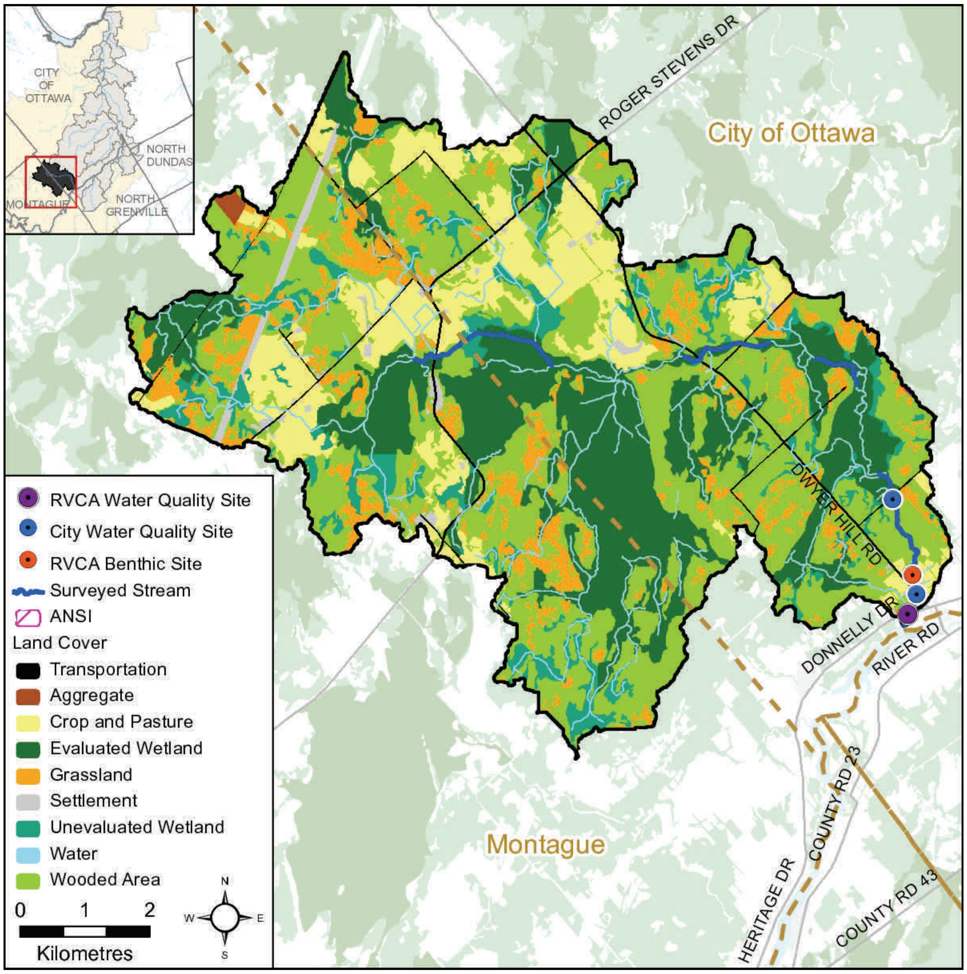
BRASSILS CREEK CATCHMENT

LOWER RIDEAU RIVER SUBWATERSHED REPORT 2012

RIDEAU VALLEY CONSERVATION AUTHORITY



The RVCA produces individual reports for 16 catchments in the Lower Rideau 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 Brassils 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 Lower Rideau catchments and Lower Rideau Subwatershed Report, please visit the RVCA website at www.rvca.ca.

Inside

Catchment Facts

- 56% of the catchment falls within the City of Ottawa and 44% within Montague Township
- Drains 68 sq. km of land or 8.8% of the Lower Rideau Subwatershed and 1.6% of the Rideau Valley Watershed
- Dominant land cover is woodland (40%) followed by wetland (33%), grassland (10%), crop and pastureland (14%), settlement (2%) and transportation (1%)
- Riparian buffer (30 m. wide along both sides of Brassils Creek and its tributaries) is comprised of wetland (72%), woodland (13%), crop and pastureland (10%), grassland (3%), transportation (2%) and settlement (1%)
- Contains a warm/cool water baitfish and recreational fishery with 27 fish species
- Contains six municipal drains
- Water quality rating along Brassils Creek ranges from good at Paden Road, to fair at Dwyer Hill Road, to good at Donnelly Drive, with no change in the water quality rating observed over a 12 year reporting period (2000-2005 vs. 2006-2011)
- Woodland cover has decreased by 4.3 percent (290 ha.) from 2002 to 2008
- Floodplain mapping is available along the Rideau River, at the confluence with Brassils Creek
- Between 2006 and 2010, fish sampling has been conducted on Brassils Creek and its tributaries by the RVCA, City Stream Watch and volunteers
- Every spring and fall since 2003, the RVCA has conducted benthic macroinvertebrate sampling downstream at Fourth Line Road
- Twenty stewardship (landowner tree planting/clean water) projects have been completed
- In 2007, volunteers undertook macro stream surveys working upstream from the mouth of the creek taking measurements and recording observations on instream habitat, bank stability, land use, etc.
- In 2007, RVCA staff undertook temperature profiling to gain a better understanding of temperature and habitat variations throughout the system

1) Surface Water Quality

Assessment of streams in the Lower Rideau is based on 24 parameters including nutrients (total phosphorus, total Kjeldahl nitrogen, nitrates), 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 Lower Rideau Subwatershed also looks at water quality targets that are presented in the 2005 Lower Rideau Watershed Strategy (LRWS), to see if they are being met. The LRWS identifies improving water quality as a priority concern; specifically reducing the levels of nutrients, bacteria and contaminants in the Lower Rideau.

1) a. Brassils Creek

Surface water quality conditions in Brassils Creek are monitored through the City of Ottawa's Baseline Water Quality Program and the RVCA's Baseline Water Quality Program (BRA-01 Donnelly Drive, CK44-02 upstream of Dwyer Hill Road bridge, CK44-11 Paden Road, see Fig. 1 for their locations).

The water quality rating for Brassils Creek ranges from is "Good" to "Fair" as determined by the CCME Water Quality Index (CCME WQI); analysis of the data has been broken into two periods 2000-2005 and 2006-2011, to examine if conditions have changed in this timeframe. Table 1 outlines the WQI scores and their corresponding ratings. For more information on the CCME WQI please see the Lower Rideau Subwatershed Report.

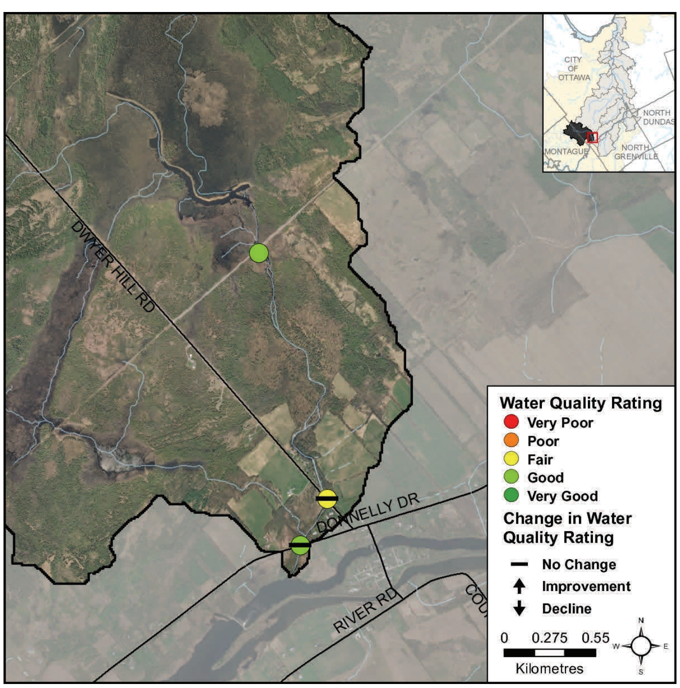


Figure 1. Sampling sites on Brassils Creek

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

Brassils Creek 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 Objectives (PWQO) of 0.030mg/l is used as the TP Guideline. Concentrations greater than 0.030 mg/l indicate an excessive amount of TP. Brassils Creek TP results are shown in Figures 2a and 2b. In addition to the TP guideline, the Lower Rideau Watershed Strategy set a target for TP concentration of 0.030 mg/l at the 85th percentile for tributaries of the Rideau River, such as Brassils Creek. Percentile plots for this data are shown in Figures 3a and 3b. Any point to the left of the 85th percentile line (vertical) and above the guideline (horizontal line) have failed to reach the LRWS target.

Total Kjeldahl nitrogen (TKN) is used as a secondary indicator of nutrient loading; RVCA uses a guideline of 0.500 mg/l (TKN Guideline) to assess TKN concentrations. Brassils Creek TKN results are shown in Figures 4a and 4b.

Tables 2 and 3 summarize average nutrient concentrations at monitored sites on Brassils Creek and shows the proportion of samples that meet guidelines. Highlighted values indicate the averages that have exceeded the guideline.

Table 2. Summary of total phosphorous results for Brassils

Total Phosphorus 2000-2005			
Site	Average (mg/l)	% Below Guideline	No. Samples
CK44-02	0.012	100	64
BRA-01	0.01	100	23
CK44-11			
Total Phosphorus 2006-2011			
Site	Average (mg/l)	% Below Guideline	No. Samples
CK44-02	0.014	97	65
BRA-01	0.014	100	40
CK44-11	0.021	73	15

Table 3. Summary of total Kjeldahl nitrogen results for Brassils Creek

Total Kjeldahl Nitrogen 2000-2005			
Site	Average (mg/l)	% Below	No. Samples
CK44-02	0.587	33	64
BRA-01	0.640	22	23
CK44-11			

Total Kjeldahl Nitrogen 2006-2011			
Site	Average (mg/l)	% Below	No. Samples
CK44-02	0.555	43	65
BRA-01	0.612	18	40
CK44-11	0.779	20	15

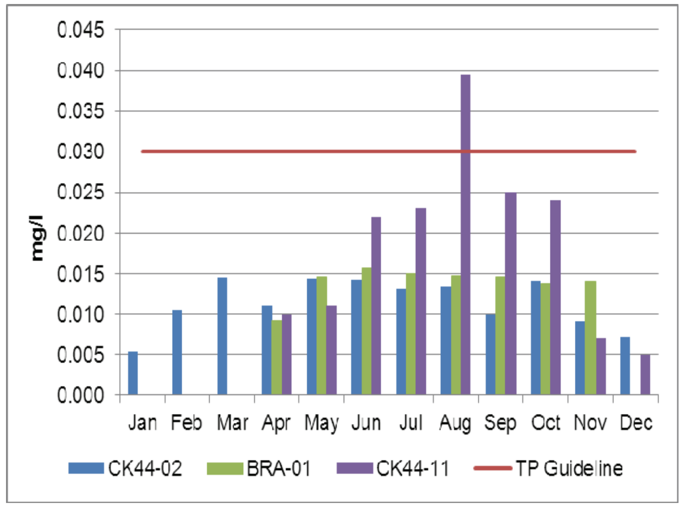


Figure 2b. Total phosphorus concentration in Brassils Creek from 2006-2011

Brassils Creek Nutrients: Site CK44-02

The majority of samples at site CK44-02 were below the TP guideline for both time periods (Fig. 2a, 2000-2005 and Fig. 2b, 2006-2011) and there has been a slight increase in average TP concentration from 0.012 mg/l (2000-2005) to 0.014 mg/l (2006-2011). The LRWS target has been achieved at site CK44-02.Though the target is achieved there has been a slight increase in the concentration at the 85th percentile from 0.017 mg/l (Fig. 3a, 2000-2005) to 0.021 mg/l (Fig. 3b, 2006-2011).

TKN results remained fairly consistent at site CK44-02. Exceedances above the guideline of 0.500 mg/l were common, with the proportion of samples below the guideline increasing slightly from thirty three percent (Fig. 4a) to forty-three percent (Fig. 4b). The mean concentration dropped slightly from 0.587 mg/l to 0.555 mg/l, and just exceeded the guideline.

Brassils Creek Nutrients: Site BRA-01

At site BRA-01 samples were below the TP guideline for both time periods (Fig. 2a, 2000-2005 and Fig. 2b, 2006-2011) and there was a slight increase in average TP concentration from 0.012 mg/l (2000-2005) and 0.014 (2006-2011). The LRWS has been achieved at site BRA-01. There is a slight increase in the concentration at the 85th percentile from 0.016 mg/l (2000-2005, Fig 3a) to 0.018 mg/l (2006-2011, Fig. 3b)

Total Kjeldahl nitrogen results at site BRA-01 indicate little change, the proportion of samples below the guideline decreased slightly from twenty-one percent (Fig. 4a) to eighteen percent (Fig. 4b). The mean concentration also dropped slightly from 0.644 mg/l to 0.612 mg/l, and was just above the guideline.

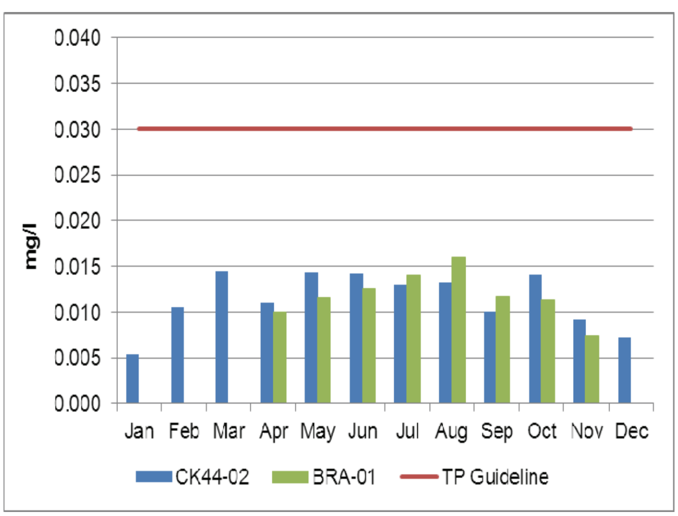


Figure 2a. Total phosphorous concentrations in Brassils Creek from 2000-2005

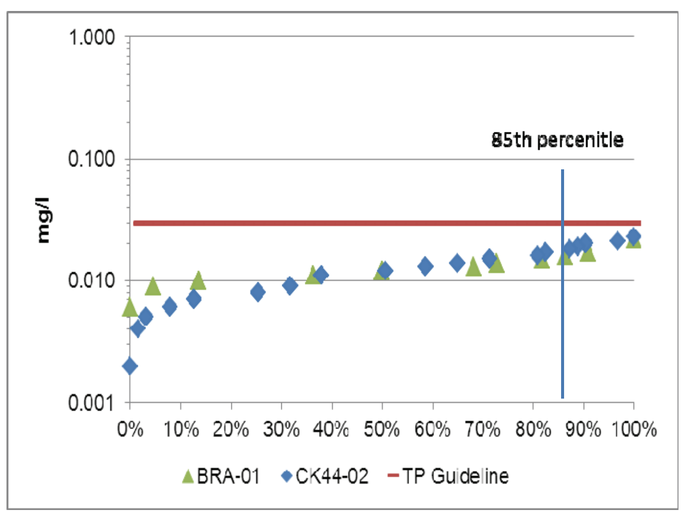


Figure 3a.Percentile plots of total phosphorus in Brassils Creek from 2000-2005

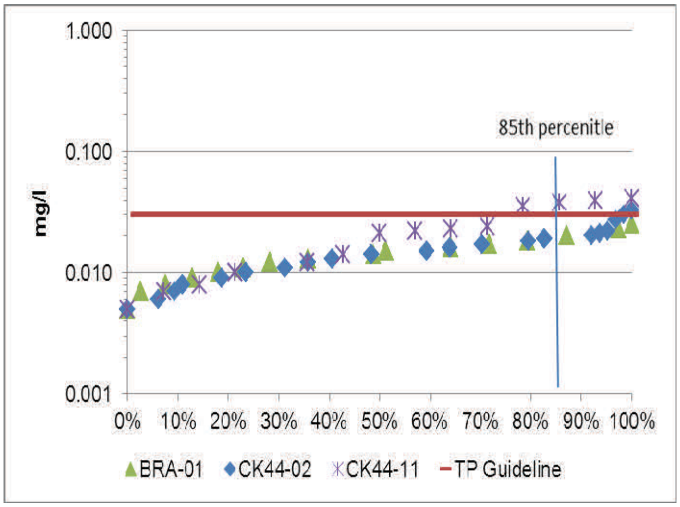


Figure 3b. Percentile plots of total phosphorous in Brassils Creek from 2006-2011

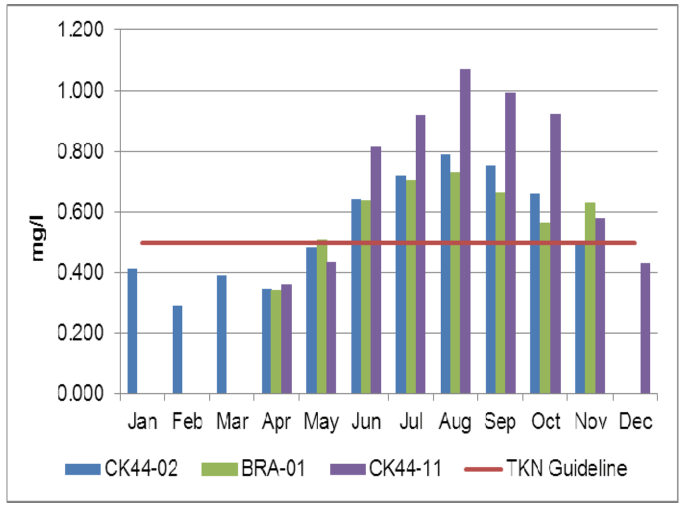


Figure 4b. Total Kjeldahl nitrogen concentrations in Brassils Creek from 2006-2011

Brassils Creek Nutrients: Site CK44-01

Seventy-three percent of samples are below the TP guideline at site CK44-11, with an average concentration of 0.021 mg/l (Fig. 2b). Please note that data was not available for the time period 2000-2005. The data from 2006-2011 shows that the LRWS target is slightly exceeded at site CK44-11 as the TP concentration at the 85th percentile is 0.034 mg/l.

At site CK44-11 the majority of results exceeded the TKN guideline of 0.500 mg/l and only twenty percent (Fig. 4b) of samples were below the guideline. The average TKN concentration was also high at 0.779 mg/l.

Brassils Creek Nutrients Summary

The data suggests that TP concentrations at in Brassils Creek are generally low but are occasionally subject to high inputs while TKN concentrations indicated that nutrient enrichment is persistent. Efforts should be made to reduce sources of nutrients inputs to the creek and improve water quality.

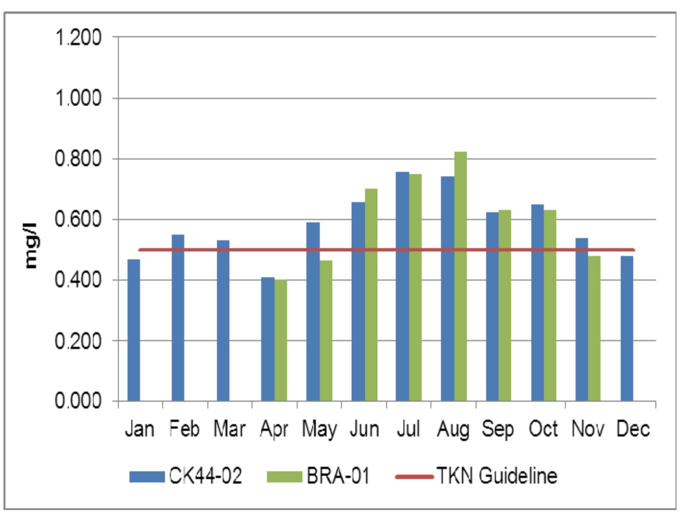


Figure 4a. Total Kjeldahl nitrogen concentrations in Brassils Creek from 2000-2005

Brassils Creek 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 Objectives of 100 colony forming units/100 millilitres is used. E. coli counts greater than this guideline indicate that bacterial contamination may be a problem within a waterbody. The Lower Rideau Watershed Strategy (2005) set a target for E. coli counts of 200 colony forming units (CFU) per 100ml at the 80th percentile for tributaries of the Rideau River, such as Brassils Creek; this target as well as the E. coli guideline of 100 CFU/100ml are used to assess bacterial conditions in the creek.

Table 4 summarizes the geometric mean at monitored sites on Brassils Creek and shows the proportion of samples that meet the E. coli guideline of 100 CFU/100ml. Highlighted values indicate averages that have exceeded the guideline.

Figure 5 shows the results of the geometric mean with respect to the guideline for the two periods 2000-2005 (Fig. 5a) and 2006-2011 (Fig 5b). Figures 6a and 6b show percentile plots of the data for the two time periods of interest 2000-2005 (Fig. 6a) and 2006-2011 (Fig. 6b). Any point to the left of the 80th percentile line (vertical) and above the guideline (horizontal line) have failed to reach the LRWS target

Brassils Creek E. coli: Site CK44-02

The proportion of samples below the guideline decreased from eighty four percent (Fig. 5a, 2000-2005) to sixty-nine percent (Fig.5b, 2006-2011), and the

Table 4. Summary of E. coli results in Brassils Creek

E. coli 2000-2005			
Site	Geometric Mean	% Below Guideline	No. Samples
CK44-02	21	84	64
BRA-01	37	87	23
CK44-11			
E. coli 2006-2011			
Site	Geometric Mean	% Below Guideline	No. Samples
CK44-02	41	69	65
BRA-01	51	68	40
CK44-11	67	53	15

geometric mean increased from 21 CFU/100 ml to 41 CFU/100 ml. E. coli counts increased at the 80th percentile over the 2000-2011 monitoring period at site CK44-02. In comparing the two time periods E. coli counts at the 80th percentile have increased from 81 CFU/100 ml (Fig. 6a, 2000-2005) to 160 CFU/100 ml (Fig. 6b, 2006-2011).

Brassils Creek E. coli: Site BRA-01

The proportion of samples below the guideline also decreased from eighty seven percent (Fig. 5a, 2000-2005) to sixty-eight percent (Fig. 5b, 2006-2011), and the count at the geometric mean increased from 37 CFU/100 ml to 51 CFU/100 ml. Similar results were observed at site BRA-01. E. coli counts at the 80th percentile increased from 78 CFU/100 ml (Fig. 6a, 2000-2005) to 141 CFU/100 ml (Fig. 6b, 2006-2011).

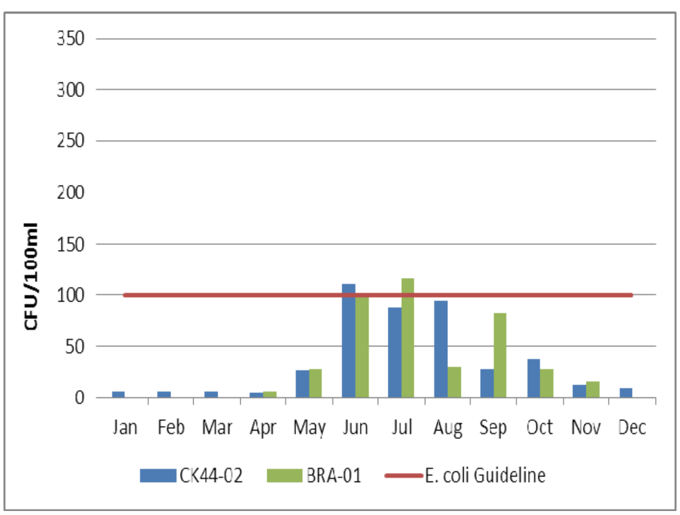


Figure 5a. E. coli concentrations in Brassils Creek from 2000-2005

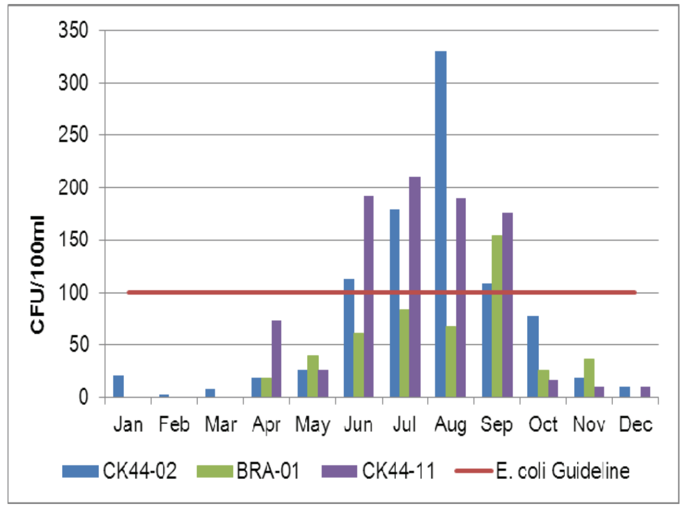


Figure 5b. E. coli concentrations in Brassils Creek from 2006-2011

Brassils Creek E. coli: Site CK44-11

Fifty-three percent (Fig. 5b, 2006-2011) of samples are below the E. coli guideline, with a geometric mean of 67 CFU/100 ml. Please note data was not available at this site for the 2000-2005 period. Percentile plots of E. coli data at site CK44-11 are shown for 2006-2011 (Fig. 6b), please note data was not available at this site for the 2000-2005 period. Figure 6b shows that this target is slightly exceeded as the E. coli count at the 80th percentile is 278 CFU/100ml.

Brassils Creek E. coli Summary

These statistics indicated that bacterial counts have increased at these sites and efforts should be made to reduce any possible sources of contamination to the creek to protect overall water quality and aquatic life.

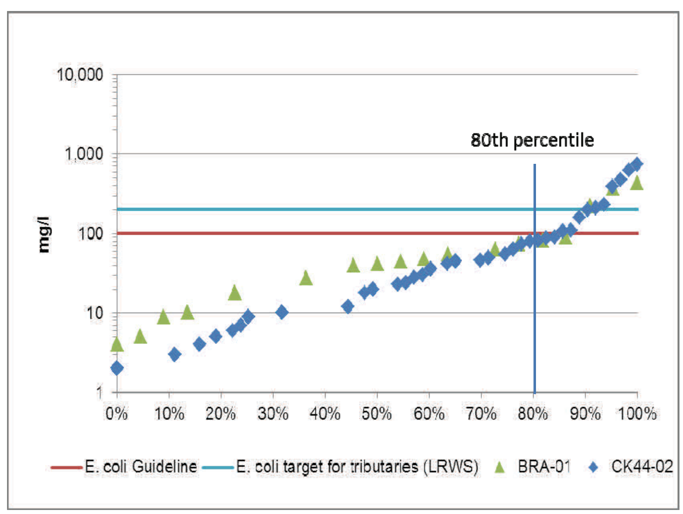


Figure 6a. Percentile plots of E. coli in Brassils Creek from 2000-2005

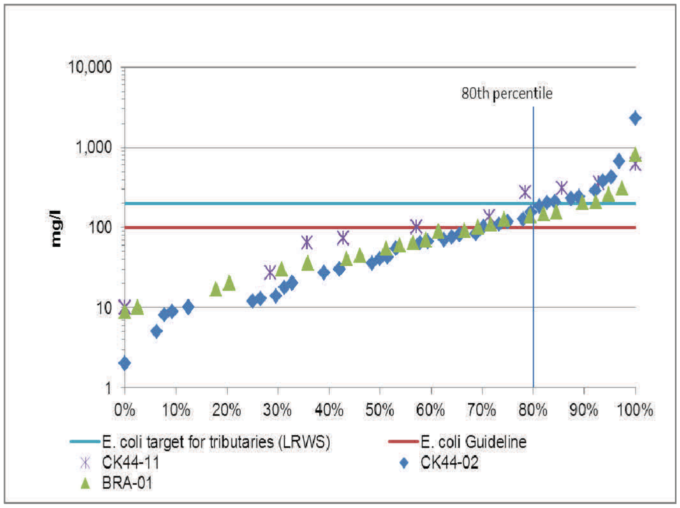


Figure 6b, E. coli concentrations in Brassils Creek from 2006-2011

Brassils Creek Metals

Targets for three metals (copper, iron and zinc) were set for tributaries of the Rideau River such as Brassils Creek. Elevated metal concentrations are a concern as they may have cumulative toxic effect on aquatic species.

Table 5 summarizes average metal concentrations at monitored sites on Brassils Creek and shows the proportion of samples that meet guidelines. Highlighted values indicate averages that have exceeded their respective guidelines.

Figures 7 and 8, show the results for each site with respect to guidelines for the two periods 2000-2005 (Figures 7a and 8a) and 2006-2011 (Figures 7b and 8b). The guidelines for each metal as stated by the PWQO are Cu 0.005 mg/l and Fe 0.300 mg/l. The Lower Rideau Watershed Strategy (2005) also set a target for Cu concentration of 0.005mg/l at the 80th percentile. Figure 9 shows percentile plots of the data for the two time periods of interest (Fig. 9a, 2000-2005) (Fig. 9b, 2006-2011). Any point to the left of the 80th percentile line (vertical) and above the guideline (horizontal line) have failed to reach the LRWS target.

Brassils Creek Metals: Site CK44-02

Iron (Fe) concentrations increased and often exceeded the guideline at site CK44-02. Fewer samples were below the guideline of 0.300 mg/l; in data from 2000-2005 (Fig. 7a), ninety-five percent of samples were below the guideline and this dropped to eighty-six percent of samples in 2006-2011 (Fig. 7b). Average Fe concentrations also increased in this same time period from 0.161 mg/l to 0.185 mg/l.

The proportion of Cu samples below the guideline decreased at this site from ninety-four percent (Fig. 8a, 2000-2005) to sixty percent (Fig. 8b, 2006-2011) between the two time periods and Cu concentrations had an overall increase from 0.002 mg/l to 0.004 mg/l. In comparing the two time periods Cu concentrations at the 80th percentile have increased from 0.003 mg/l (Fig. 9a, 2000-2005) to 0.007 mg/l (Fig. 9b, 2006-2011) at site CK44-02.

Table 5. Metal concentrations in Brassils Creek

Iron 2000-2005			
Site	Average (mg/l)	% Below Guideline	No. Samples
CK44-02	0.161	95	64
BRA-01	0.136	100	23
CK44-11			
Iron 2006-2011			
Site	Average (mg/l)	% Below Guideline	No. Samples
CK44-02	0.185	86	65
BRA-01	0.063	56	40
CK44-11	0.306	47	15
Copper 2000-2005			
Site	Average (mg/l)	% Below Guideline	No. Samples
CK44-02	0.002	94	60
BRA-01	0.003	87	23
CK44-11			
Copper 2006-2011			
Site	Average (mg/l)	% Below Guideline	No. Samples
CK44-02	0.004	95	64
BRA-01	0.003	67	21
CK44-11	0.005	60	15

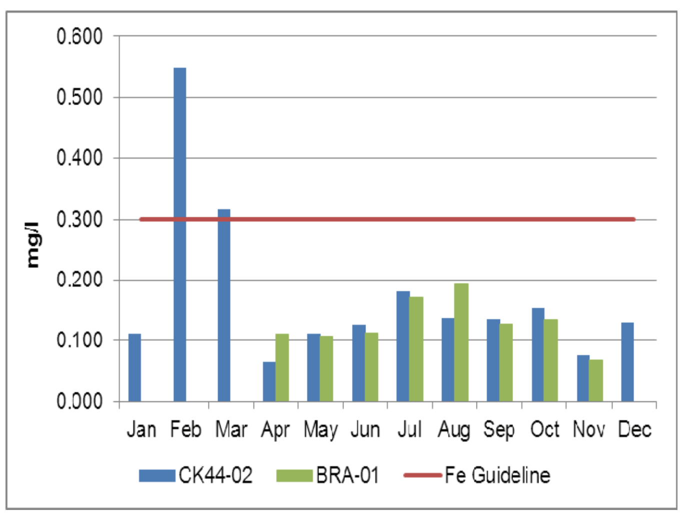


Figure 7a. Iron concentrations in Brassils Creek from 2000-2005

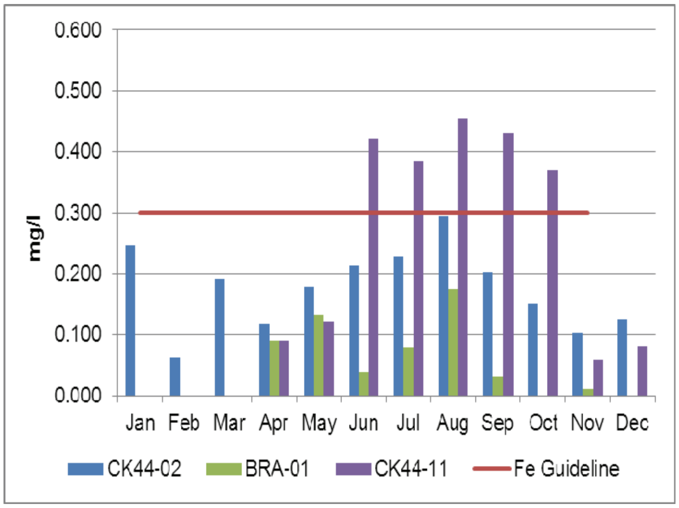


Figure 7b. Iron concentrations in Brassils Creek from 2006-2011

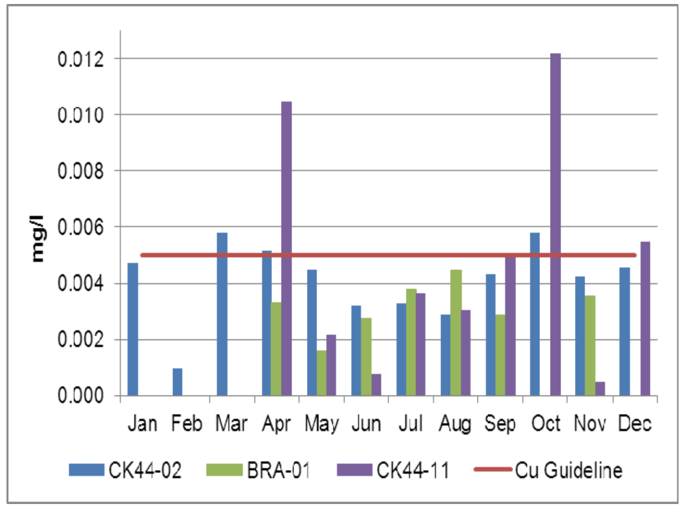


Figure 8b. Copper concentrations in Brassils Creek from 2006-2011

Brassils Creek Metals: Site BRA-01

Site BRA-01 did not have any instances of Fe exceedances and all results were below the Fe guideline (Fig. 7a, 2000-2005 and Fig. 7b, 2006-2011).

The proportion of samples below the guideline decreased from eighty-seven percent (Fig. 8a, 2000-2005) to sixty-seven percent (Fig. 8b, 2006-2011) between the two time periods, mean concentration remained unchanged and below the guideline at 0.003 mg/l. At site BRA-01 concentrations at the 80th percentile have also increased from 0.004 mg/l (Fig. 9a, 2000-2005) to 0.006 mg/l (Fig. 9b, 2006-2011) to just exceed the target of 0.005 mg/l at the 80th percentile.

Brassils Creek Metals: Site CK44-11

Only forty six percent of Fe samples at site CK44-11 were below the Fe guideline with an average concentration of 0.306 mg/l (Fig. 7b, 2006-2011).

Sixty percent of samples were below the Cu guideline with an average concentration equal to the guideline of 0.005 mg/l (Fig. 8b). Data for site CK44-11 was only available during the 2006-2011 period; Cu concentrations at the 80th percentile were slightly above the target at 0.007 mg/l. Sixty percent of samples were below the Cu guideline with an average concentration equal to the guideline of 0.005 mg/l.

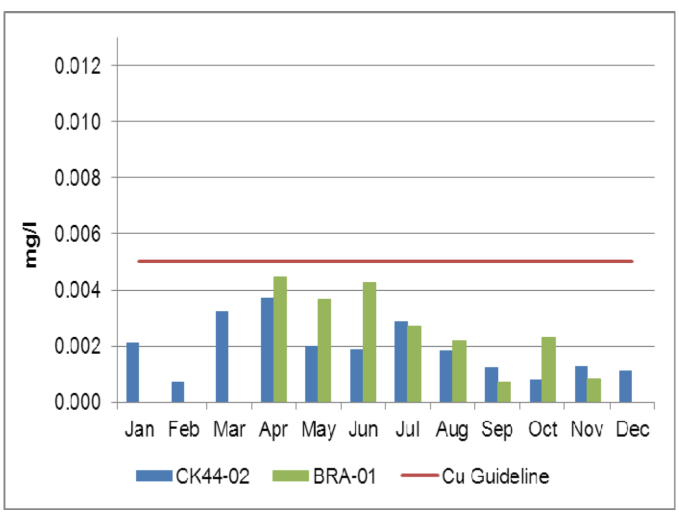


Figure 8a. Copper concentrations in Brassils Creek from 2000-2005

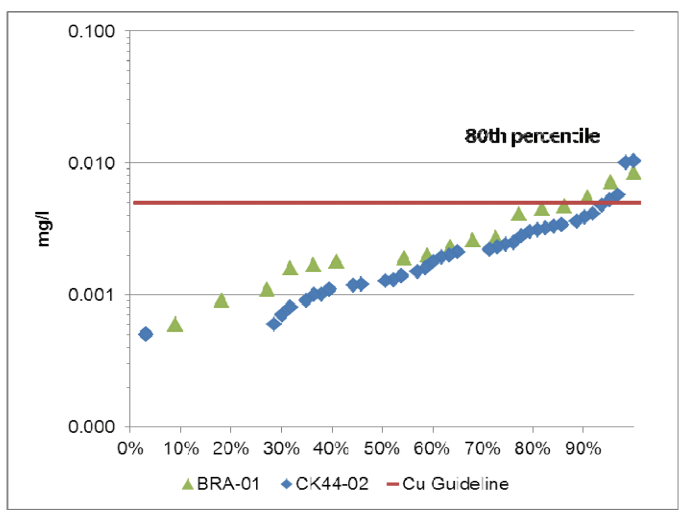


Figure 9a. Percentile plots of copper in Brassils Creek from 2000-2005

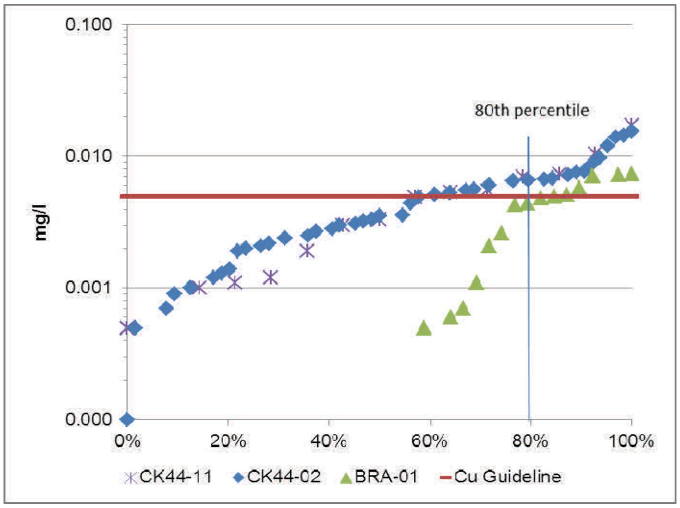


Figure 9b. Percentile plots of Copper in Brassils Creek from 2000-2006

Brassils Creek Metals Summary

These results shows that some metals concentrations do exceed established concentrations which indicates that pollution may be a problem at these three sites; efforts should be made to reduce possible sources wherever possible to improve water quality and prevent any negative impacts on aquatic species in the creek.

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.

Benthic sampling site replicate one on Brassils Creek at Dwyer Hill Rd in the city of Ottawa, this image was captured in the spring of 2011.

As part of the Ontario Benthic Biomonitoring Network (OBBN), the RVCA has been collecting benthic invertebrates at one location on Brassils Creek at Dwyer Hill Road since 2003. Monitoring data is analyzed and the results are presented using the Family Biotic Index, Family Richness and percent Ephemeroptera, Plecoptera and Trichoptera.

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 Brassils Creek show that it has “Poor” to “Good” water quality conditions for the period from 2006 to 2011 (Fig.10) and scores an overall “Fair” surface water quality rating using a grading scheme developed by Conservation Authorities in Ontario for benthic invertebrates.

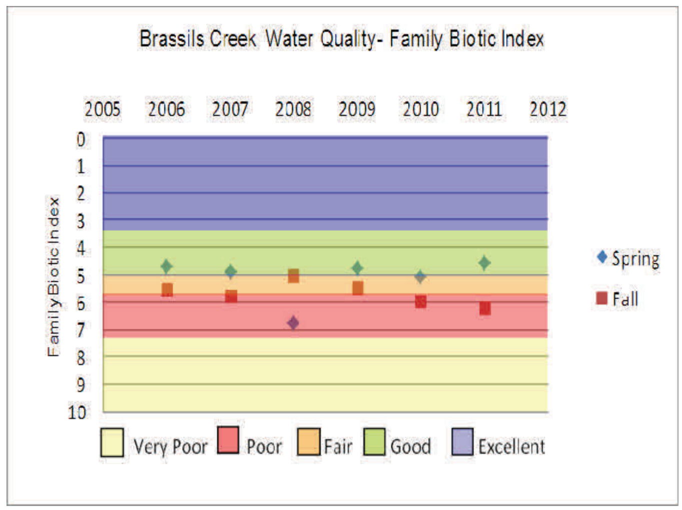


Figure 10. Surface water quality conditions in Brassils Creek based on the Family Biotic Index

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.

Using Family Richness as the indicator, Brassils Creek is reported to have “Fair” water quality (Fig.11).

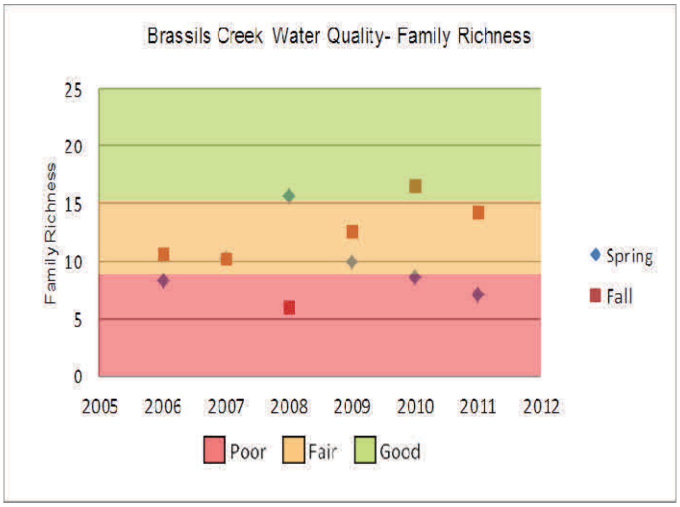


Figure 11. Surface water quality conditions in Brassils Creek based on Family Richness

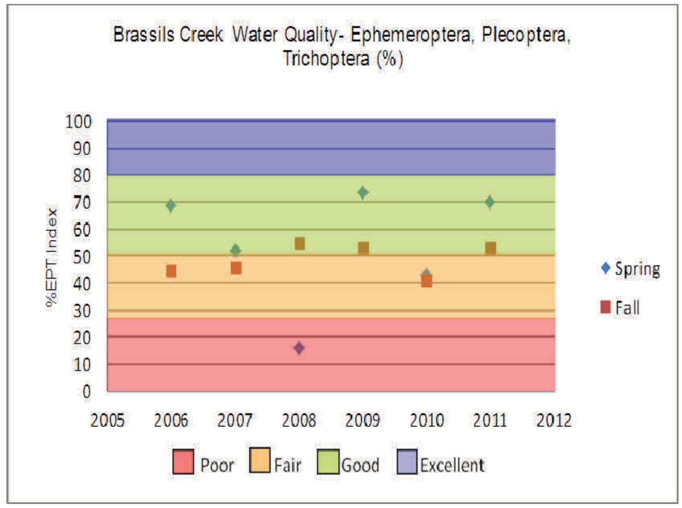


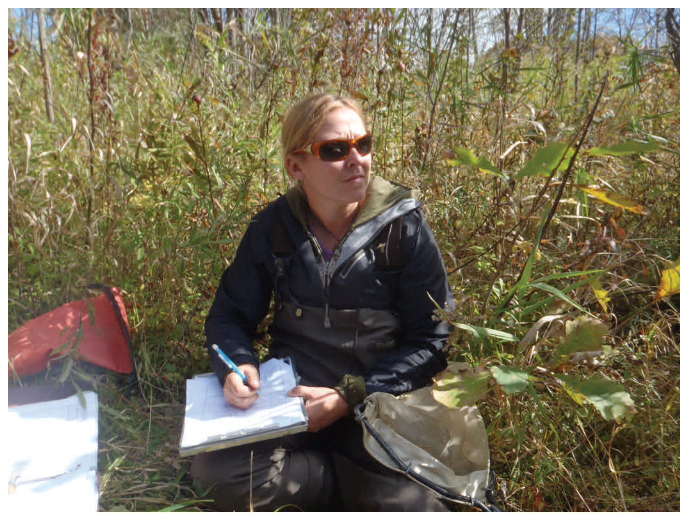
Figure 12. Surface water quality conditions in Brassils Creek using the EPT Index

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.

With the EPT indicator, Brassils Creek is reported to have water quality ranging from “Poor” to “Good” (Fig.12) from 2006 to 2011.

Identification of the benthic invertebrates is done by compound microscope

Overall, Brassils Creek has a water quality rating of “Good” from 2006 to 2011.



Recording data during the collection of the benthic invertebrates

2) a. Overbank Zone

Riparian Buffer along Brassils Creek and Tributaries

Figure 13 shows the extent of the naturally vegetated riparian zone in the catchment, 30 metres on either side of all waterbodies and watercourses. Results from the RVCA's Land Cover Classification Program show that 84 percent of streams, creeks and lakes are buffered with woodland, wetland and grassland; the remaining 16 percent of the riparian buffer is occupied by settlement, crop and pastureland and transportation.

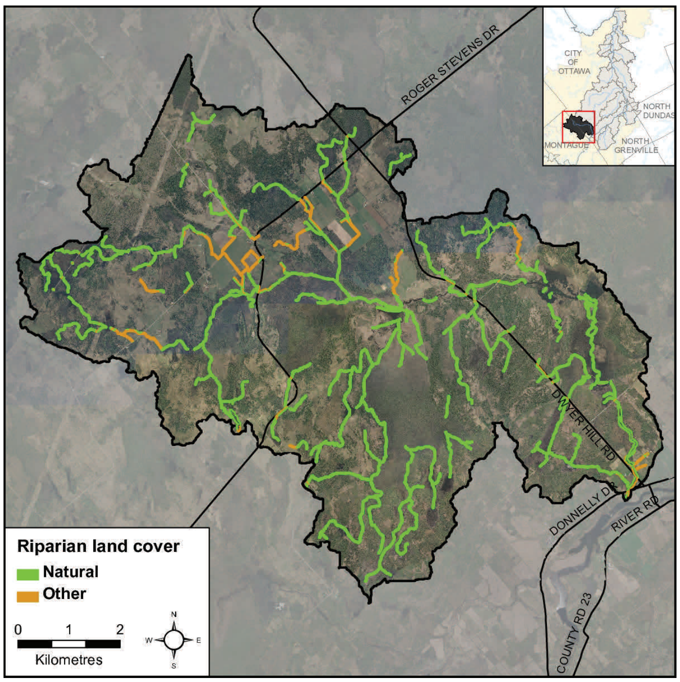


Figure 13. Catchment land cover in the riparian zone

Data from the RVCA's Macrostream Survey Program (Stream Characterization) is used in this section of the report and is generated from an assessment of 82 (100 metre long) sections along Brassils Creek in 2010.

Riparian Buffer along Brassils Creek

The riparian or shoreline zone is that special area where the land meets the water. Well-vegetated shorelines are critically important in protecting water quality and creating healthy aquatic habitats, lakes and rivers. Natural shorelines intercept sediments and contaminants that could impact water quality conditions and harm fish habitat in streams. Well established buffers protect the banks against erosion, improve habitat for fish by shading and cooling the water and provide protection for birds and other wildlife that feed and rear young near water.

A recommended target (from Environment Canada's Guideline: How Much Habitat is Enough?) is to maintain a minimum 30 metre wide vegetated buffer along at least 75 percent of the length of both sides of rivers, creeks and streams. Figure 14 demonstrates the buffer conditions of the left and right banks separately. Brassils Creek had a buffer of greater than 30 metres along 91 percent of the left bank and 88 percent of the right bank.

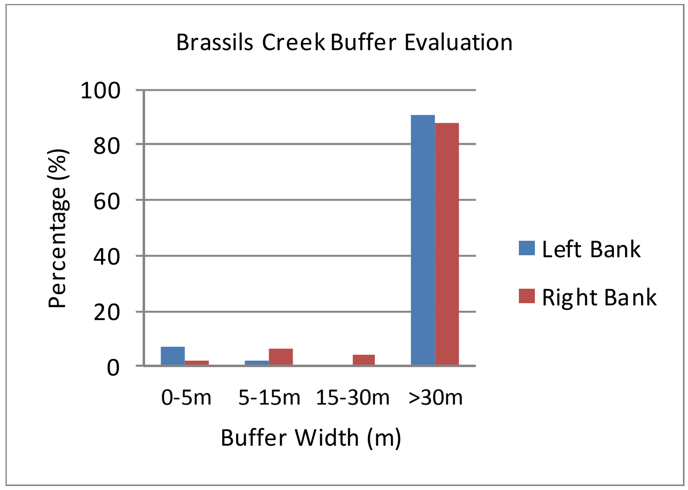


Figure 14. Vegetated buffer width along Brassils Creek

Land Use beside Brassils Creek

The RVCA's Macrostream Survey Program identified nine different land uses beside Brassils Creek (Figure 15). Surrounding land use is considered from the beginning to the end of the survey section (100m) and up to 100m 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 85 percent of the stream, characterized by wetland, forest, scrubland and meadow. The remaining land use consisted of residential, pasture, active agriculture, infrastructure, and industrial/commercial.

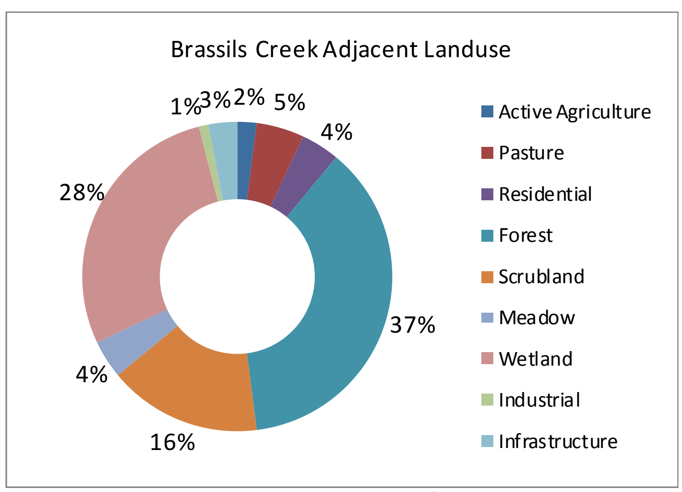


Figure 15. Land use alongside Brassils Creek

2) b. Shoreline Zone

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. Bank stability indicates how much soil has eroded from the bank into the stream. 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 16 shows the bank stability of the left and right bank along Brassils Creek.

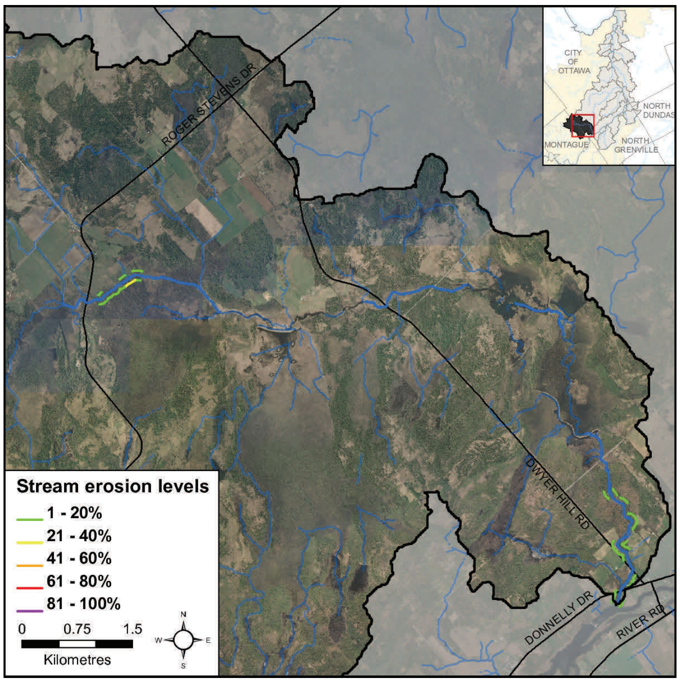


Figure 16. Erosion along Brassils Creek

Streambank Undercutting

Undercut banks are a normal and natural part of stream function and can provide excellent refuge areas for fish. Figure 17 shows that Brassils Creek had minimal locations with identified undercut banks.

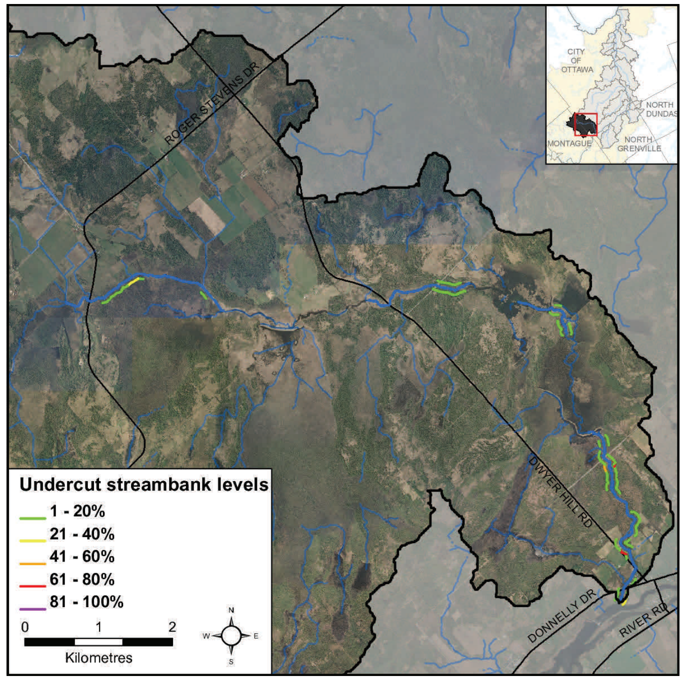


Figure 17. Undercut streambank along Brassils Creek

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 18shows the stream shading locations along Brassils Creek.

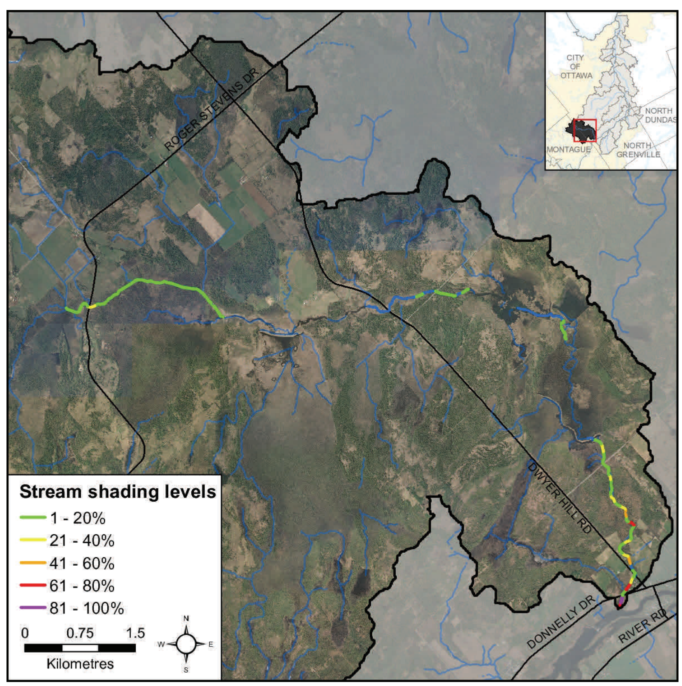


Figure 18. Stream shading along Brassils Creek

Human Alterations

Figure 19 shows that 60 percent of Brassils Creek remains “unaltered.” Sections considered “natural” with some human changes accounted for 24 percent of sections. "Altered" sections accounted for ten percent of the stream, with only six percent of sections sampled being considered “highly altered” (e.g., including road crossings and areas of little or no buffer).

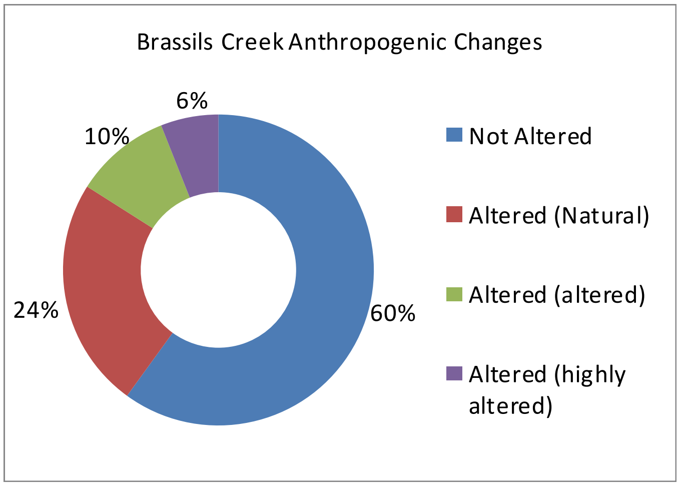


Figure 19. Alterations to Brassils Creek

Overhanging Trees and Branches

Figure 20 shows that the majority of Brassils Creek had varying levels of overhanging trees and branches. Overhanging trees and branches provide a food source, nutrients and shade which helps to moderate instream water temperatures.

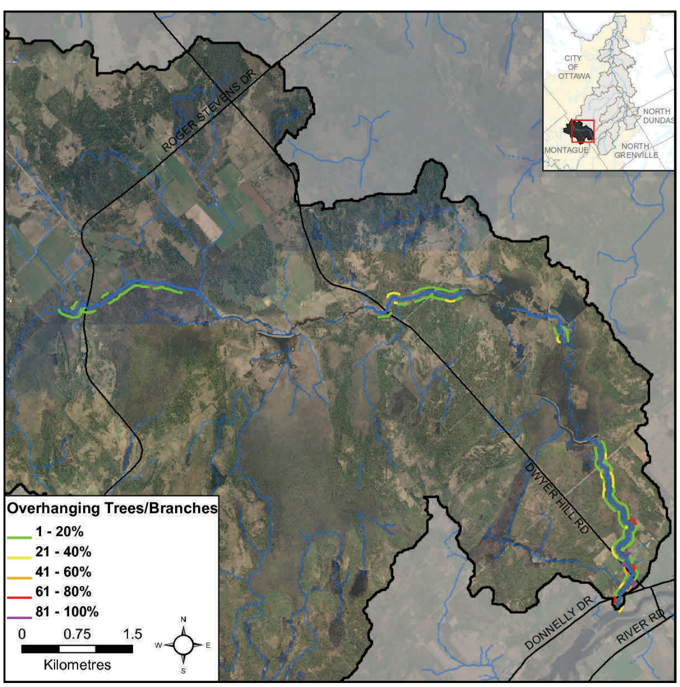


Figure 20. Overhanging trees and branches

Instream Woody Debris

Figure 21 shows that the majority of Brassils Creek had varying levels of instream woody debris in the form of trees and branches. Instream woody debris is important for fish and benthic habitat, by providing refuge and feeding areas.

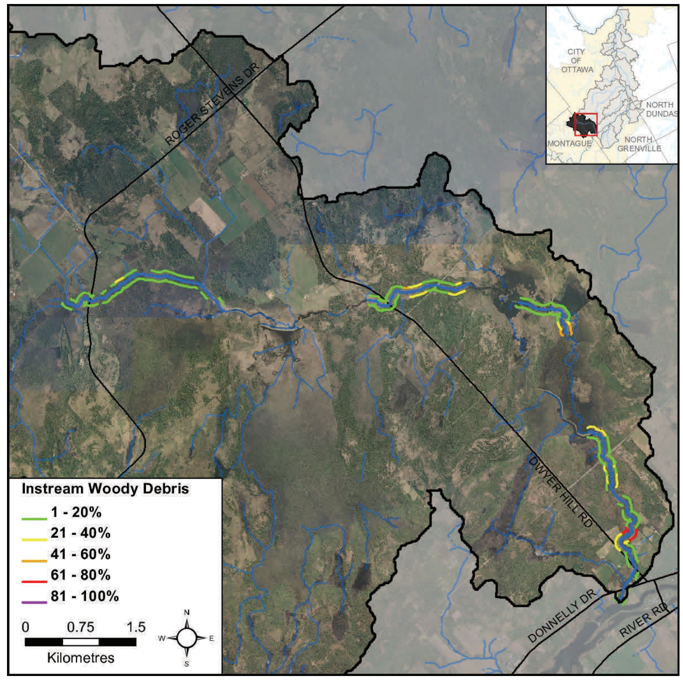


Figure 21. Instream woody debris

2 c) Instream Aquatic Habitat

Habitat Complexity

Streams are naturally meandering systems and move over time; there are varying degrees of habitat complexity, depending on the creek(Figure 22). A high percentage of habitat complexity (heterogeneity) typically increases the biodiversity of aquatic organisms within a system. Seventy-eight percent of Brassils Creek was considered heterogeneous.

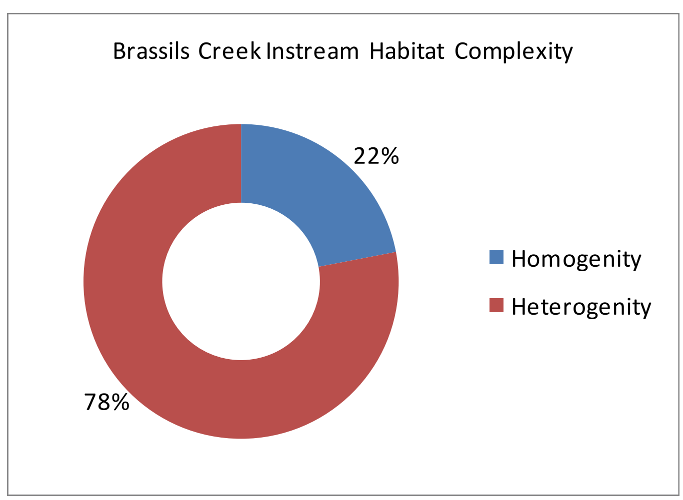


Figure 22. Instream habitat complexity in Brassils Creek.

Instream Substrate

Diverse substrate is important for fish and benthic invertebrate habitat because some species have specific substrate requirements and for example will only reproduce on certain types of substrate. Figure 23 demonstrates the substrate diversity along Brassils Creek.

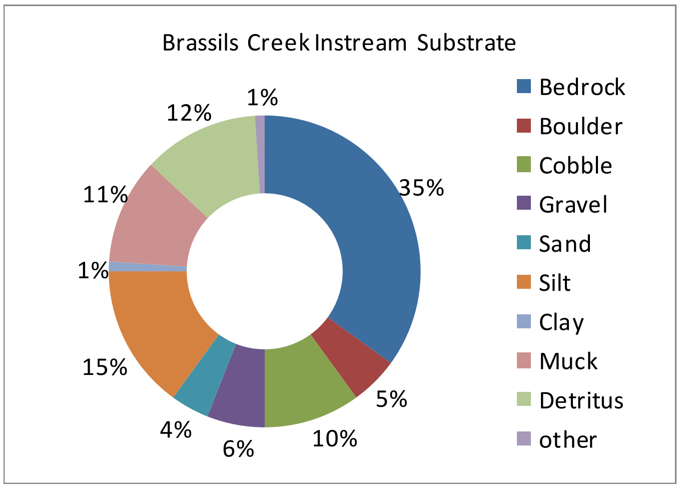


Figure 23. Instream substrate in Brassils Creek

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 24 shows where cobble and boulder substrate was found in Brassils Creek.

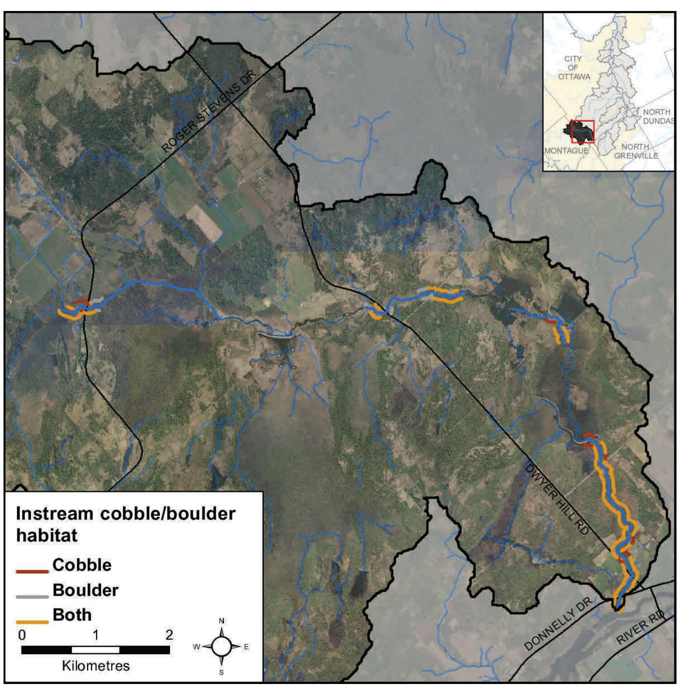


Figure 24. Instream cobble and boulder habitat along Brassils Creek

Instream Morphology

Pools and riffles are important features for fish habitat. 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 25 shows that Brassils Creek was fairly uniform; 87 percent consisted of runs, eight percent riffles and five percent pools.

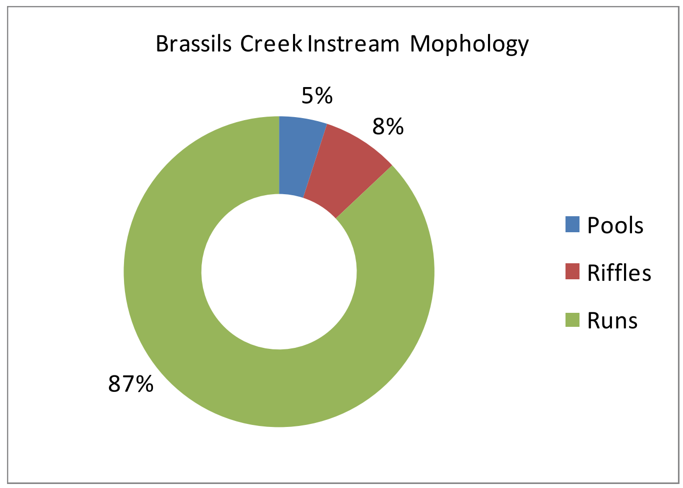


Figure 25. Instream morphology in Brassils Creek

Types of Instream Vegetation

The majority of Brassils Creek had a high diversity of instream vegetation (Figure 26). The dominant vegetation type recorded at thirty-two percent was algae. Submerged vegetation was recorded at seventeen percent while a total of sixteen percent was floating vegetation. Recorded at eleven percent was both narrow and robust emergent vegetation. Broad-leaved emergents made up the remainder at thirteen percent.

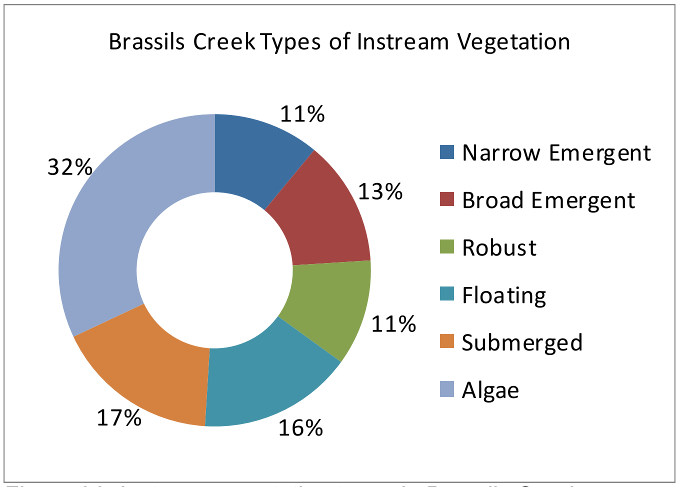


Figure 26. Instream vegetation types in Brassils Creek.

Amount of Instream Vegetation

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 27 demonstrates that Brassils Creek had a healthy variety of instream vegetation levels for most of its length.

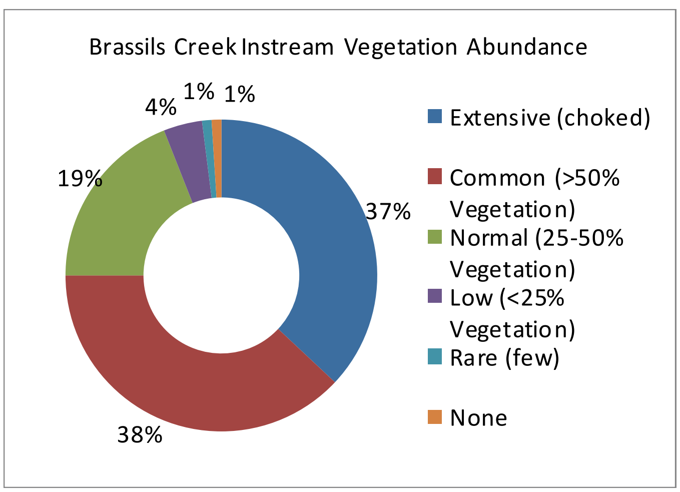


Figure 27. Vegetation abundance in Brassils Creek

Riparian Restoration

Figure 28 depicts the locations where various riparian restoration activities can be implemented as a result of observations made during the stream survey assessments.

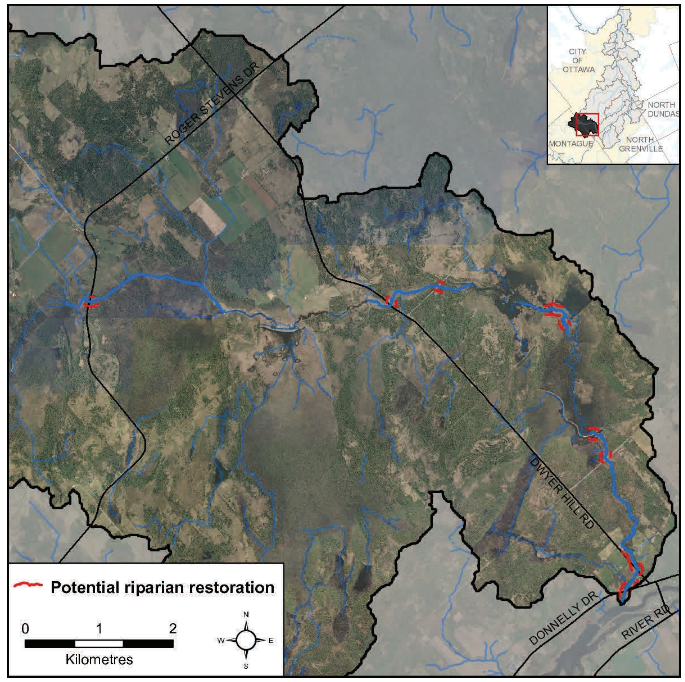


Figure 28. Riparian restoration opportunities

Instream Restoration

Figure 29 depicts the locations where various instream restoration activities can be implemented as a result of observations made during the stream survey assessments.

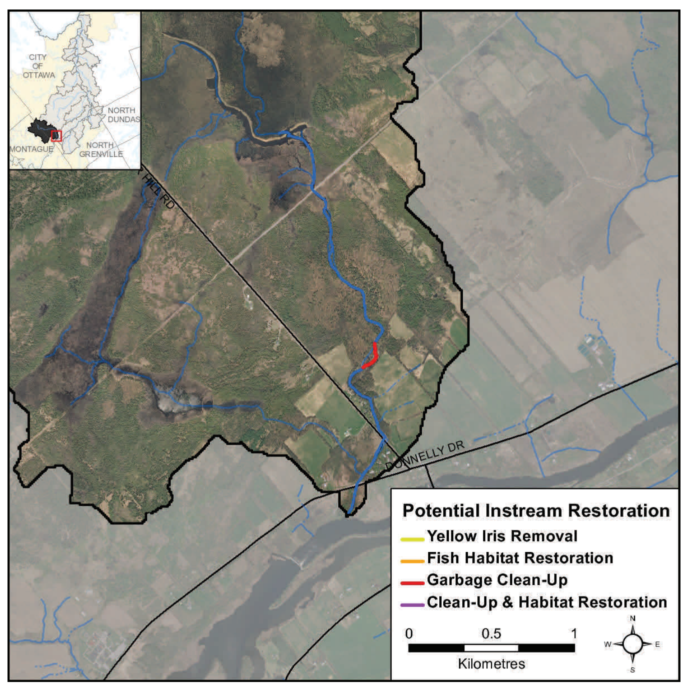


Figure 29. Instream restoration opportunities

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. One hundred percent of the sections surveyed along Brassils Creek had invasive species (Figure 30). The species observed in Brassils Creek were purple loosestrife, European frogbit, rusty crayfish, common/European buckthorn, and Manitoba maple.

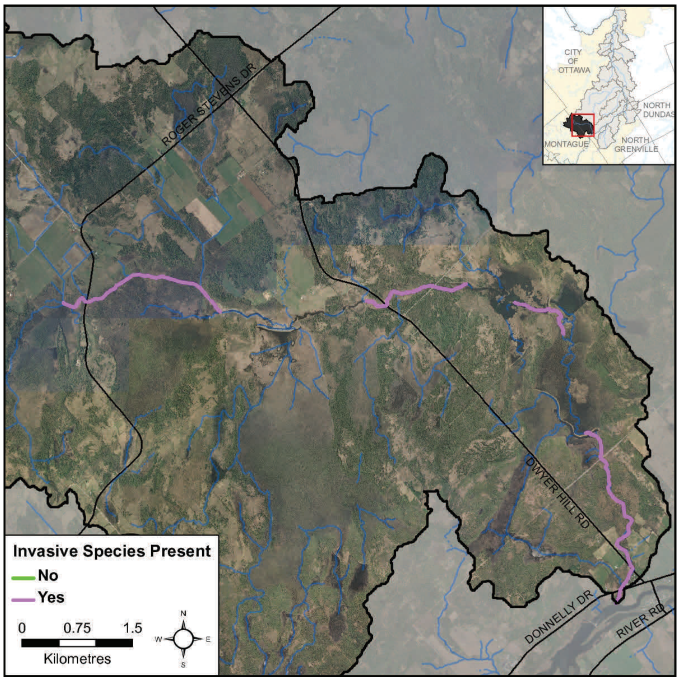


Figure 30. Invasive species along Brassils Creek

Thermal Classification

Temperature is an important parameter in streams as it influences many aspects of physical, chemical and biological health. Four temperature dataloggers were deployed in Brassils Creek from April to late September 2010 (Figure 31). 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 warmwater, coolwater or cold water. Analysis of the data collected indicates that Brassils Creek is a coolwater system.

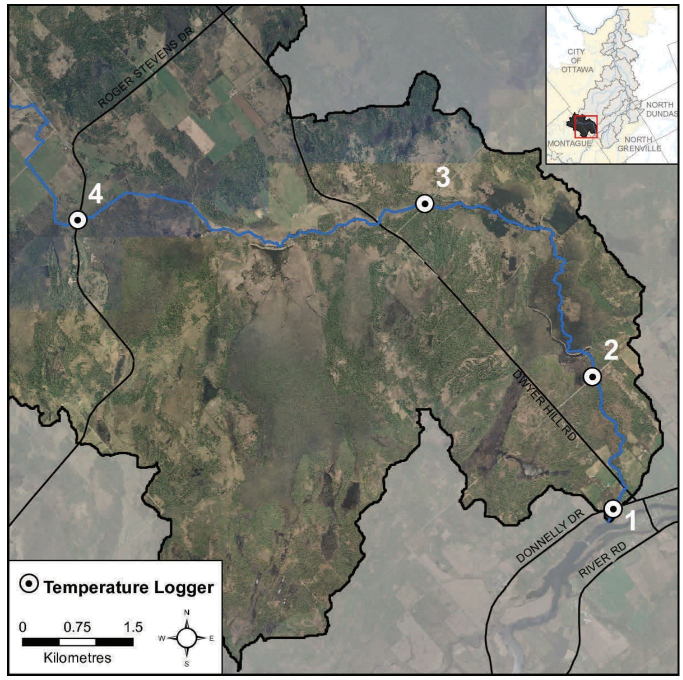


Figure 31. Temperature dataloggers along Brassils Creek

Fish Sampling

Fish sampling sites located along Brassils Creek are shown in Figure 32. The provincial fish codes shown on the map below are listed (in Table 6) beside the common name of those fish species identified in Brassils Creek (Data source: RVCA and City of Ottawa).

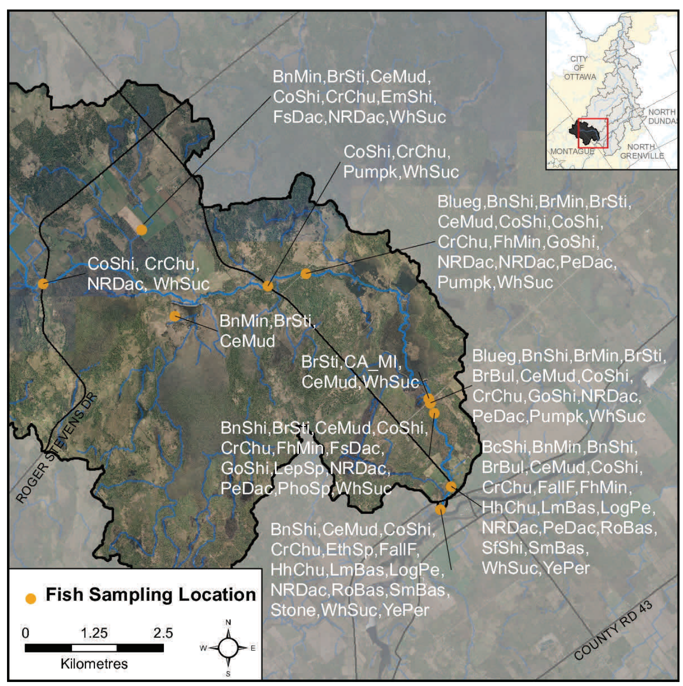


Figure 32. Fish species observed along Brassils Creek

Table 6. Fish species observed in Brassils Creek

BcShi- **blackchin shiner**	BnShi- **blacknose shiner**	Blueg- **bluegill**	BnMin- **bluntnose minnow**	BrMin- **brassy minnow**
BrSti- **brook stickleback**	BrBul- **brown bullhead**	CeMud- **central Mudmin-now**	CoShi- **common shiner**	CrChu- **creek chub**
Fallf- **fallfish**	FhMin- **fathead minnow**	FsDac- **finescale dace**	GoShi- **golden shiner**	HhChu- **hornyhead chub**
EthSp.- **Etheosto-ma Spp.**	LmBas- **largemouth bass**	LogPe- **logperch**	NRDac- **northern redbelly dace**	PeDac- **pearl dace**
Pumk- **pumpkin-seed**	RoBas- **rock bass**	SmBas- **smallmouth bass**	SfShi- **spotfin shiner**	Stone- **stonecat**
WhSuc- **white suck-er**	YePer- **yellow perch**	CA_MI- **carps and minnows**	EmShi **emarald shiner**	LepSp **lepomis species**
PhoSp **phoximus species**	EmShi **emerald shiner**	LepSp **lepomis species**	Phosp **phoximus species**	

Migratory Obstructions

It is important to know the locations of migratory obstructions because they can prevent fish from accessing important spawning and rearing habitat. Migratory obstructions can be natural or manmade, and they can be permanent or seasonal. There were 18 within the Brassils Creek catchment at the time of the survey (Figure 33). Many of them were the result of beaver activity and as a result conditions change constantly.

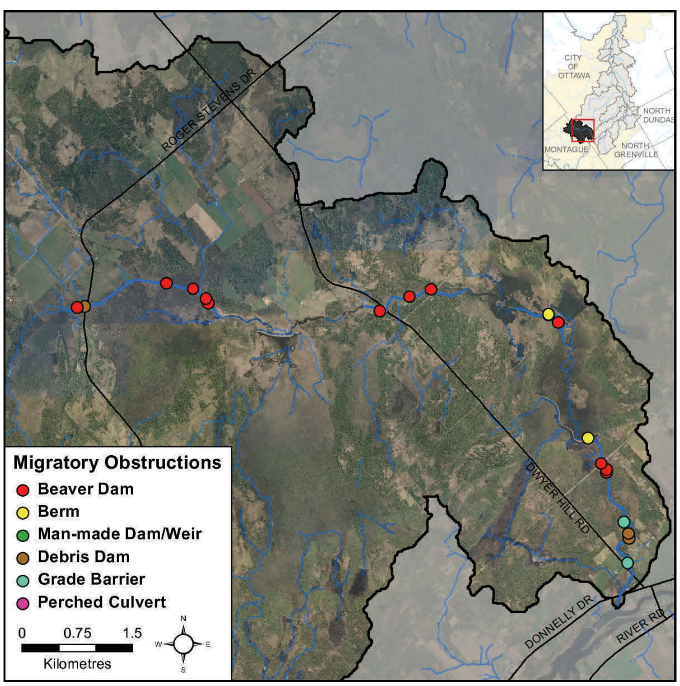


Figure 33. Migratory obstructions in Brassils Creek

Water Chemistry

During the macrostream 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 warmwater 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
- 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 1 (most acidic) to 14 (most alkaline/ basic), with 7 occupying a neutral point.

2010 data for these three parameters" is summarized in Table 7.

Table 7. 2010 Water chemistry collected along Brassils Creek

Month	Range	DO (mg/L)	DO (%)	Conductivity (µs/cm)	pH
May-10	low	-	-	-	-
	high	-	-	-	-
Jun-10	low	6.3	77	278	8.08
	high	13.42	129	386	8.47
Jul-10	low	3.31	43	402	7.12
	high	4.54	60	452	7.71
Aug-10	low	1.54	20	331	7.28
	high	7.88	85	419	7.7

This is an image of a mud puppy, a native species caught on Brassils Creek

3) ***Land Cover***

Woodland and wetland are the dominant land cover types in the catchment as shown in Table 8 and displayed in the map on the front cover of the report.

Table 8. Catchment land cover type

Cover Type	Area (ha)	Area (% of Cover)
Woodland	2665	40
Wetland	2237	33
Crop & Pasture	967	14
Grassland	654	10
Settlement	116	2
Transportation	95	1

Woodland Cover

The Brassils Creek catchment contains 2665 hectares of woodland (Fig.34) that occupies 40 percent of the drainage area. 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.

Eighty-six (66%) of the 192 woodland patches in the catchment are very small, being less than one hectare in size. Another 77 (40%) 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 29 (15%) woodland patches range between 22 and 479 hectares. Twenty-one 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, eight (4%) of the 192 woodland patches in the drainage area exceed the 100 plus hectare size needed to support most forest dependent, area sensitive birds and is large enough to support approximately 60 percent of edge-intolerant species. Two 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 192 woodlands contain 111 forest interior patches (Fig.34) that occupy seven percent (447 ha.) of the catchment land area. 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.

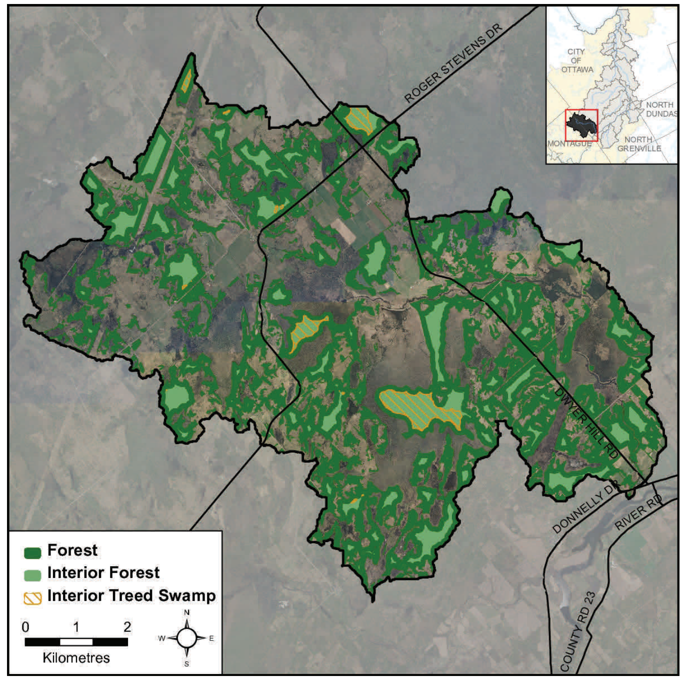
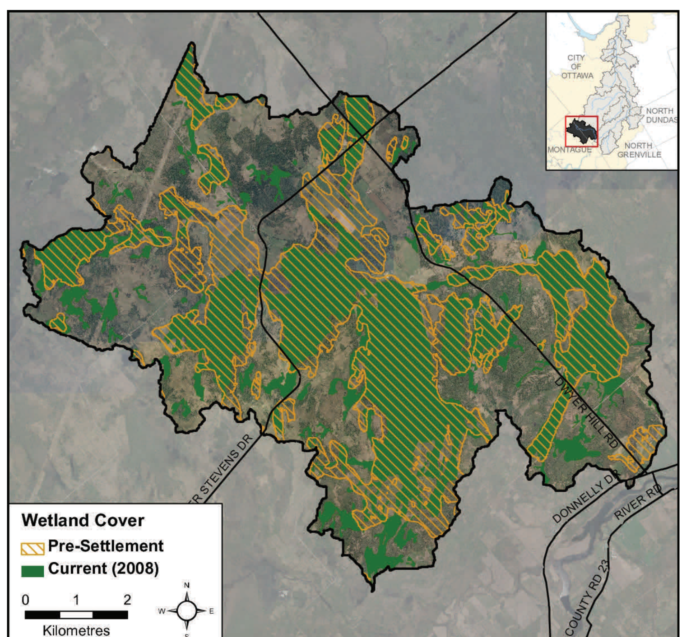


Figure 34. Catchment woodland cover and forest interior

Most patches (99) have less than 10 hectares of interior forest, 63 of which have small areas of interior forest habitat less than one hectare in size. Conversely, 34 patches have greater than 10 hectares of interior forest, containing between 10 and 76 hectares of interior forest habitat, with one patch being greater than 50 hectares in size (at 76 hectares).



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 35. Pre-settlement and present day wetland cover

4) Stewardship and Protection

The RVCA and its partners are working to protect and enhance environmental conditions in the Lower Rideau River Subwatershed.

Rural Clean Water Projects

Figure 36 shows the location of all Rural Clean Water Projects in the Brassils Creek drainage area. From 2006 to 2011, landowners completed 2 projects, both septic system repair/replacements. In total, RVCA contributed $3,000 in grant dollars to projects valued at $29,318.

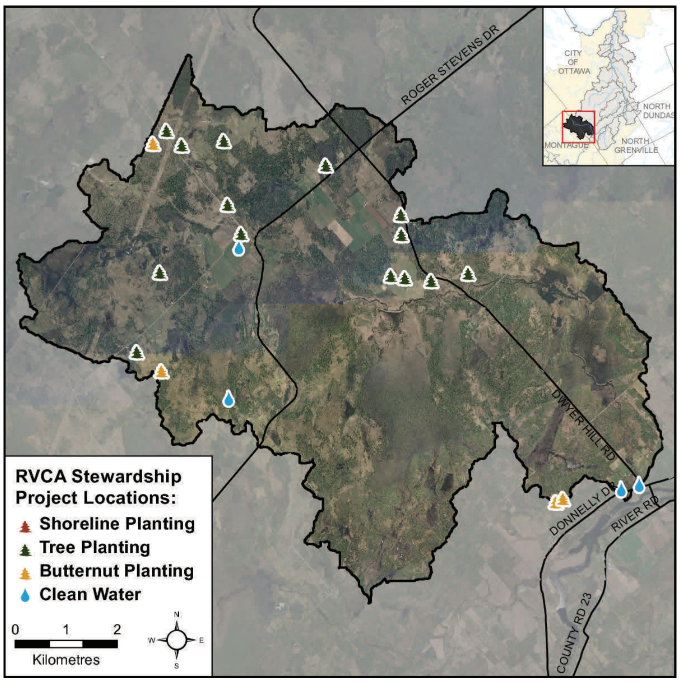


Figure 36. RVCA stewardship program project locations

Prior to 2006, the Rural Clean Water Program completed 4 projects in the area consisting of 3 well upgrades and 1 livestock fencing project. In total, RVCA contributed $2,813 in grant dollars to projects valued at $4,448.

Tree Planting Projects

The location of all tree planting and shoreline projects is also shown in Figure 36. From 2006 to 2011, 8,700 trees, valued at $15,618, were planted on 1 site through the RVCA Tree Planting Program.

Before that, from 1984 to 2006, landowners helped plant 159,530 trees valued at $172,873 on 13 project sites, using the RVCA Tree Planting Program, on 80 hectares of private land; fundraising dollars account for $125,983 of that amount.

Valley, Stream, Wetland and Hazard Land Regulation

Thirty square kilometres or 45 percent of the catchment drainage area is within the regulation limit of Ontario Regulation 174/06 (Fig.37), giving protection to wetland areas and river or stream valleys that are affected by flooding and erosion hazards.

Natural features within the regulation limit include 17.3 sq. km. of wetlands (representing 77 percent of all wetlands in the catchment) and 72.7 kilometres of streams (representing 64 percent of all streams in the catchment). Many of these regulated watercourses (62.5 km or 55 percent of streams) flow through regulated wetlands.

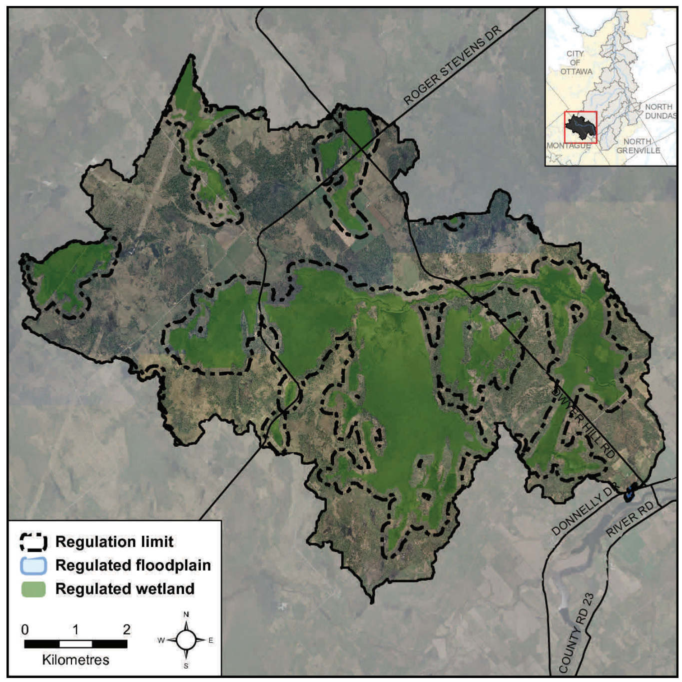


Figure 37. RVCA regulation limits

Regulation limit mapping has been plotted along 10.2 km (or nine percent) of the streams that are outside of wetlands. Plotting of the regulation limit on the remaining 41.1 (or 36 percent) of streams requires identification of flood and erosion hazards and valley systems.

Within the regulation limit, “development” and “site alteration” require RVCA permission, as do any proposed works to alter a watercourse, which are subject to the “alteration to waterways” provision of Ontario Regulation 174/06.

5) *Issues*

- Some removal of natural riparian vegetation along Brassils Creek and some tributaries
- Altered hydrology from drainage practices on tributaries causing in-stream erosion and impacts to aquatic habitats
- Increasing presence of invasive species
- Some nutrient, E.coli and metal exceedances observed in water samples taken

6) *Opportunities for Action*

- Work with landowners to implement agricultural best management practices and pursue improvements to the riparian corridor along Brassils Creek and tributaries (by increasing buffers through reforestation/riparian plantings and invasive species removal)
- Target riparian and instream restoration at sites identified in this report (as shown in Figures 28, 29 and 33) and explore other restoration and enhancement opportunities along the Brassils Creek riparian corridor