines to determine water quality conditions. Those parameters that frequently exceed guidelines are presented below.

The assessment of water quality throughout the Kemptville Creek Subwatershed also looks at water quality targets that are presented in the 2007 Kemptville Creek Watershed Plan Update (KCWP). The KCWP identifies nutrient and bacteria loading to be of concern as well as maintaining and/or improving water quality aesthetics throughout the Kemptville Creek watershed.

Surface water quality conditions in North Kemptville Creek are monitored through the RVCA's Baseline Water Quality Monitoring Program. See Figure 1 and Table 2 for monitoring site locations.

The water quality rating for North Kemptville Creek within the North Branch catchment is reported as "Fair" at all sites as determined by the CCME Water Quality Index (CCME WQI); analysis of the data has been broken into two periods 2001–2006 and 2007–2012, to examine if conditions have changed in this timeframe. Water quality scores are largely influenced by nutrient concentrations. For more information on the CCME WQI please see the Kemptville Creek Subwatershed Report.

Table 1 outlines the WQI scores and their corresponding ratings and Table 2 shows the overall rating for the two monitored sites on North Kemptville Creek within the North Branch catchment.

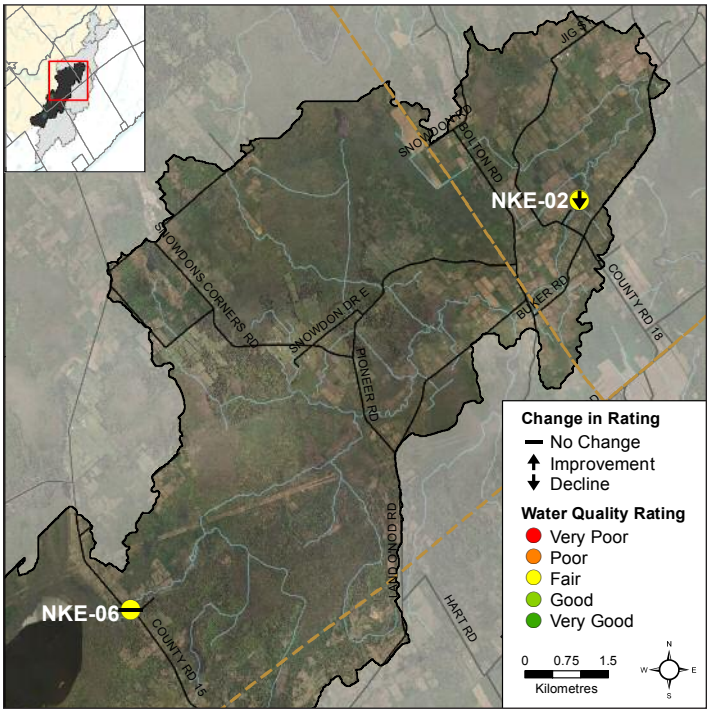


Figure 1 Water quality in the North Branch of Kemptville Creek. The rating shown on the map is for the 2007–2012 period. Arrows are used to show a change in the rating from the 2001–2006 period

Table 1 WQI Ratings and corresponding index scores (RVCA terminology, original WQI category names in brackets)

Rating	Index Score
Very good (Excellent)	95-100
Good	80-94
Fair	65-79
Poor (Marginal)	45-64
Very poor (Poor)	0-44

Table 2 WQI Ratings for North Kemptville Creek from 2001–2006 and 2007–2012

Sampling Site	Nearest interesection	2001-2006	Rating
NKE-06	West of County Rd. 15 and Gardiner Rd.	78	Fair
NKE-02	West of County Rd. 15 and Gardiner Rd.	83	Good
Sampling Site	**Nearest interesction**	**2007-2012**	**Rating**
NKE-06	West of County Rd. 15 and Gardiner Rd.	68	Fair
NKE-02	West of Mill St. and Buker Rd.	68	Fair

North Branch Nutrients

Total phosphorus (TP) is used as a primary indicator of excessive nutrient loading and may contribute to abundant aquatic vegetation growth and depleted dissolved oxygen levels. The Provincial Water Quality Objective (PWQO) of 0.030 mg/l is used as the TP Guideline. Concentrations greater than 0.030 mg/l indicate an excessive amount of TP.

Total Kjeldahl nitrogen (TKN) and ammonia (NH_3) are used as secondary indicators of nutrient loadings. RVCA uses a guideline of 0.500 mg/l to assess TKN[1] and the PWQO of 0.020 mg/l to assess ammonia concentrations in North Kemptville Creek.

Tables 3, 4 and 5 summarize average nutrient concentration at monitored sites on North Kemptville Creek and show the proportion of results that meet the guidelines.

Table 3 Summary of total phosphorus results for North Kemptville Creek from 2001–2006 and 2007–2012, highlighted values indicate average concentrations exceed the guideline

Total Phosphorus 2001–2006			
Site	**Average (mg/l)**	**Below Guideline**	**No. Samples**
NKE-06	0.017	97%	31
NKE-02	0.015	97%	31
Total Phosphorus 2007–2012			
Site	**Average (mg/l)**	**Below Guideline**	**No. Samples**
NKE-06	0.025	85%	33
NKE-02	0.031	79%	39

Table 4 Summary of total Kjeldahl nitrogen results for North Kemptville Creek from 2001–2006 and 2007–2012, highlighted values indicate average concentrations exceed the guideline

Total Kjeldahl Nitrogen 2001–2006			
Site	**Average (mg/l)**	**Below Guideline**	**No. Samples**
NKE-06	0.874	16%	31
NKE-02	0.796	19%	31
Total Kjeldahl Nitrogen 2007–2012			
Site	**Average (mg/l)**	**Below Guideline**	**No. Samples**
NKE-06	0.826	9%	39
NKE-02	0.803	8%	39

NKE-06

Site NKE-06 is the most upstream site within the North Branch catchment. The majority of samples at NKE-06 were below the TP guideline; 97 percent of samples were below the guideline in the 2001–2006 period (Figure 2a) and declined to 85 percent of samples in the 2007–2012 period (Figure 2b). Average TP concentration increased from 0.017 mg/l (2001–2006) to 0.025 mg/l (2007–2012).

TKN results show that the bulk of results exceeded the guideline (Figures 3a and 3b); only 16 percent of samples were below the guideline in the 2001–2006 period and declined to nine percent in the 2007–2012 period. The average concentration decreased slightly from 0.874 mg/l (2001-2006) to 0.826 mg/l (2007–2012). NH_3 results at this site were typically above the guideline (Figures 4a and 4b); however the proportion of samples below the

Table 5 Summary of ammonia results for North Kemptville Creek from 2001–2006 and 2007–2012, highlighted values indicate average concentrations exceed the guideline

Ammonia 2001–2006			
Site	**Average (mg/l)**	**Below Guideline**	**No. Samples**
NKE-06	0.063	29%	31
NKE-02	0.006	97%	31
Ammonia 2007–2012			
Site	**Average (mg/l)**	**Below Guideline**	**No. Samples**
NKE-06	0.048	48%	33
NKE-02	0.014	79%	39

[1] No Ontario guideline for TKN is presently available however waters not influenced by excessive organic inputs typically range from 0.100 to 0.500 mg/l, Environment Canada (1979) Water Quality Sourcebook, A Guide to Water Quality Parameters, Inland Waters Directorate, Water Quality Branch, Ottawa, Canada

guideline improved from 29 percent to 48 percent. This was complemented by a decrease in the average concentration from 0.063 mg/l (2001–2006) to 0.048 mg/l (2007–2012).

NKE-02

NKE-02 is the most downstream site within this catchment. Most sample results were below the TP guideline for both time periods (Figures 2a and 2b); 97 percent of samples were below the guideline in the 2001-2006 period and decreased to 79 percent of samples in the 2007-2012 period. There was also an increase in average TP concentration from 0.015 mg/l (2001-2006) to 0.031 mg/l (2007-2012).

Figures 3a and 3b show that the majority of results exceeded the TKN guideline; 19 percent of samples were below the guideline in 2001-2006 and declined to eight percent in the 2007-2012 period. The average concentration also increased marginally from 0.796 mg/l (2001-2006) to 0.803 mg/l (2007-2012), and continued to exceed the guideline. The majority of NH3 results were below the guideline (Figures 4a and 4b); the proportion of samples below the guideline declined from 97 percent to 79 percent while average concentration increased from 0.006 mg/l (2001-2006) to 0.014 mg/l (2007-2012).

North Branch Nutrient Summary

The data shows that nutrient enrichment continues to be a concern in North Branch Creek. Water quality guidelines for all three nutrient indicators were exceeded at monitored sites and may negatively impact water quality. It should be noted that the frequent exceedances in TKN at both sites may be influenced by the organic matter held in the large wetland areas within the catchment resulting in naturally high concentrations of organic nitrogen.

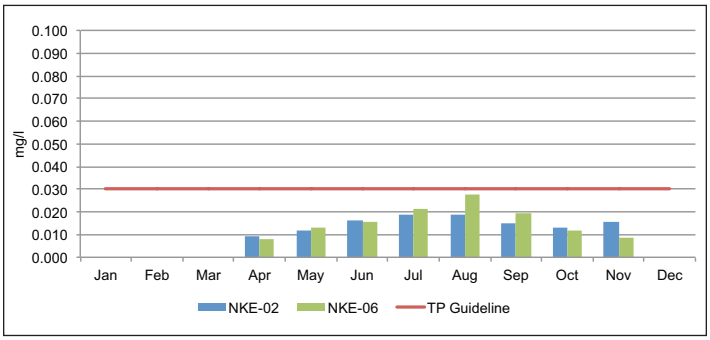


Figure 2a Total phosphorus concentrations in North Branch from 2001–2006

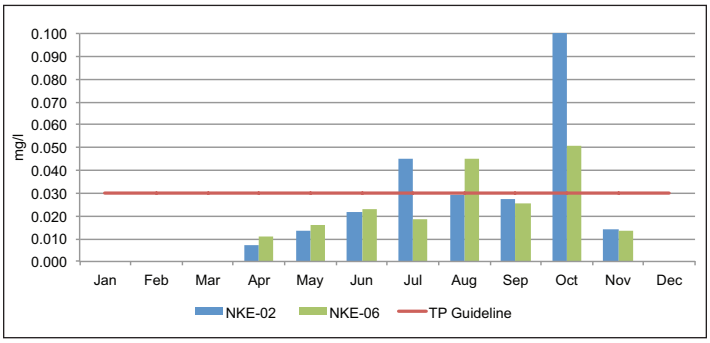


Figure 2b Total phosphorus concentrations in North Branch from 2007–2012

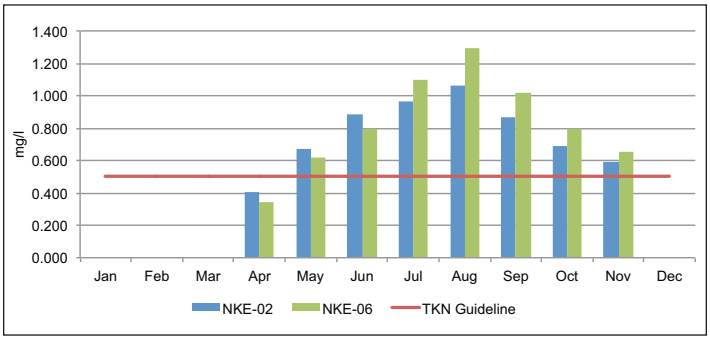


Figure 3a Total Kjeldahl nitrogen concentrations in North Branch from 2001–2006

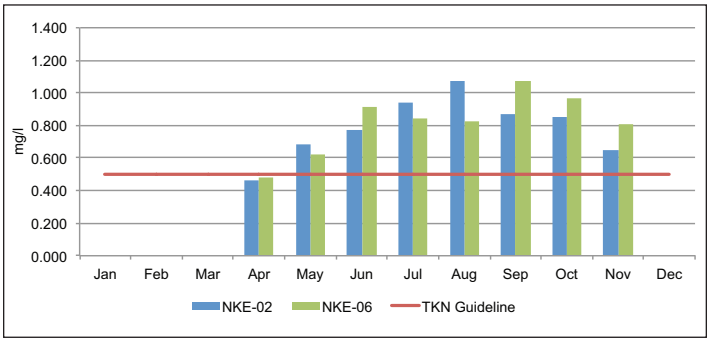


Figure 3b Total Kjeldahl nitrogen concentrations in North Branch from 2007–2012

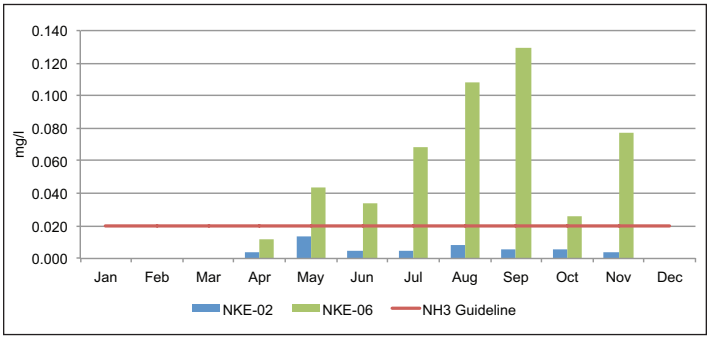


Figure 4a Ammonia concentrations in North Branch from 2001–2006

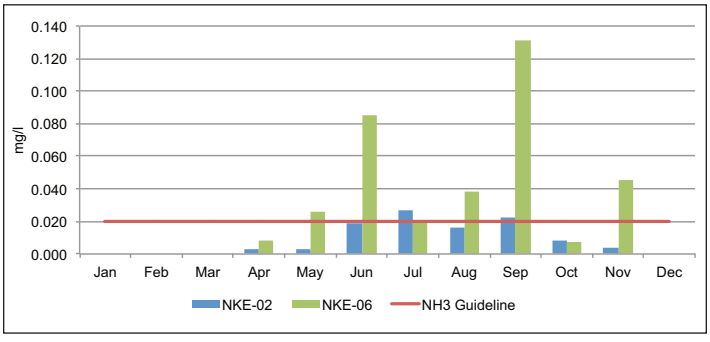


Figure 4b Ammonia concentrations in North Branch from 2007–2012

North Branch *E.coli*

E. coli is used as an indicator of bacterial pollution from human or animal waste; in elevated concentrations it can pose a risk to human health. The PWQO of 100 colony forming units/100 milliliters (CFU/100 ml) is used to assess *E. coli*. Counts greater than this guideline indicate that bacterial contamination may be a problem within a waterbody. The KCWP also set a target of *E. coli* counts of 100 CFU/100 ml at the 70th percentile for Kemptville Creek.

Table 6 summarizes the geometric mean[2] at monitored sites on North Kemptville Creek and shows the proportion of samples that meet the *E. coli* guideline.

Figure 5 shows the results of the geometric mean with respect to the guideline for the two periods; 2001-2006 and 2007-2012. Figure 6 shows percentile plots of the data for the two time periods of interest. Any point to the left of the 70th percentile line (vertical) and above the guideline (horizontal line) has failed to reach the KCWP target.

NKE-06

E. coli counts at site NKE-06 show an increase in bacterial counts. Counts at the 70th percentile increased from 67 CFU/100 ml (Figure 6a) to 144 CFU/100 ml (Figure 6b), thus rose to exceed the target set by the KCWP. The proportion of samples below the guideline declined from 73 percent to 58 percent (Figures 5a and 5b). The count at the geometric mean also increased from 38 CFU/100 ml (2001-2006) to 78 CFU/100 ml (2007-2012).

NKE-02

Percentile plots of *E. coli* data at site NKE-02 show the 70th percentile target was not achieved in either time period. However, the *E. coli* count at the 70th percentile did decrease from 146 CFU/100 ml (Figure 6a) to 135 CFU/100 ml (Figure 6b). The proportion of samples below the guideline showed little change and only decreased from 55 percent (Figure 5a) to 51 percent (Figure 5b) and is consistent with a slight decline from 68 CFU/100 ml (2001-2006) to 67 CFU/100 ml (2007-2012).

E.coli Summary

The results indicate that bacterial contamination is a concern within the North Branch Catchment of Kemptville Creek. The target set by the KCWP was not achieved at either site and there was evidence of increased counts at site NKE-06.

Table 6 Summary of *E. coli* results for Barnes Creek from 2001–2006 and 2007–2012

E. coli 2001–2006			
Site	**Geometric mean (CFU/100ml)**	**Below Guideline**	**No. Samples**
NKE-06	38	73%	30
NKE-02	68	55%	29
***E. coli* 2007–2012**			
Site	**Geometric mean (CFU/100ml)**	**Below Guideline**	**No. Samples**
NKE-06	78	58%	33
NKE-02	67	51%	39

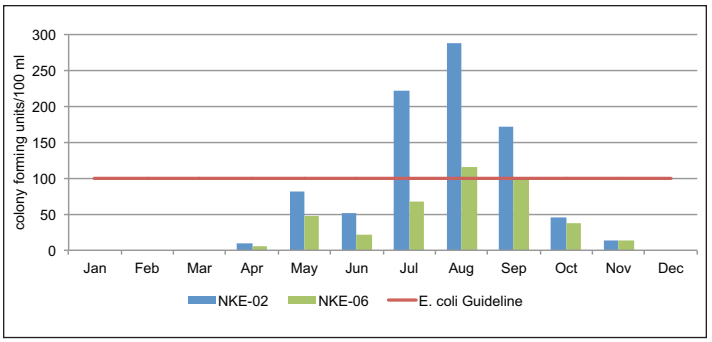


Figure 5a *E. coli* counts in North Branch from 2001–2006

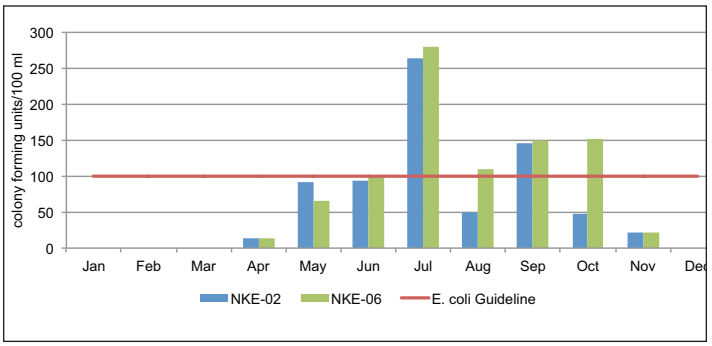


Figure 5b *E. coli* counts in North Branch from 2007–2012

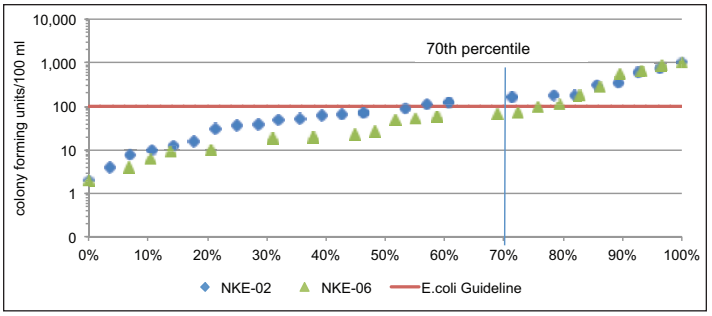


Figure 6a Percentile plots of *E. coli* in North Branch for 2001–2006

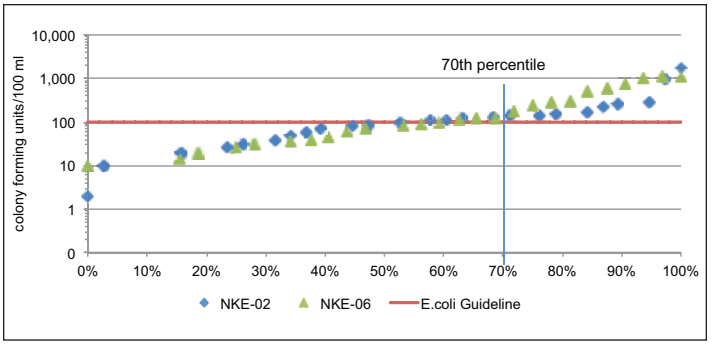


Figure 6b Percentile plots of *E. coli* in North Branch for 2007–2012

[2] A type of mean or average, which indicates the central tendency or typical value of a set of numbers by using the product of their values (as opposed to the arithmetic mean which uses their sum). It is often used to summarize a variable that varies over several orders of magnitude, such as *E. coli* counts.

2. North Branch Riparian Conditions

NORTH BRANCH OVERBANK ZONE

Riparian Buffer Width Evaluation

Figure 7 shows the extent of the naturally vegetated riparian zone in the catchment, 30 metres on either side of all water bodies and watercourses. Results from the RVCA's Land Cover Classification Program show that 83 percent of rivers, streams and creeks are buffered with woodland, and wetland; the remaining 17 percent of the riparian buffer is occupied by settlement, transportation, sand and gravel and crop and pastureland.

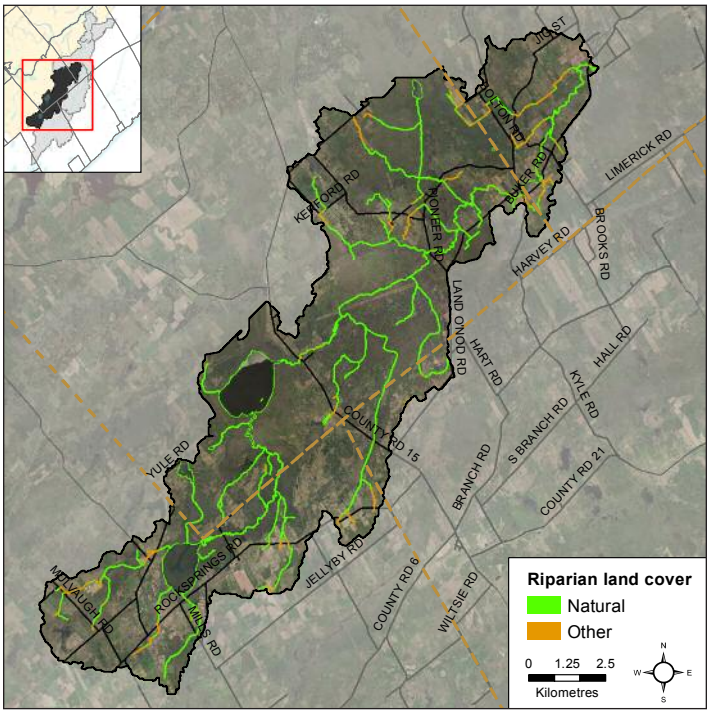


Figure 7 Natural and other riparian land cover along North Branch

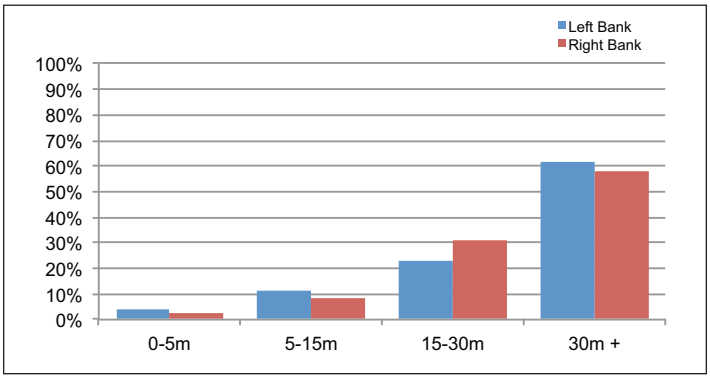


Figure 8 Riparian Buffer Evaluation along North Branch

Adjacent Land Use

The RVCA's Macro stream Survey Program identifies eight different land uses beside the North Branch (Figure 9). Surrounding land use is considered from the beginning to end of the survey section (100 metres) and up to 100 metres on each side of the creek. Land use outside of this area is not considered for the surveys but is nonetheless part of the subwatershed and will influence the creek. Natural areas made up 88 percent of the stream, characterized by forest, scrubland, meadow and wetland. The remaining land use consisted of residential, active agriculture, abandoned agriculture and infrastructure.

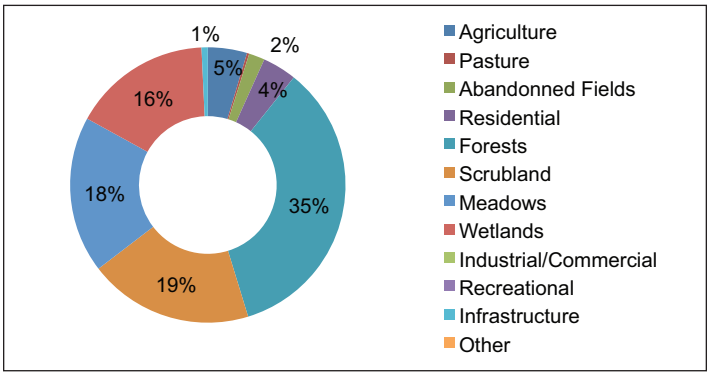


Figure 9 Land Use along North Branch

35 percent of North Branch is forested

NORTH BRANCH SHORELINE ZONE

Instream Erosion

Erosion is a normal, important stream process and may not affect actual bank stability; however, excessive erosion and deposition of sediment within a stream can have a detrimental effect on important fish and wildlife habitat. Poor bank stability can greatly contribute to the amount of sediment carried in a waterbody as well as loss of bank vegetation due to bank failure, resulting in trees falling into the stream and the potential to impact instream migration. Figure 10 shows that there was very limited bank erosion observed on the left and right bank along the North Branch.

Undercut Stream Banks

Undercut banks are a normal and natural part of stream function and can provide excellent refuge areas for fish. Figure 11 shows that the North Branch had very few locations with identified undercut banks.

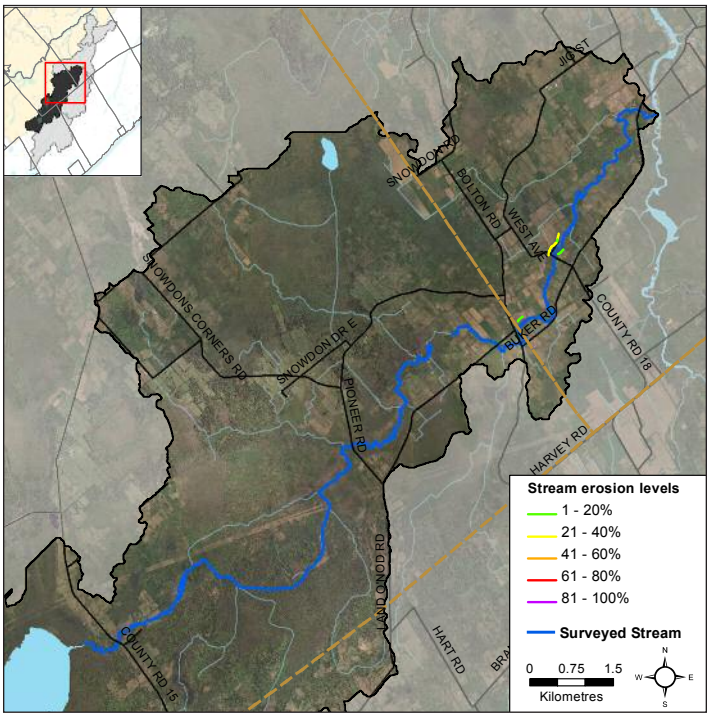


Figure 10 Erosion along North Branch

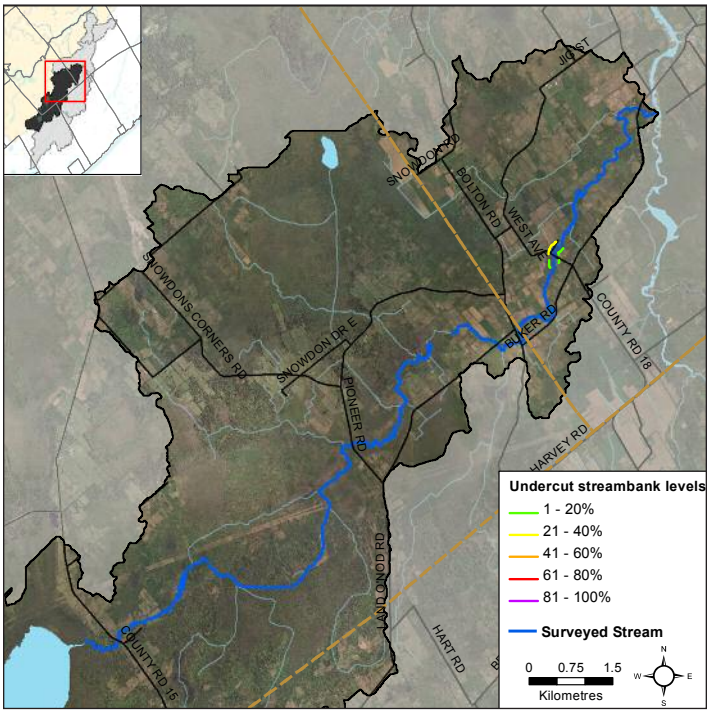


Figure 11 Undercut stream banks along North Branch

There is limited erosion on North Branch

There is limited undercut bank along North Branch

Stream Shading

Grasses, shrubs and trees all contribute towards shading a stream. Shade is important in moderating stream temperature, contributing to food supply and helping with nutrient reduction within a stream. Figure 12 shows the stream shading locations along the North Branch.

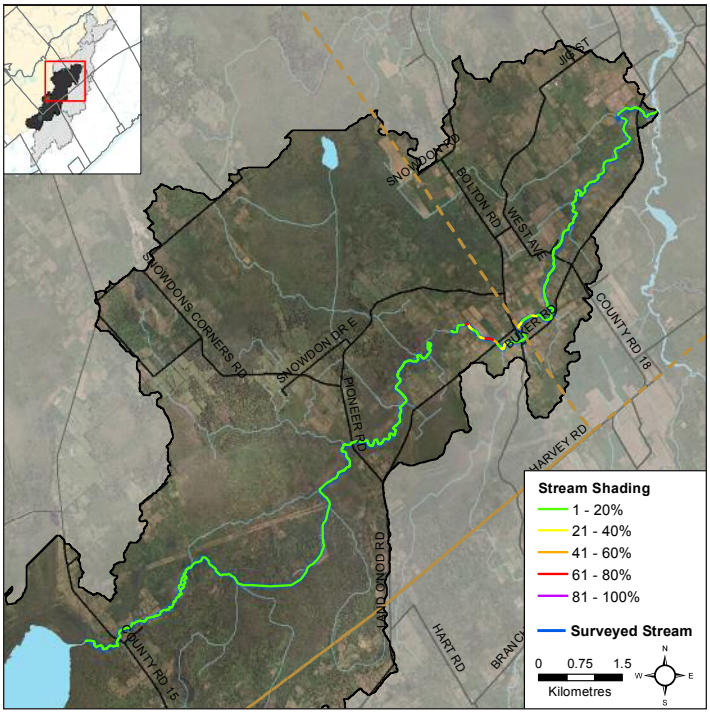


Figure 12 Stream shading along North Branch

Instream Woody Debris

Figure 13 shows that the majority of the North Branch had varying levels of instream woody debris in the form of branches and trees. Instream woody debris is important for fish and benthic habitat, by providing refuge and feeding areas.

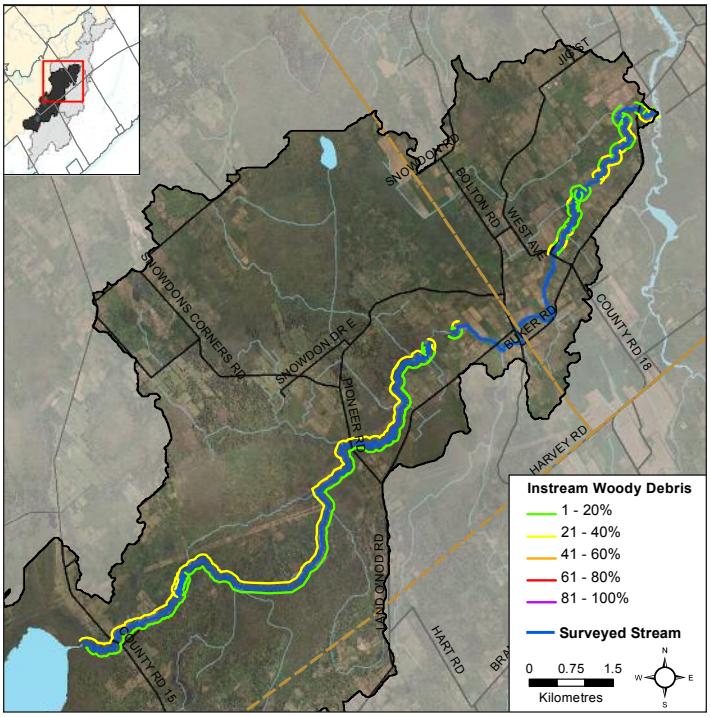


Figure 13 Instream woody debris along North Branch

Stream shading on North Branch

Instream woody debris on North Branch

Overhanging Trees and Branches

Figure 14 shows that the majority of the North Branch had varying levels of overhanging branches and trees. Overhanging branches and trees provide a food source, nutrients and shade which helps to moderate instream water temperatures.

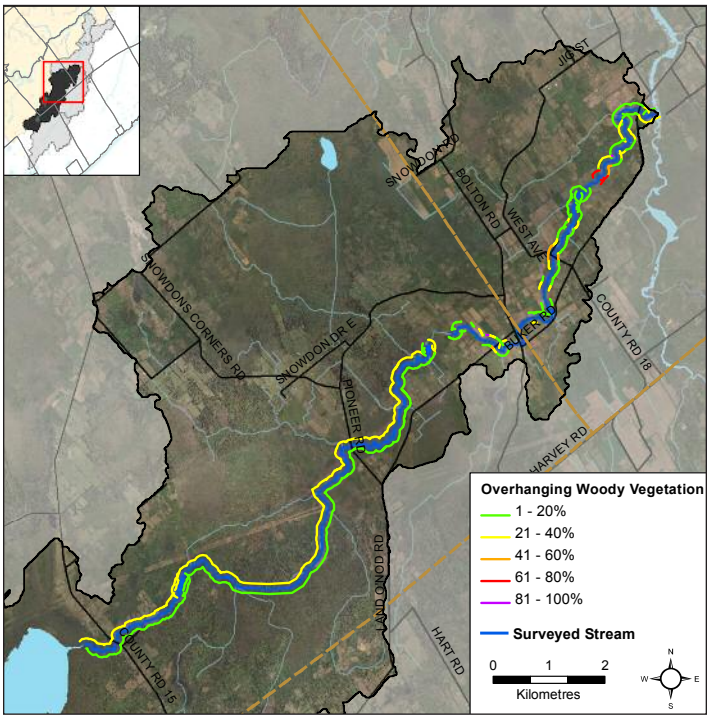


Figure 14 Overhanging trees and branches along North Branch

Overhanging trees and branches

Anthropogenic Alterations

Figure 15 shows 88 percent of the North Branch remains “unaltered.” Sections considered “natural” with some human changes account for seven percent of sections. "Altered" sections accounted for four percent of the stream, with only one section sampled being considered “highly altered.” Areas classified as highly altered and altered included existing road crossings, shoreline/instream modifications and little or no buffer.

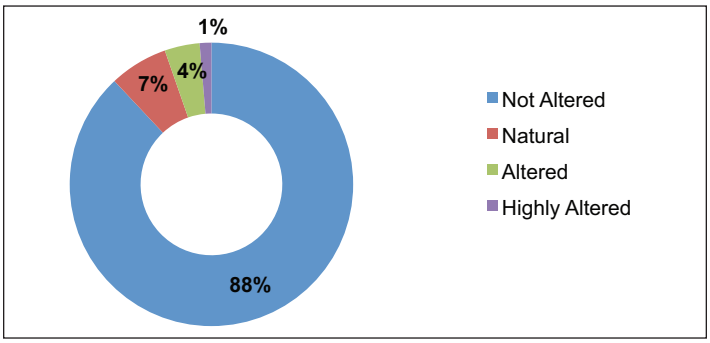


Figure 15 Anthropogenic alterations along North Branch

Man-made alterations along North Branch

NORTH BRANCH INSTREAM AQUATIC HABITAT

Benthic Invertebrates

Freshwater benthic invertebrates are animals without backbones that live on the stream bottom and include crustaceans such as crayfish, molluscs and immature forms of aquatic insects. Benthos represent an extremely diverse group of aquatic animals and exhibit wide ranges of responses to stressors such as organic pollutants, sediments and toxicants, which allows scientists to use them as bioindicators.As part of the Ontario Benthic Biomonitoring Network (OBBN), the RVCA has been collecting benthic invertebrates at this location on the North Branch in Bishops Mills since 2003. Monitoring data is analyzed and the results are presented using the Family Biotic Index, Family Richness and percent *Ephemeroptera, Plecoptera* and *Trichoptera.*

Hilsenhoff Family Biotic Index

The Hilsenhoff Family Biotic Index (FBI) is an indicator of organic and nutrient pollution and provides an estimate of water quality conditions for each site using established pollution tolerance values for benthic invertebrates. FBI results for the North Branch show that it has a "Fair to Poor" water quality conditions for the period from 2007 to 2012 (Figure 16) using a grading scheme developed by Conservation Authorities in Ontario for benthic invertebrates.

Family Richness

Family Richness measures the health of the community through its diversity and increases with increasing habitat diversity suitability and healthy water quality conditions. Family Richness is equivalent to the total number of benthic invertebrate families found within a sample. Although the family richness appears to be high the samples are dominated by species that are moderately tolerant and tolerant to poor water quality conditions. Using Family Richness as the indicator, the North Branch is reported to have "Fair to Poor" water quality (Figure 17).

EPT

Ephemeroptera (Mayflies), *Plecoptera* (Stoneflies), and *Trichoptera* (Caddisflies) are species considered to be very sensitive to poor water quality conditions. High abundance of these organisms is generally an indication of good water quality conditions at a sample location. The community structure is dominated by species that are not sensitive to poor water quality conditions. As a result, the EPT indicates that the North Branch is reported to have "Fair to Poor" water quality (Figure 18) from 2007 to 2012.

Conclusion

Overall the North Branch has a water quality rating of "Fair to Poor" from 2007 to 2012.

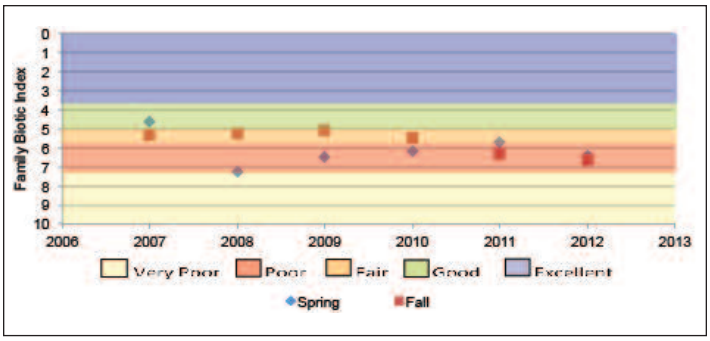


Figure 16 Hilsenhoff Family Biotic Index on North Branch

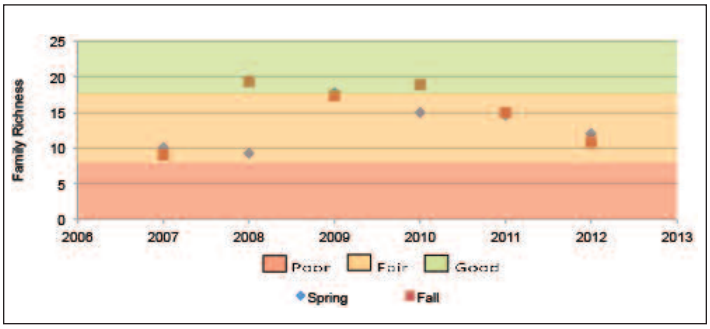


Figure 17 Family Richness in North Branch

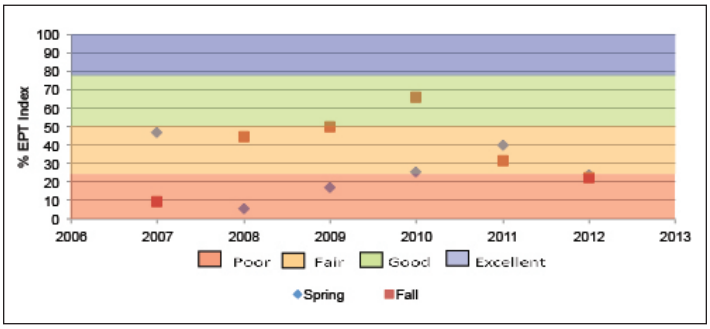


Figure 18 EPT in North Branch

RVCA Staff on North Branch

Habitat Complexity

Streams are naturally meandering systems and move over time; there are varying degrees of habitat complexity, depending on the creek. Examples of habitat complexity include variable habitat types such as pools and riffles as well as substrate variability and woody debris structure. A high percentage of habitat complexity (heterogeneity) typically increases the biodiversity of aquatic organisms within a system. Twenty-nine percent of the North Branch was considered heterogeneous, as shown in Figure 19.

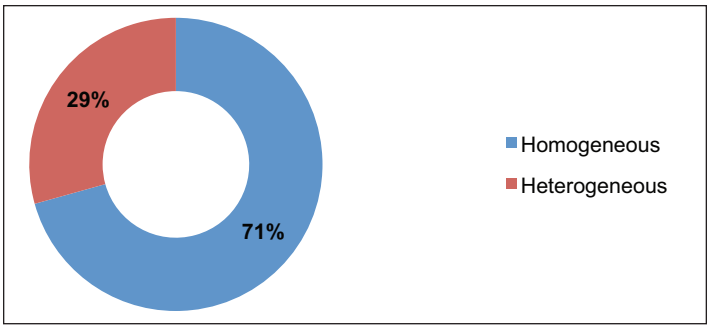


Figure 19 Habitat complexity along North Branch

Instream Substrate

Boulders create instream cover and back eddies for large fish to hide and/or rest out of the current. Cobble provides important over wintering and/or spawning habitat for small or juvenile fish. Cobble can also provide habitat conditions for benthic invertebrates that are a key food source for many fish and wildlife species. Figure 20 shows where cobble and boulder substrate is found in the North Branch. Diverse substrate is important for fish and benthic invertebrate habitat because some species have specific

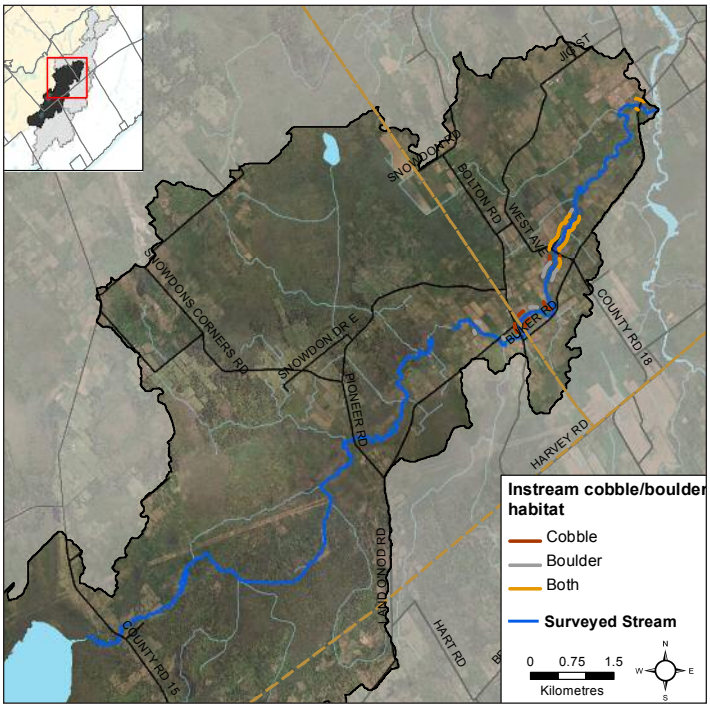


Figure 20 Instream substrate along North Branch

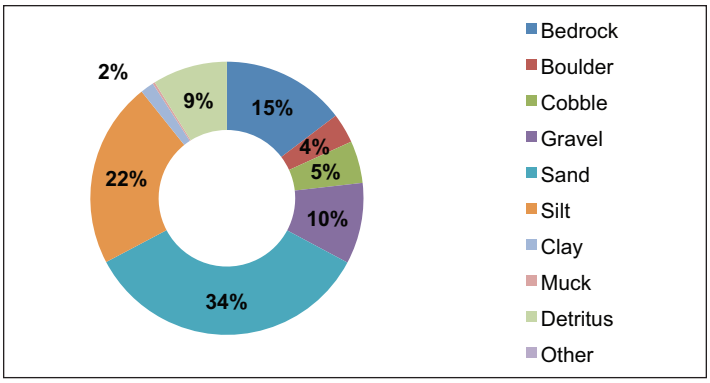


Figure 21 Instream substrate along North Branch

substrate requirements and for example will only reproduce on certain types of substrate (Figure 21).

Instream Morphology

Pools and riffles are important habitat features for fish. Riffles are areas of agitated water and they contribute higher dissolved oxygen to the stream and act as spawning substrate for some species of fish, such as walleye. Pools provide shelter for fish and can be refuge pools in the summer if water levels drop and water temperature in the creek increases. Pools also provide important over wintering areas for fish. Runs are usually moderately shallow, with unagitated surfaces of water and areas where the thalweg (deepest part of the channel) is in the center of the channel.

Figure 22 shows that the North Branch is somewhat variable; 84 percent consists of runs, 10 percent pools and 6 percent riffles.

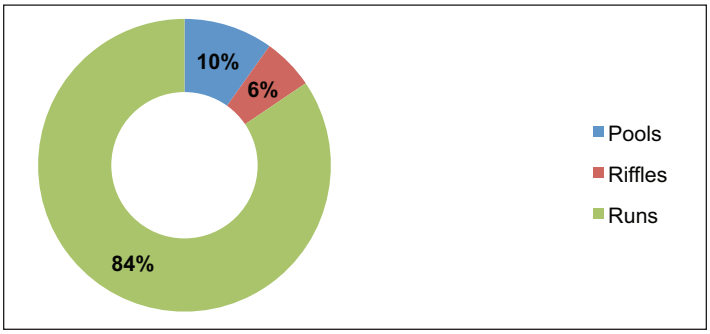


Figure 22 Instream morphology along North Branch

Vegetation Type

Instream vegetation provides a variety of functions and is a critical component of the aquatic ecosystem. For example emergent plants along the shoreline can provide shoreline protection from wave action and important rearing habitat for species of waterfowl. Submerged plants provide habitat for fish to find shelter from predator fish while they feed. Floating plants such as water lilies shade the water and can keep temperatures cool while reducing algae growth. The North Branch had a healthy diversity of instream vegetation. The dominant vegetation type recorded at thirty-five percent consisted of narrow leafed emergents. Figure 23 depicts the plant community structure for the North Branch.

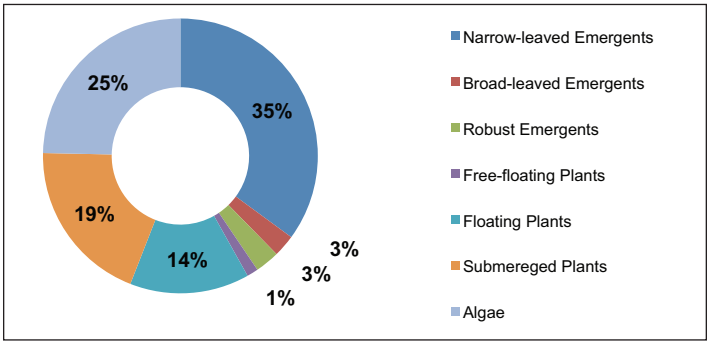


Figure 23 Vegetation type along North Branch

Instream Vegetation Abundance

Instream vegetation is an important factor for a healthy stream ecosystem. Vegetation helps to remove contaminants from the water, contributes oxygen to the stream, and provides habitat for fish and wildlife. Too much vegetation can also be detrimental. Figure 24 demonstrates that the North Branch had healthy levels of instream vegetation for most of its length.

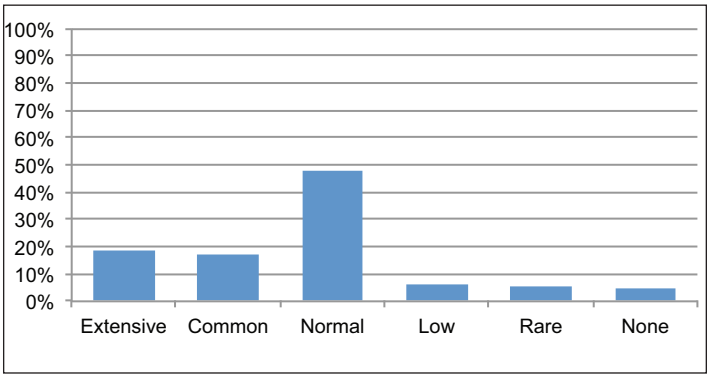


Figure 24 Instream vegetation abundance along North Branch

Invasive Species

Invasive species can have major implications on streams and species diversity. Invasive species are one of the largest threats to ecosystems throughout Ontario and can outcompete native species, having negative effects on local wildlife, fish and plant populations. Forty-six percent of the sections surveyed along the North Branch had invasive species (Figure 25). The invasive species observed in the North Branch were curly leaf pondweed, European frogbit, Eurasian milfoil, purple loosestrife, rusty crayfish and dog strangling vine.

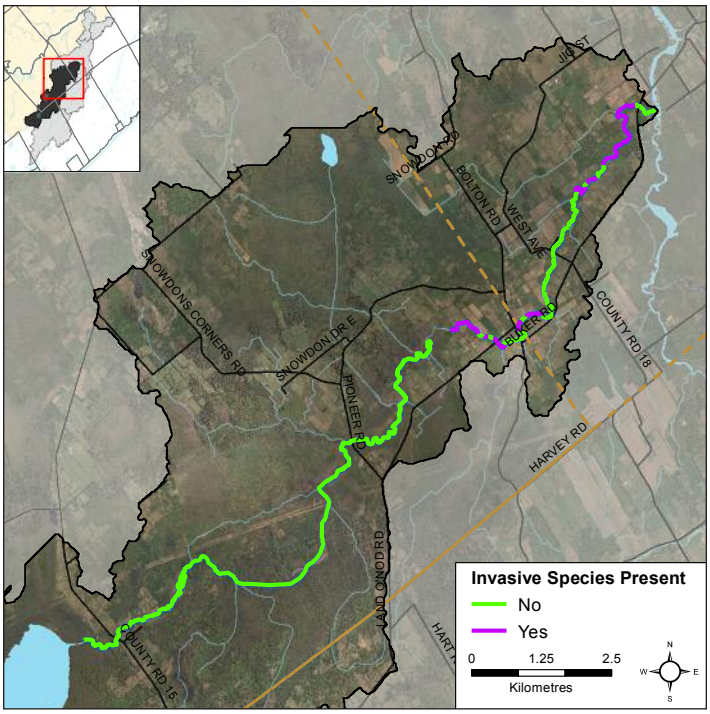


Figure 25 Invasive species along North Branch

Invasive rusty crayfish found in North Branch

Thermal Regime

Many factors can influence fluctuations in stream temperature, including springs, tributaries, precipitation runoff, discharge pipes and stream shading from riparian vegetation. Water temperature is used along with the maximum air temperature (using the Stoneman and Jones method) to classify a watercourse as either warm water, cool water or cold water. Analysis of the data collected indicates that the North Branch is classified as a warm water system (Figure 27). Figure 26 shows the location of temperature loggers at two sampling locations on the North Branch.

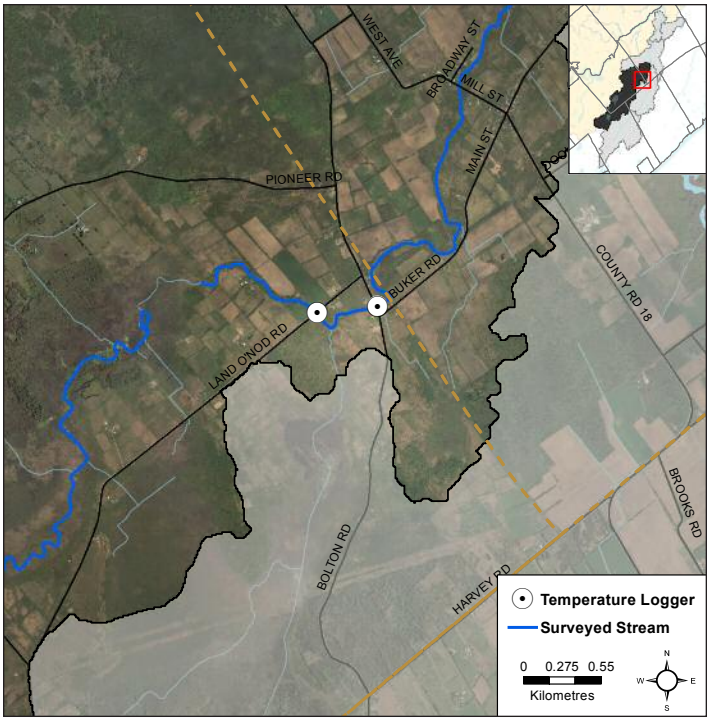
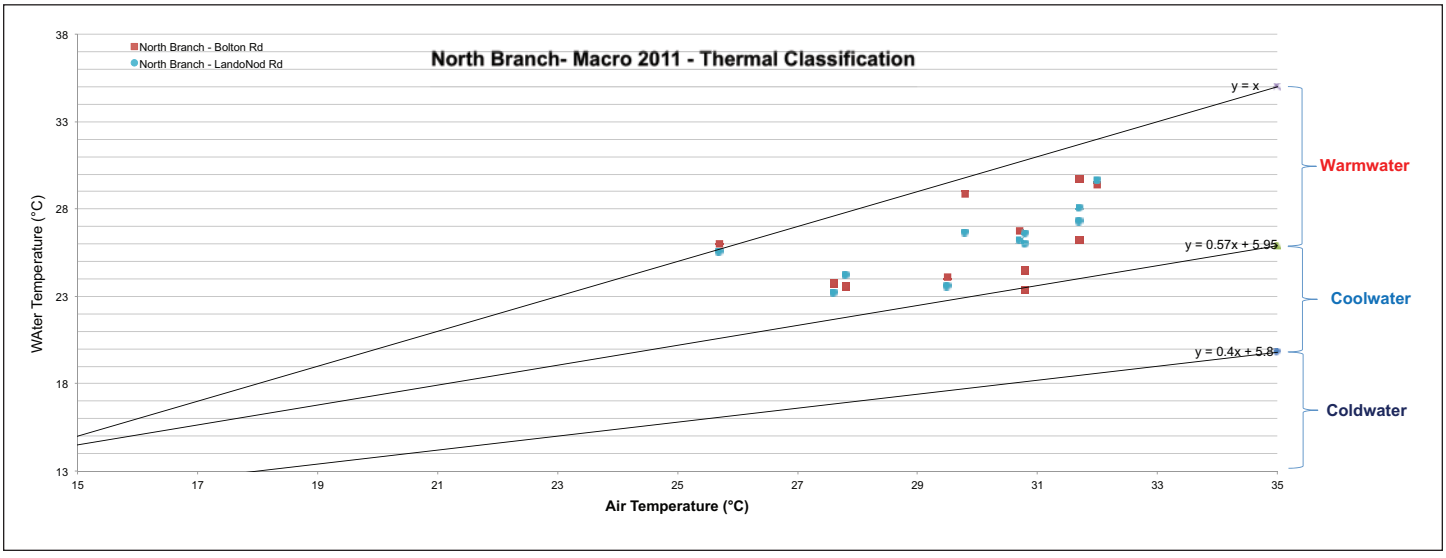


Figure 26 Temperature loggers in North Branch



SITE ID	SOURCE_ID	Y_WATER	X_AIR	CLASSIFICATION	PROGRAM	YEAR
North Branch — Bolton Rd	NB-1	26.337	30.3	WARMWATER	MACRO	2011
North Branch — Landonod Rd	NB-2	26.379	30.3	WARMWATER	MACRO	2011

Figure 27 Temperature logger data for three sites on North Branch
Each point on the graph represents a temperature that meets the following criteria:

- Sampling dates between July 1 and September 7
- Sampling date is preceded by two consecutive days above 24.5 °C, with no rain
- Water temperatures are collected at 4 p.m.
- Air temperature is recorded as the max temperature for that day.

Migratory Obstructions

It is important to know the locations of migratory obstructions because they can prevent fish from accessing important spawning and rearing habitat (Figure 28). Migratory obstructions can be natural or manmade, and they can be permanent or seasonal. There were eight beaver dams on the North Branch at the time of the survey. The North Branch does consistently have beaver dam activity each year.

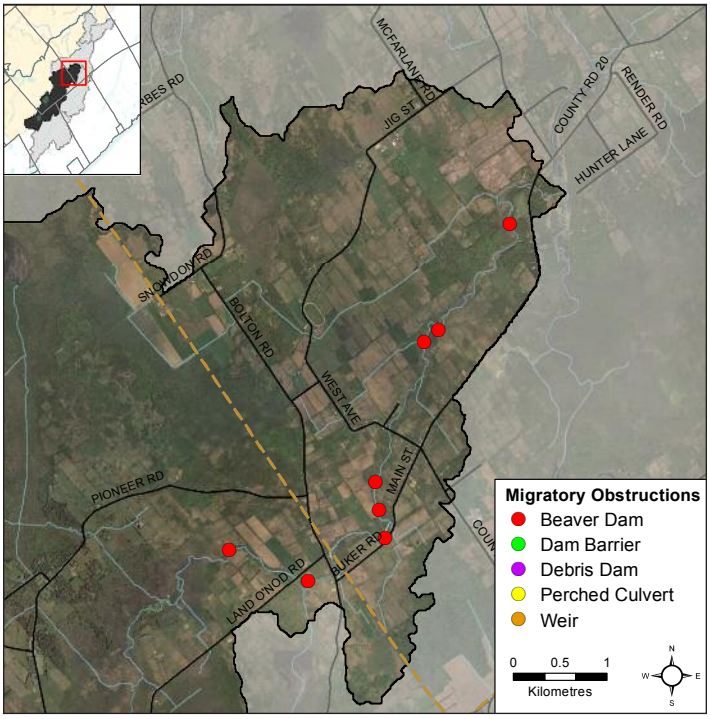


Figure 28 Migratory obstructions along North Branch

Beaver dam — a migratory obstruction on North Branch

Fish Sampling

Fish sampling sites located along the North Branch are shown in Figure 29. The provincial fish codes shown on the preceding map are listed (in Table 7) beside the common name of those fish species identified in the North Branch. The North Branch is classified as a warm/cool water recreational and baitfish fishery with 22 species observed.

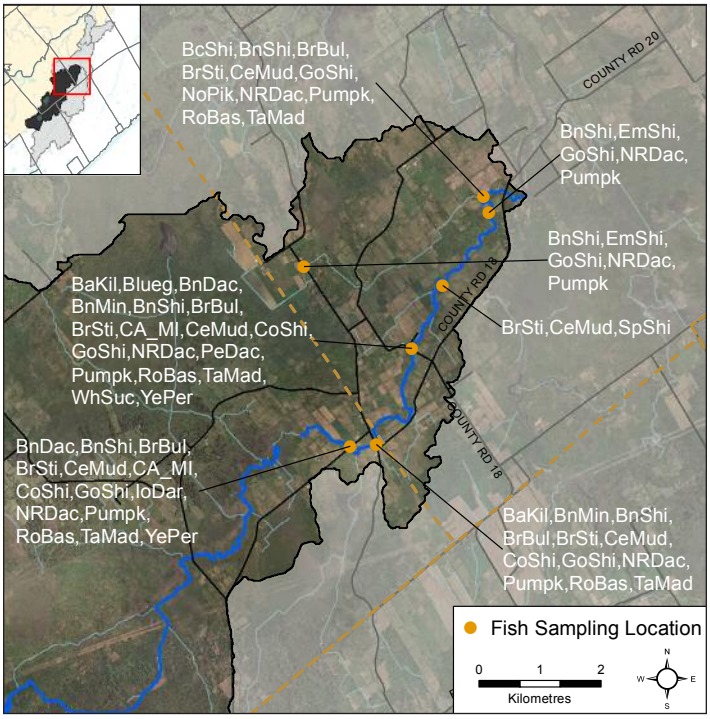


Figure 29 Fish sampling along North Branch

Table 7 Fish species identified in North Branch

Species observed in North Branch (with fish code)			
banded killifish	BaKil	golden shiner	GoShi
blackchin shiner	BcShi	iowa darter	IoDar
blacknose dace	BnDac	northern pike	NoPik
blacknose shiner	BnShi	northern redbelly dace	NRDac
bluegill	Blueg	pearl dace	PeDac
bluntnose minnow	BnMin	pumpkinseed	Pumpk
brook stickleback	BrSti	rock bass	RoBas
brown bullhead	BrBul	spottail shiner	SpShi
central mudminnow	CeMud	tadpole madtom	TaMad
common shiner	CoShi	white sucker	WhSuc
emerald shiner	EmShi	yellow perch	YePer

Riparian Restoration

Figure 30 depicts the locations where various riparian restoration activities can be implemented as a result of observations made during the stream survey assessments.

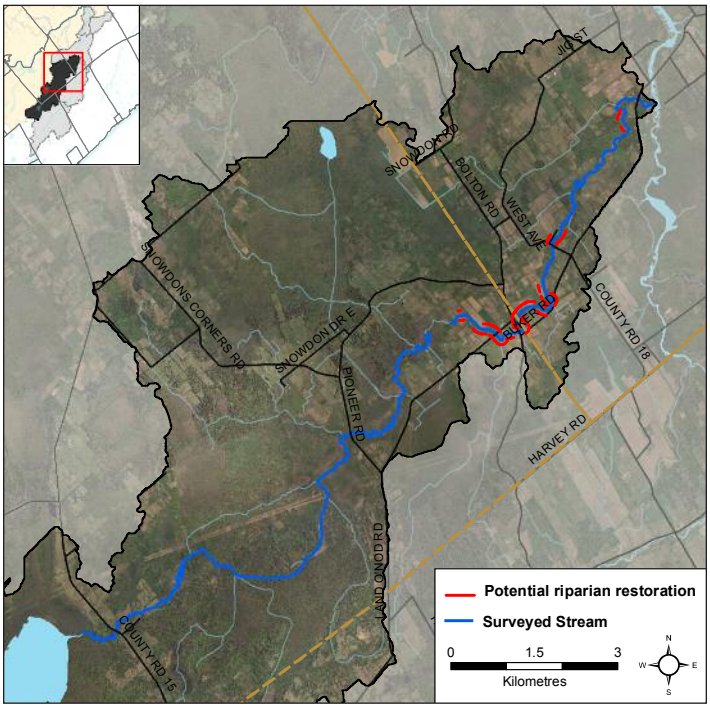


Figure 30 Riparian restoration along North Branch

Water Chemistry

During the macro stream survey, a YSI probe is used to collect water chemistry, as follows:

- Dissolved Oxygen is a measure of the amount of oxygen dissolved in water. The lowest acceptable concentration of dissolved oxygen is 6.0 mg/L for early stages of warm water fish and 9.5 mg/L for cold water fish (CCME, 1999).
- A saturation value (concentration of oxygen in water) of 90 percent or above is considered healthy. Saturation levels above one hundred percent are not uncommon in sections of stream where there are high amounts of algae and other aquatic plants.
- Conductivity is the ability of a substance to transfer electricity. This measure is influenced by the presence of dissolved salts and other ions in the stream.
- pH is a measure of relative acidity or alkalinity, ranging from one (most acidic) to 14 (most alkaline/basic), with 7 occupying a neutral point.

2011 data for these four parameters is summarized in Table 8.

Table 8 Water chemistry in North Branch

Month	Range	DO (mg/L)	DO(%)	Conductivity (µs/cm)	pH
May 2011	Low	5.73	55.7	189	7.54
	High	9.01	87.6	242	7.88
June 2011	Low	3.35	39.3	218	7.39
	High	7.69	90.1	315	7.80
July 2011	Low	4.13	47.1	279	7.55
	High	7.85	89.5	296	7.55

Monitoring on North Branch

3. Land Cover

Wetland is the dominant land cover type in the catchment along with woodland and crop and pastureland, as shown in Table 9 and displayed in the map on the front cover of the report.

Table 9 Catchment land cover type

Cover Type	Area (ha)	Area (% of Cover)
Wetland**	5363	42
Woodland*	3633	28
Crop & Pasture	3391	26
Settlement	293	2
Transportation	188	2

* Does not include treed swamps ** Includes treed swamps

Woodland Cover

The North Branch of Kemptville Creek catchment contains 3633 hectares of upland forest and 835 hectares of lowland forest (treed swamps) (Figure 31) that occupies 35 percent of the drainage area (versus the 36 percent of woodland cover in the Kemptville Creek Subwatershed). This figure is greater than the 30 percent of woodland area required to sustain forest birds, according to Environment Canada's Guideline: "How much habitat is enough?" When forest cover declines below 30 percent, forest birds tend to disappear as breeders across the landscape.

One hundred and five (40 percent) of the 264 woodland patches in the catchment are very small, being less than one hectare in size. Another 118 (45 percent) of the wooded patches ranging from one to less than 20 hectares in size tend to be dominated by edge-tolerant bird species. The remaining 41 (15 percent of) woodland patches range between 20 and 334 hectares. Thirty of these patches contain woodland between 20 and 100 hectares and may support a few area-sensitive species and some edge intolerant species, but will be dominated by edge tolerant species.

Conversely, 11 (four percent) of the 264 woodland patches in the drainage area exceed the 100 plus hectare size needed to support most forest dependent, area sensitive birds and are large enough to support approximately 60 percent of edge-intolerant species. Five of these patches top 200 hectares, which according to the Environment Canada Guideline will support 80 percent of edge-intolerant forest bird species (including most area sensitive species) that prefer interior forest habitat conditions.

Forest Interior

The same 264 woodlands contain 56 forest interior patches (Figure 31) that occupy eight percent (992 hectares) of the catchment land area (that is the same as the eight percent of interior forest in the Kemptville Creek Subwatershed). This is below the ten percent figure referred to in the Environment Canada Guideline that is considered to be the minimum threshold for supporting edge intolerant bird species and other forest dwelling species in the landscape. Most patches (32) have less than 10 hectares of interior forest, 17 of which have small areas of interior forest habitat less than one hectare in size. Another 16 patches contain between 10 and 30 hectares of interior forest. Conversely, eight patches have greater than 30 hectares of interior forest, with three patches exceeding 100 hectares (at 114, 122 and 134 hectares).

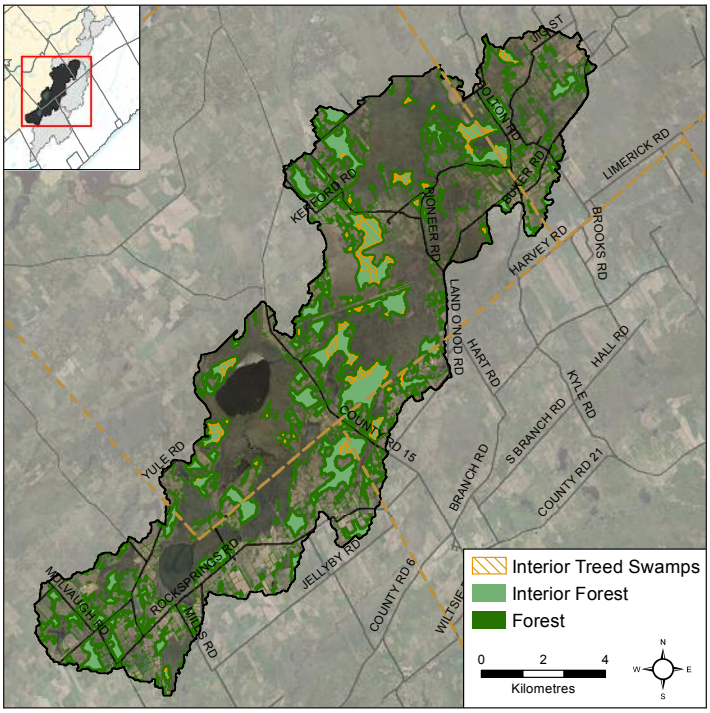
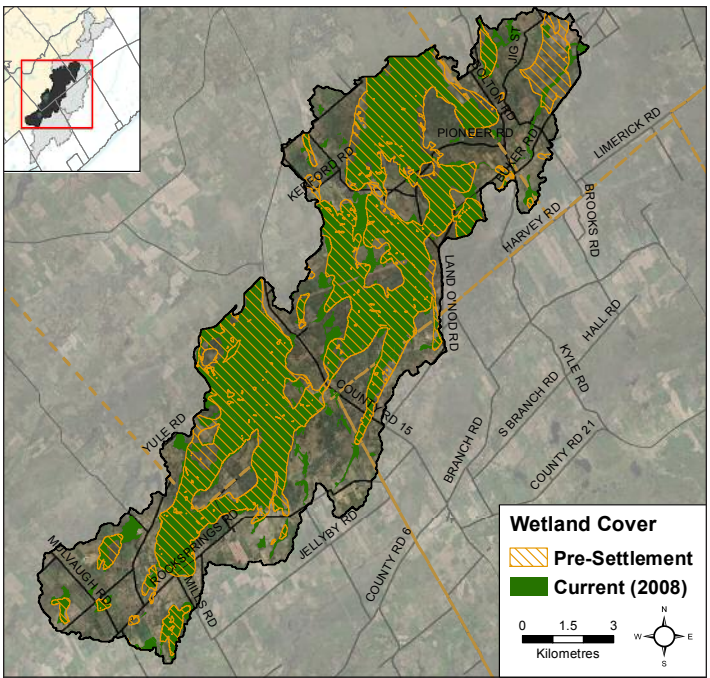


Figure 31 Catchment woodland cover and forest interior

Wetland Cover

Figure 32 shows pre-settlement versus current (2008) wetland cover in the catchment.



Pre-Settlement data provided by: Ducks Unlimited Canada, 2010. Southern Ontario Wetland Conversion Analysis, http://www.ducks.ca/aboutduc/news/archives/prov2010/pdf/duc_ontariowca.pdf, (March 2010)

Figure 32 Catchment wetland cover

4. Stewardship and Protection

The RVCA and its partners are working to protect and enhance environmental conditions in the Kemptville Creek Subwatershed.

Rural Clean Water Projects

Figure 33 shows the location of all Rural Clean Water Projects in the North Branch of Kemptville Creek drainage area. From 2007 to 2012, landowners completed one septic system repair/replacement. RVCA contributed $1,000 in grant dollars towards the total project cost of $15,550.

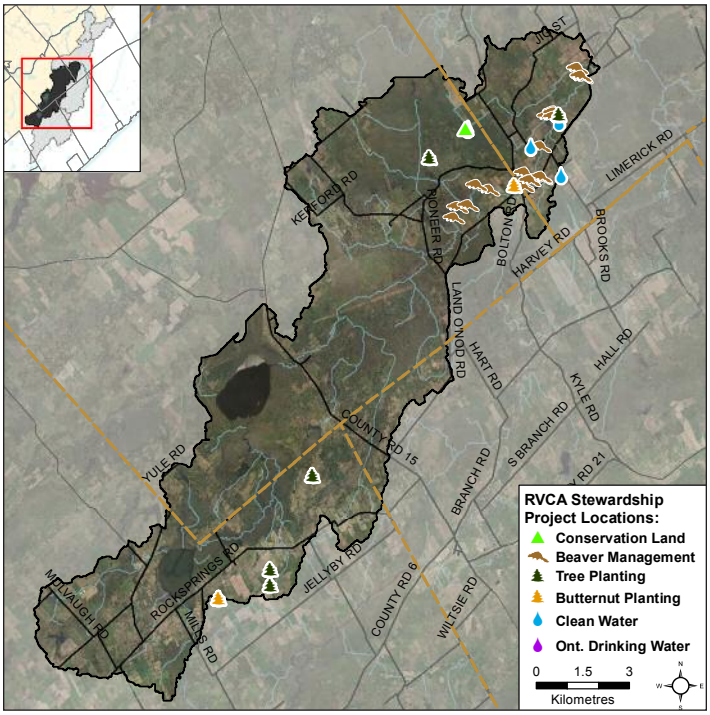


Figure 33 RVCA stewardship program project locations

Prior to 2007, the RVCA completed three projects in the area consisting of two buffer/windbreak plantings and one well upgrade. In total, RVCA contributed $7,190 in grant dollars to projects valued at $9,778.

Tree Planting Projects

The location of all tree planting projects is also shown in Figure 33. From 2007 to 2012, 23,800 trees were planted on two sites through the RVCA Tree Planting Program. Project value is $46,209 with $26,046 of that amount coming from other fundraising sources.

Before that, landowners helped plant 34,700 trees, valued at $58,428, on three project sites, using the RVCA Tree Planting Program; fundraising dollars accounted for $48,260 of that amount.

Beaver Management

The Kemptville Creek Beaver Dam Pilot Project was initiated by the Rideau Valley Conservation Authority in 2003 to tackle landowner flooding concerns along the North and South Branch of Kemptville Creek. The pilot project consisted of: beaver dam surveys; aquatic habitat and fish community surveys; nuisance beaver trapping; beaver dam removal; water level monitoring of beaver dam removals and a database recording landowner flooding concerns. Final results show a total of 64 beaver and six dams being removed from 2003 to 2005 along with the breaching of 11 dams.

Lessons learned from the pilot project have been used to assist with further beaver management along the North Branch of Kemptville Creek in 2011/2012. Working with local landowners and the municipalities of North Grenville and Merrickville-Wolford, RVCA has assisted with the removal of 74 beaver and the breaching of seven dams at a total project cost of $5,000. This work carried out on a 13 km section of Kemptville Creek (along with beaver dam pilot project locations shown in Figure 33) has resulted in a much improved situation (lower water levels) on this section of the North Branch, as confirmed by landowners. RVCA has been asked to continue the coordination of beaver management work at the request of the Drain Wolford landowners, who have been able to provide some additional funds for this.

Valley, Stream, Wetland and Hazard Land Regulation

Fifty-five square kilometres or 43 percent of the catchment drainage area is within the regulation limit of Ontario Regulation 174/06 (Figure 34), giving protection to wetland areas and river or stream valleys that are affected by flooding and erosion hazards.

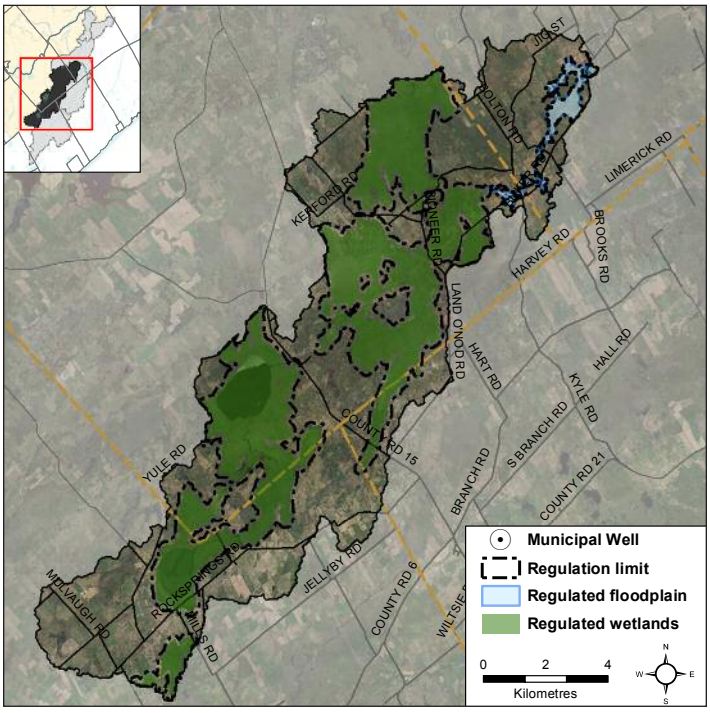


Figure 34 RVCA regulation limits

5. Issues

- Water quality along Kemptville Creek is "Fair" as determined by benthic invertebrate and surface water chemistry data. Surface water quality rating has declined at the Bishops Mills site and remains unchanged at County Road 15, downstream of Cranberry Lake, over a 12 year reporting period. Exceedances of ammonia, total Kjeldahl nitrogen and total phosphorus above water quality guidelines are largely responsible for this change
- There are flood susceptible areas adjacent to Kemptville Creek as identified by the RVCA's Kemptville Creek Floodplain Mapping Study (2009). Although private property extends into the flood risk area, most development is located outside the floodplain due to past (and ongoing) efforts to minimize landowner exposure to natural hazards by regulating development in the floodplain. Regulations administered by the RVCA have been in place around wetlands since 2006 and along the creek since 2009
- Water levels and land drainage have been a subject of controversy within the catchment for many years. Work carried out by the RVCA (from 2003 to 2007) through the Kemptville Creek Beaver Dam Management Pilot Project included aquatic habitat/beaver surveys and beaver/dam removals and has had a positive effect on the creek's aquatic ecosystem and concerns about high water levels. Lessons learned have been subsequently used to assist Drain Wolford landowners and the municipalities of North Grenville and Merrickville-Wolford with land drainage issues associated with beaver activity along the North Branch of Kemptville Creek
- Woodland cover has changed/decreased by 1995 hectares from 2002 to 2008, which appears to be largely attributable to elevated water level changes in treed swamps, resulting in much of the reported loss of tree cover
- The catchment contains 1406 ha of unevaluated wetland (occupying 11 percent of its total area) that provides many important social, hydrological, biological and ecological functions/services. Although not under imminent threat from development activity, they do remain vulnerable to drainage and land clearing activities in the absence of any regulatory and planning controls that would otherwise protect them

6. Opportunities for Action

- Investigate cause of "Fair" surface water quality rating along Kemptville Creek. Reported decline (from "Good" to "Fair") in the rating may be attributed to sources such as land use conversion, wetland cover change and wildlife activity within the catchment. Further study is necessary to better understand the contributing factors
- Continue to use official plan policy, zoning and regulatory controls under Section 28 of the *Conservation Authorities Act* to restrict development in and adjacent to the floodplain along the North Branch of Kemptville Creek and the Provincially Significant Wetlands found in the catchment (i.e., the Greenbush Wetland Complex, the Wolford Bog Wetland Complex and the Wolford Bog Wetland Parts One and Four; the Wolford Bog Wetland Part Five is also regulated by the RVCA, even though it is not designated as Provincially Significant)
- Consider establishing RVCA regulations limits in areas of unevaluated wetlands subject to site alteration
- Target riparian restoration at areas shown in Figure 30 (to address minimal shoreline buffers and degraded/ornamental shoreline)
- Work with landowners to implement agricultural best management practices and pursue improvements to the riparian corridor along the North Branch of Kemptville Creek and tributaries (by increasing buffers through reforestation/riparian plantings and invasive species removal)
- Continue to monitor and respond to landowner and municipal concerns about high water levels along the North Branch of Kemptville Creek and its effect on agricultural land drainage and flooding in adjacent woodlots
- Protect shorelines, floodplains, locally/regionally/provincially significant natural heritage features such as wetlands, woodlands, valleylands, wildlife habitat, areas of natural and scientific interest, aquatic habitat and municipal drinking water intake/wellhead protection zones/areas through conservation agreements/easements or land acquisition programs