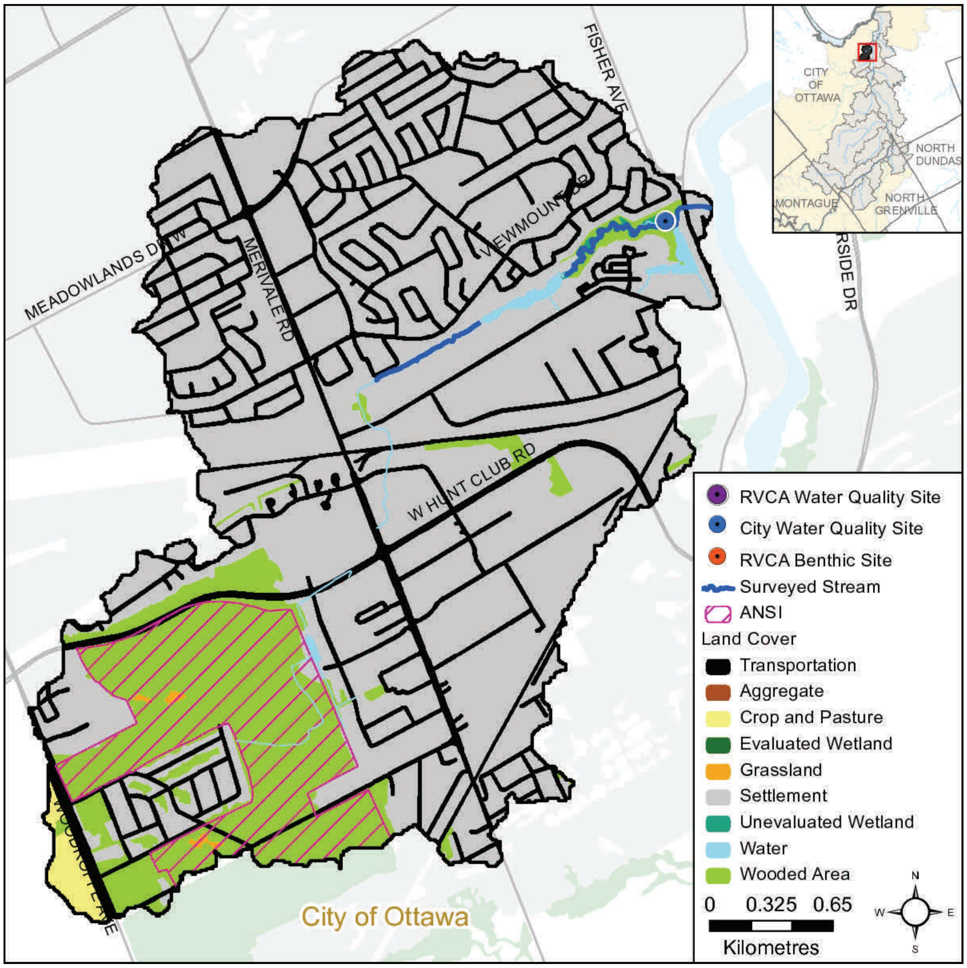
NEPEAN CREEK CATCHMENT

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 Nepean 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 the Lower Rideau Subwatershed Report, please visit the RVCA website at www.rvca.ca.

Inside

Catchment Facts

- The drainage area is largely urbanized and the creek channel west of Merivale Road was entombed during the initial development of the area
- Drains 11 sq. km of land or 1.4% of the Lower Rideau Subwatershed and 0.3% of the Rideau Valley Watershed
- Dominant land cover is settlement (64%), followed by transportation (18%), woodland (16%), crop and pastureland (1%) and water (1%)
- Riparian buffer (30 m. wide along both sides of Nepean Creek and its tributaries) is comprised of settlement (53%), woodland (35%), wetland (9%) and transportation (3%)
- Contains a cool/warm water recreational and baitfish fishery with 18 fish species
- Water quality rating is poor along Nepean Creek, with no change in water quality ratings observed over a 12 year reporting period (2000-2005 vs. 2006-2011)
- Woodland cover has decreased by 1.7 percent (17 ha.) from 2002 to 2008
- Prior to the early 2000's, this catchment had two separate outlets to the Rideau River - one of them was the Merivale Trunk Storm Sewer which collected largely untreated stormwater from industrial/business park lands south of Colonnade Road N and the railway line and discharged it to the river just east of the Colonnade Road/Prince of Wales Drive intersection. To address this, the Merivale/Colonnade/Nepean Creek Stormwater Facility ESR. 2000 (CH2M Gore and Storrie Ltd. for the City of Nepean) was completed
- Storm water is now managed in the Nepean Creek Stormwater Management Facilities in three storm water cells (one on-line and two off-line) prior to being discharged to the remaining two kilometres of natural creek valley and the Rideau River
- No buildings or structures are exposed to flood risk, based on an assessment of 1:100 year flood conditions on the stormwater management ponds
- Setbacks have been applied to adjacent development in the Fisher Glen and CitiPlace communities to avoid risk associated with marginal slope stability
- Formal pathways system to improve public access to the creek corridor has been developed in conjunction with the stormwater management facilities and CitiPlace
- During 2007 and 2012, City Stream Watch (CSW) staff and community volunteers completed a total of 22 macro stream surveys and fish sampling
- In 2012, CSW and RVCA Shoreline Naturalization staff joined community volunteers and numerous Scouts Canada groups to plant 1500 trees and shrubs along the creek corridor
- Three temperature data loggers were deployed by RVCA in 2012 in an effort to better understand the thermal regime of the creek as it relates to fish habitat

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. Nepean Creek

Surface water quality conditions in Nepean Creek are monitored through the City of Ottawa's Baseline Water Quality Program (downstream of Fisher Glen stormwater treatment facility, see Fig. 1 for the location).

The water quality rating for Nepean Creek is "Poor" 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.

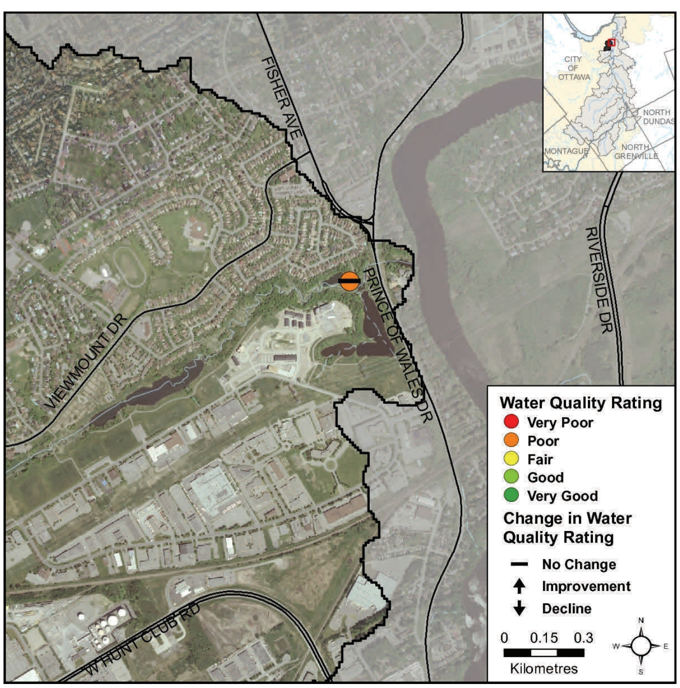


Figure 1. Sampling site in Nepean Creek

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

Nepean 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. Nepean 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 Nepean Creek (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. Nepean Creek TKN results are shown in Figures 4a and 4b.

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

Table 2. Summary of total phosphorous results for Nepean Creek from 2000-2005 and 2006-2011

Total Phosphorus 2000-2005			
Site	Average (mg/l)	% Below Guideline	No. Samples
CK14-14	0.059	8	66
Total Phosphorus 2006-2011			
Site	Average (mg/l)	% Below Guideline	No. Samples
CK14-14	0.052	10	63

Nepean Creek Nutrients: Site CK14-14

The majority of samples at site CK14-14 were above the TP guideline of 0.030mg/l for both time periods (Fig. 2a, 2000-2005 and 2b, 2006-2011), only 8 percent of samples were below the guideline in the 2000-2005 period this improved to ten percent of samples in the

Table 3. Summary of total Kjeldahl nitrogen results for Nepean Creek from 2000-2005 and 2006-2011

Total Kjeldahl Nitrogen 2000-2005			
Site	Average (mg/l)	% Below Guideline	No. Samples
CK14-14	0.668	18	66
Total Kjeldahl Nitrogen 2006-2011			
Site	Average (mg/l)	% Below Guideline	No. Samples
CK14-14	0.615	11	63

2006-2011 period. There was also a slight decrease in average TP concentration from 0.059 mg/l (2000-2005) to 0.052 mg/l (2006-2011). Percentile plots of TP data are shown for two time periods 2000-2005 (Fig. 3a) and 2006-2011 (Fig. 3b). The target of a TP concentration of

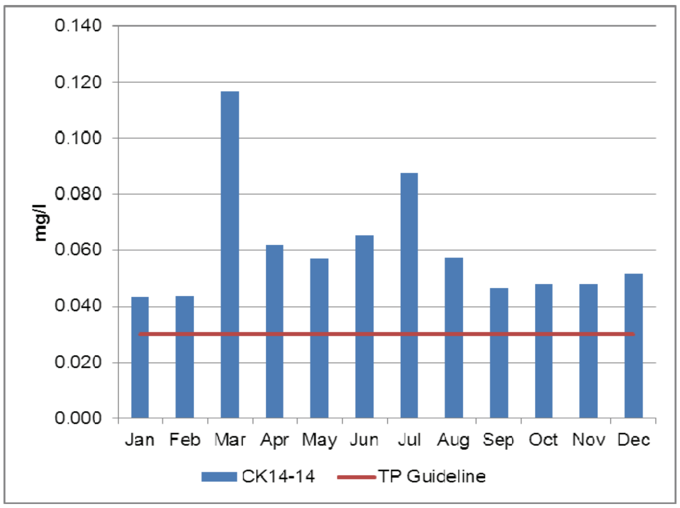


Figure 2a. Total phosphorous concentrations in Nepean Creek from 2000-2005

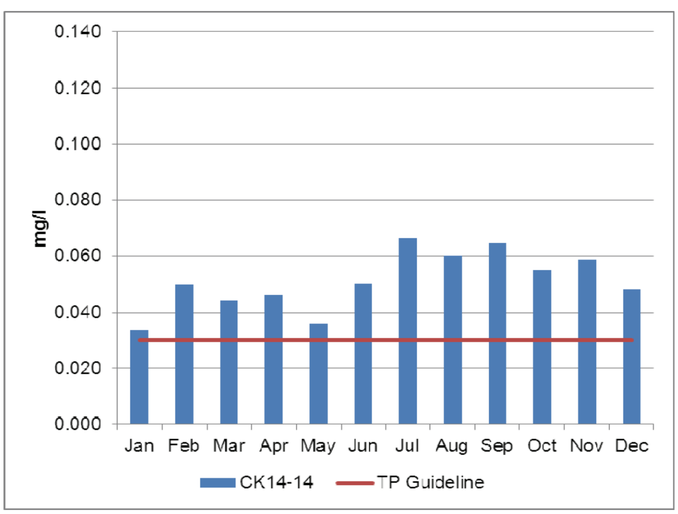


Figure 2b. Total phosphorous concentrations in Nepean Creek from 2006-2011

0.030mg/l at the 85th percentile has not been achieved at this site, though the concentration at the 85th percentile did decrease from 0.083 mg/l (2000-2005, Fig. 3a) to 0.072 mg/l (2006-2011, Fig. 3b).

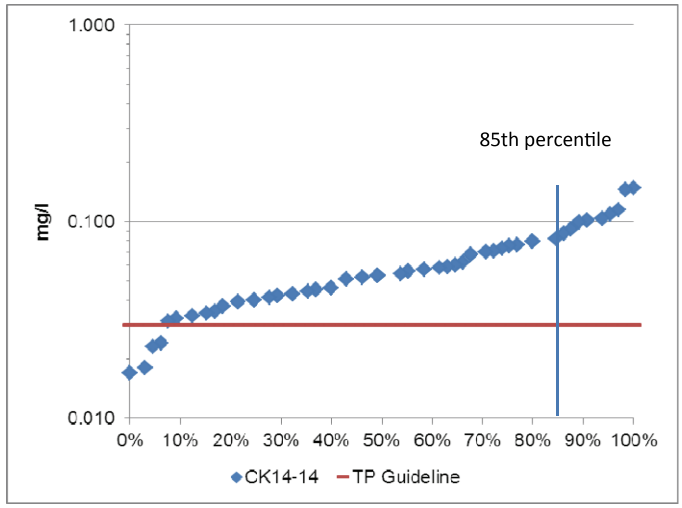


Figure 3a, Percentile plots of total phosphorous in Nepean Creek from 2000-2005

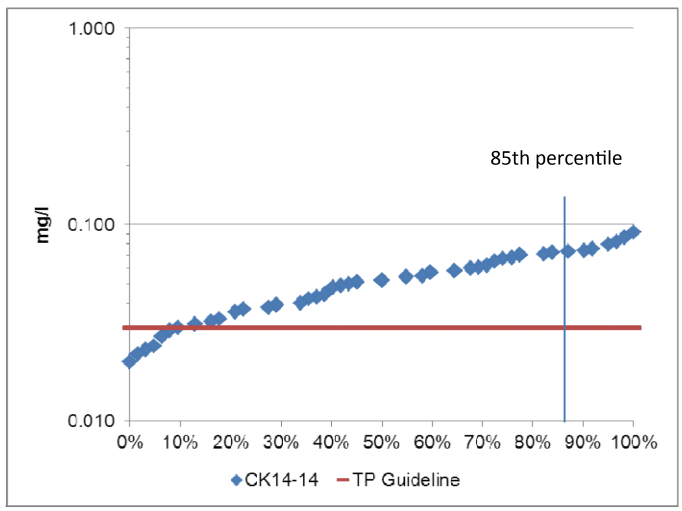


Figure 3b. Percentile plots of total phosphorous in Nepean Creek from 2006-2011

TKN is used as a secondary indicatory of nutrient enrichment. Figure 4a, 2000-2005 and 4b, 2006-2011 shows that the majority of results exceeded the TKN guideline of 0.500 mg/l; eighteen percent of samples were below the guideline in 2000-2005 and decreased to eleven percent below the guideline in the 2006-2011 periods. The average concentration decreased slightly from 0.668 mg/l to 0.615mg/l, but still exceeded the guideline.

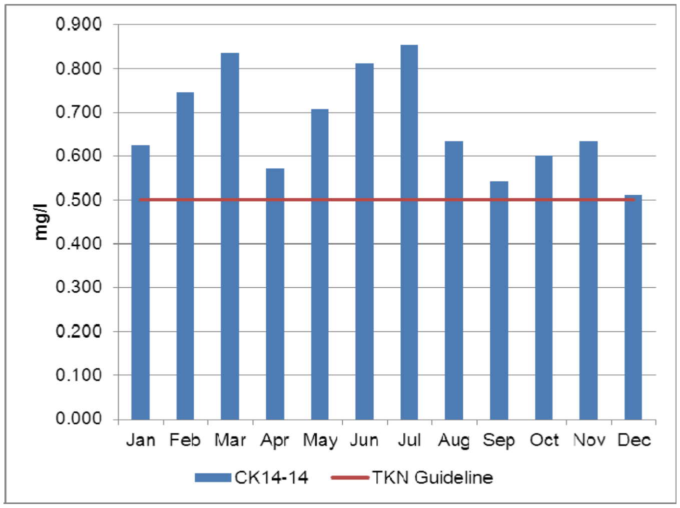


Figure 4a. Total Kjeldahl nitrogen concentrations in Nepean Creek from 2000-2005

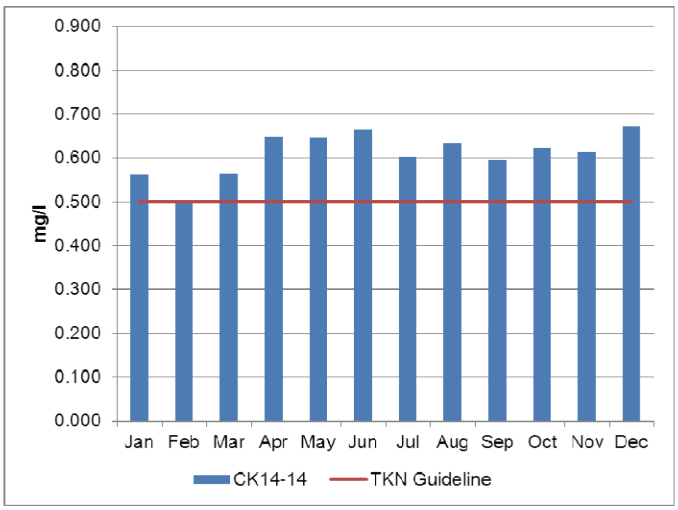


Figure 4b. Total Kjeldahl nitrogen concentrations in Nepean Creek from 2006-2011

Nepean Creek Nutrients Summary

Overall the data suggests that nutrient loading is a significant problem at this site; efforts should be made to reduce nutrient inputs to the creek.

Nepean 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 also set a target for E. coli counts of 200 CFU/100 ml at the 80th percentile for tributaries of the Rideau River, such as Nepean Creek.

Table 4 summarizes the geometric mean at monitored sites on Nepean 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.

Table 4. Summary of E. coli results for Nepean Creek

E. coli 2000-2005			
Site	Geometric mean (mg/l)	% Below Guideline	No. Samples
CK14-14	87	52	66
E. coli 2006-2011			
Site	Geometric mean (mg/l)	% Below Guideline	No. Samples
CK14-14	85	61	61

Nepean Creek E. coli: Site CK14-14

E. coli counts above the guideline of 100 colony forming units per 100 mL (CFU/100mL) were common at site CK14-14 on Nepean Creek. In comparing the two time periods, the proportion of samples below the guideline increased from fifty-two percent (Fig. 5a) to sixty two percent (Fig. 6b), indicating higher counts were less prevalent. The count at the geometric mean decreased from 87 CFU/100 ml to 85CFU/100 ml. Percentile plots of E. coli data are shown for both periods. Figures 6a, 2000-2005 and 6b, 2006-2011 show that this target was exceeded in both time periods, however the E. coli count at the 80th percentile decreased from 260 CFU/100 ml to 210 CFU/100 ml.

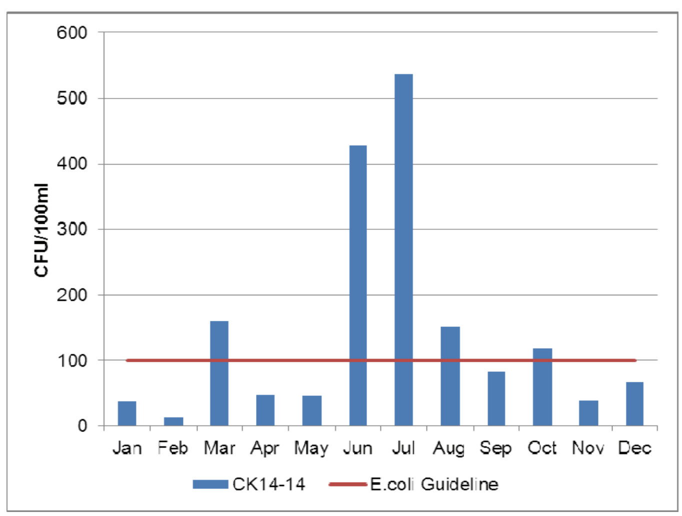


Figure 5a. E. coli counts in Nepean Creek from 2000-2005

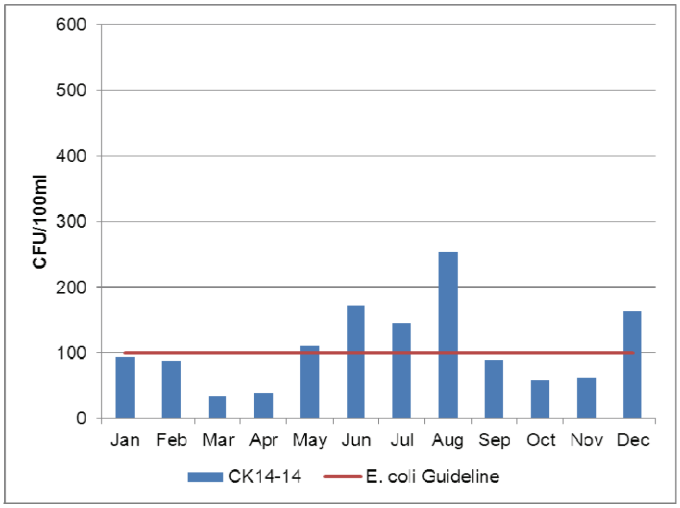


Figure 5b. E. coli counts in Nepean Creek from 2006-2011

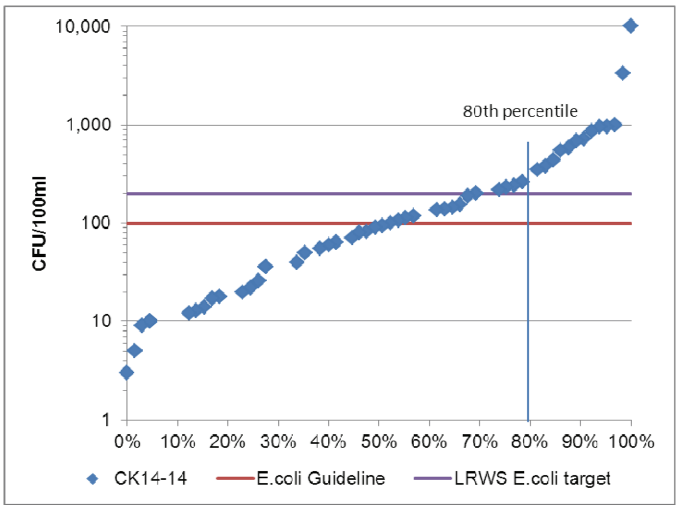


Figure 6a. Percentile plots of E. coli in Nepean Creek from 2000-2005

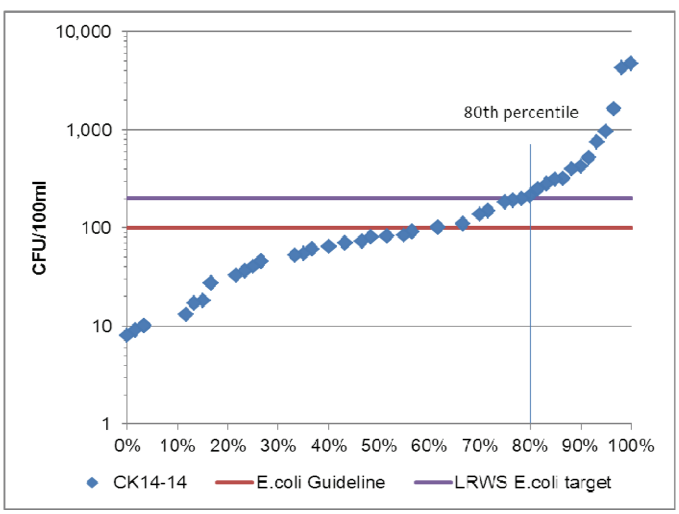


Figure 6b. Percentile plots of E. coli in Nepean Creek from 2006-2011

Nepean Creek E. coli Summary

These statistics indicated that bacterial counts have declined in this creek and are approaching the target; efforts should be made to reduce any possible additional sources of contamination to the creek to protect overall water quality and aquatic life.

Nepean Creek Metals

Of the metals routinely monitored in Nepean Creek, aluminum (Al), copper (Cu), iron (Fe) and zinc were metals that frequently reported concentrations above their respective PWQO. In elevated concentrations these metals can have toxic effects on sensitive aquatic species.

Table 5 summarizes average metal concentrations at monitored sites on Nepean Creek and shows the proportion of samples that meet guidelines. Highlighted values indicated averages that have exceeded the guideline.

Table 5. Summary of metal concentrations in Nepean Creek

Aluminum 2000-2005			
Site	Average (mg/l)	% Below	No. Samples
CK14-14	0.397	8	66
Aluminum 2006-2011			
Site	Average (mg/l)	% Below	No. Samples
CK14-14	0.232	19	63
Iron 2000-2005			
Site	Average (mg/l)	% Below	No. Samples
CK14-14	0.544	23	66
Iron 2006-2011			
Site	Average (mg/l)	% Below	No. Samples
CK14-14	0.364	51	63
Copper 2000-2005			
Site	Average (mg/l)	% Below	No. Samples
CK14-14	0.005	56	66
Iron 2006-2011			
Site	Average (mg/l)	% Below	No. Samples
CK14-14	0.008	32	63
Zinc 2000-2005			
Site	Average (mg/l)	% Below	No. Samples
CK14-14	0.021	86	66
Zinc 2006-2011			
Site	Average (mg/l)	% Below	No. Samples
CK14-14	0.014	89	63

Figures 7, 8, 9 and 10 show the results for each site with respect to guidelines for the two periods 2000-2005 (Figures 7a, 8a, 9a and 10a) and 2006-2011 (Figures 7b, 8b, 9b and 10b). The Lower Rideau Watershed Strategy (2005) also set a target for a Cu concentration of 0.005mg/l and a target for Zn concentration of 0.02 mg/l at the 80th percentile. Figures 10 and 12 show percentile plots of the data for the two time periods of interest (Fig. 10a, 2000-2005) (Fig. 10b, 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.

Nepean Creek Metals: Site CK14-14

The Al guideline of 0.075 mg/l was generally exceeded in both time periods (Fig. 7a, 2000-2005 and 7b, 2006-2011), only eight percent of samples were below the guideline in the 2000-2005 period; this improved to nineteen percent in the 2006-2011 period. There was a decrease in average Al concentration from 0.397 mg/l (2000-2005) to 0.232 mg/l (2006-2011).

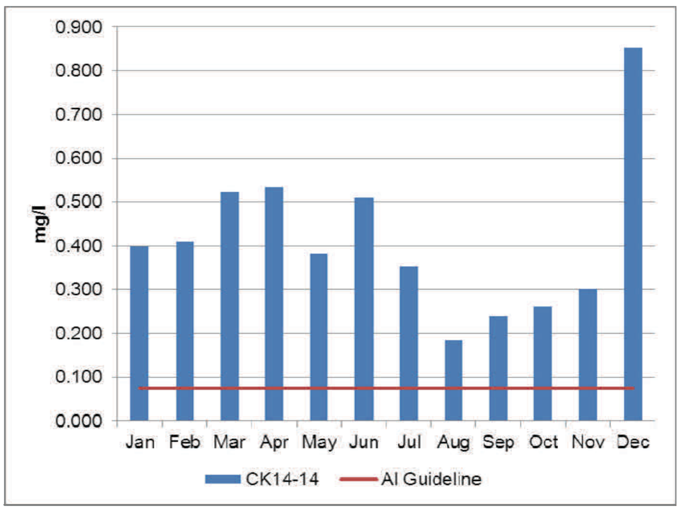


Figure 7a. Aluminum concentrations in Nepean Creek from 2000-2005

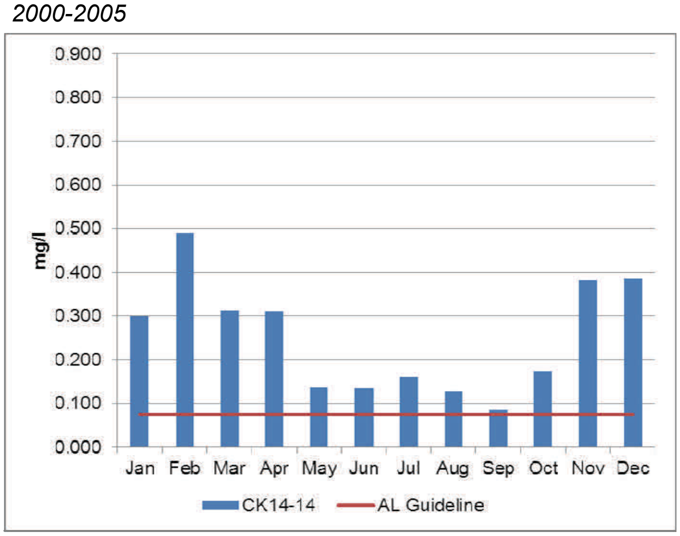


Figure 7b. Aluminum concentrations in Nepean Creek from 2006-2011

Figures 8a, 2000-2005 and 8b, 2006-2011 show that the Fe results often exceed the guideline of 0.300 mg/l but there was an overall decrease in concentrations over the periods of interest. Twenty-three percent of samples were below the guideline in 2000-2005; this improved to fifty-one percent in the 2006-2011 period. The average concentration decreased from 0.544 mg/l to 0.364 mg/l, however it continued to exceed the guideline.

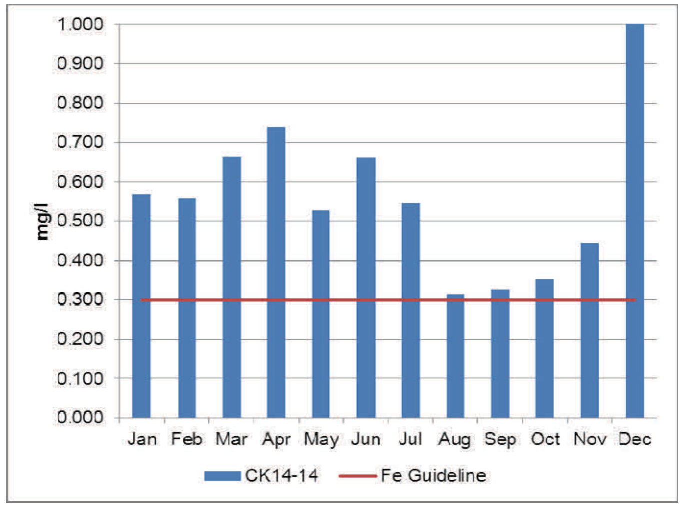


Figure 8a. Iron concentrations in Nepean Creek from 2000-2005

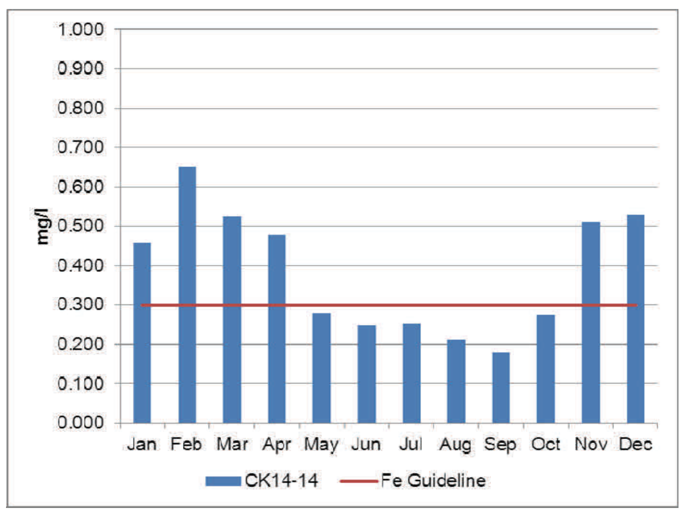


Figure 8b. Iron concentrations in Nepean Creek from 2006-2011

Results for Cu concentrations were also occasionally above the guideline of 0.005 mg/l. The proportion of samples below the guideline decreased from fifty-six percent (Fig. 9a, 2000-2005) to thirty-two percent (Fig. 8b, 2006-2011), the average concentration increased from 0.005 mg/l to 0.008 mg/l .Percentile plots of Cu data are shown for the two time periods 2000-2005 (Fig. 10a) and 2006-2011 (Fig. 10b). The target of a Cu concentration of 0.005 mg/l at the 80th percentile has not

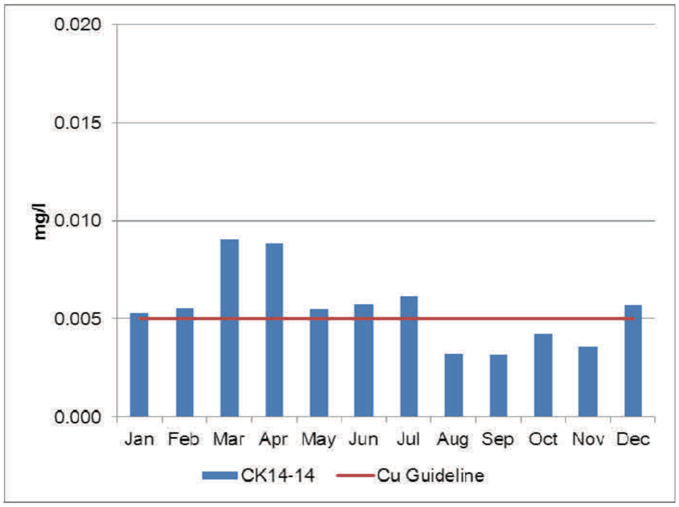


Figure 9a. Copper concentrations in Nepean Creek from 2000-2005

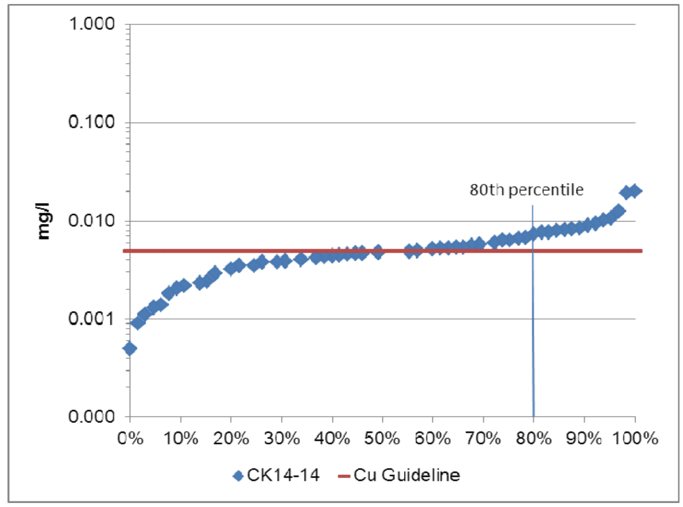


Figure 10a. Percentile plot of copper in Nepean Creek from 2000-2005

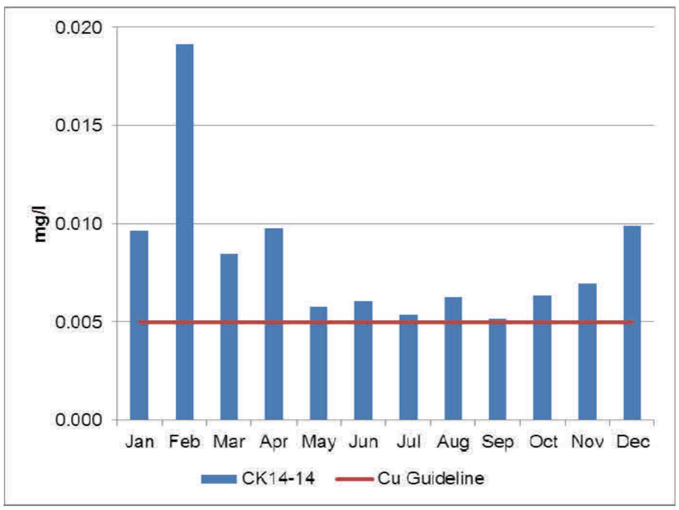


Figure 9b. Copper concentrations in Nepean Creek from 2006-2011

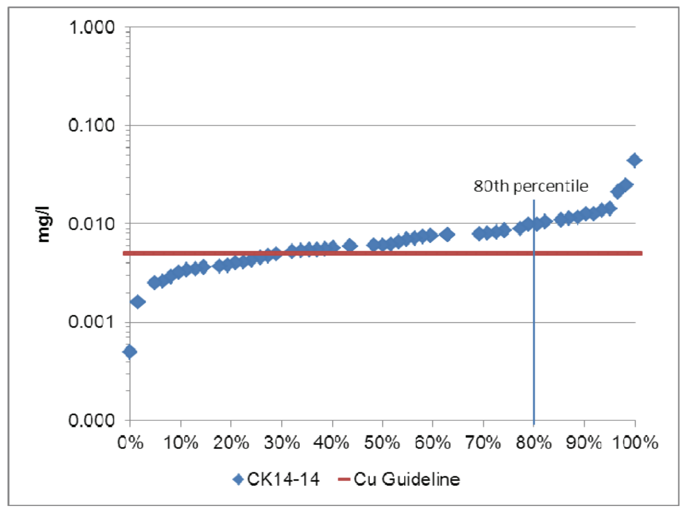


Figure 10b. Percentile plots of copper in Nepean Creek from 2006-2011

been achieved at this site; the concentration at the 80th percentile increased from 0.007 mg/l (2000-2005, Fig. 10a) to 0.010 mg/l (2006-2011, Fig. 10b).

Zn concentrations also exceeded the established guidelines on occasion. The majority of samples were below the guideline and the proportion increased slightly from eighty-six percent (Fig. 11a, 2000-2005) to eighty-nine percent (Fig. 11b, 2006-2011) and the average concentration decreased from 0.021 mg/l to 0.014 mg/l . Percentile plots of Zn data are shown for the two time periods 2000-2005 (Fig. 12a) and 2006-2011 (Fig. 12b). The target of a Zn concentration of 0.020 mg/l at the 80th percentile was not achieved in the 2000-2005 (Fig. 12a) as Zn results were 0.030 at the 80th percentile. The target was met in the 2006-2011 periods (Fig. 12b) as the concentration at the 80th percentile equals 0.020 mg/l.

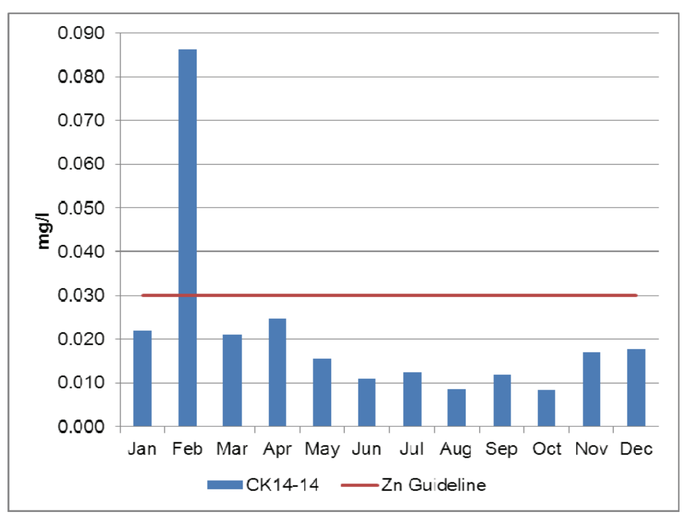


Figure 11a. Zinc concentrations in Nepean Creek from 2000-2005

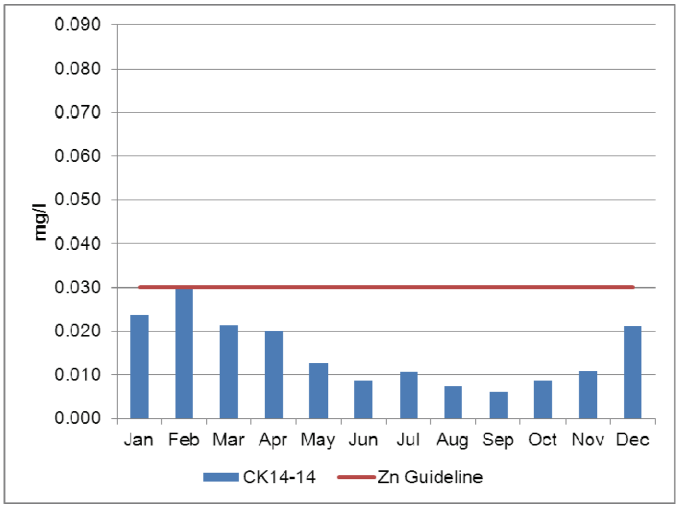


Figure 11b. Zinc concentrations in Nepean Creek from 2006-2011

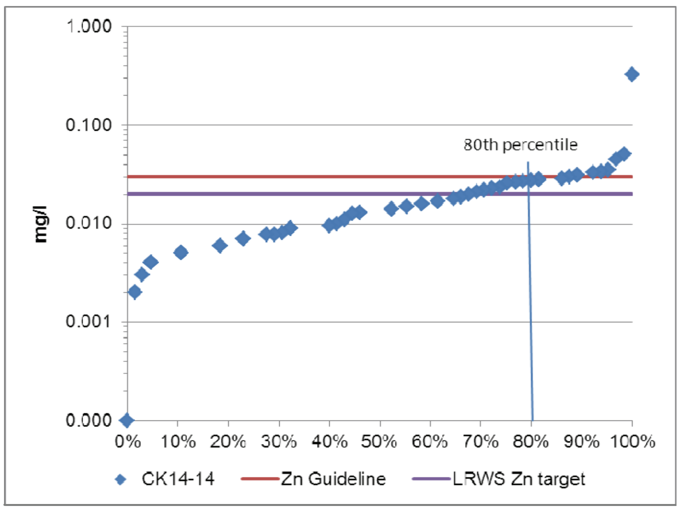


Figure 12a. Percentile plots of zinc in Nepean Creek from 2000 -2005

Gathering water quality using a YSI

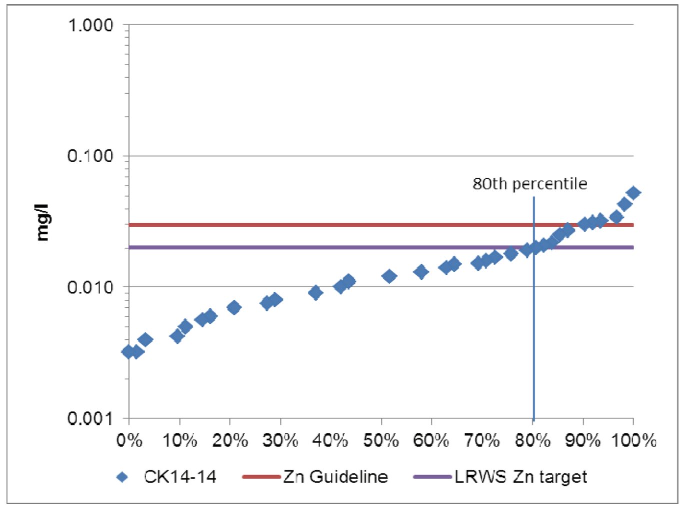


Figure 12b. Percentile plots of zinc in Nepean Creek from 2006 -2011

Nepean Creek Metals Summary

Overall the data shows that metal pollution is a problem in the creek and efforts should be made to reduce concentrations wherever possible.

Image of a Mink frog

2) a. Overbank Zone

Riparian Buffer along Nepean 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 44 percent of streams and creeks are buffered with woodland and wetland; the remaining 56 percent of the riparian buffer is occupied by settlement and transportation.

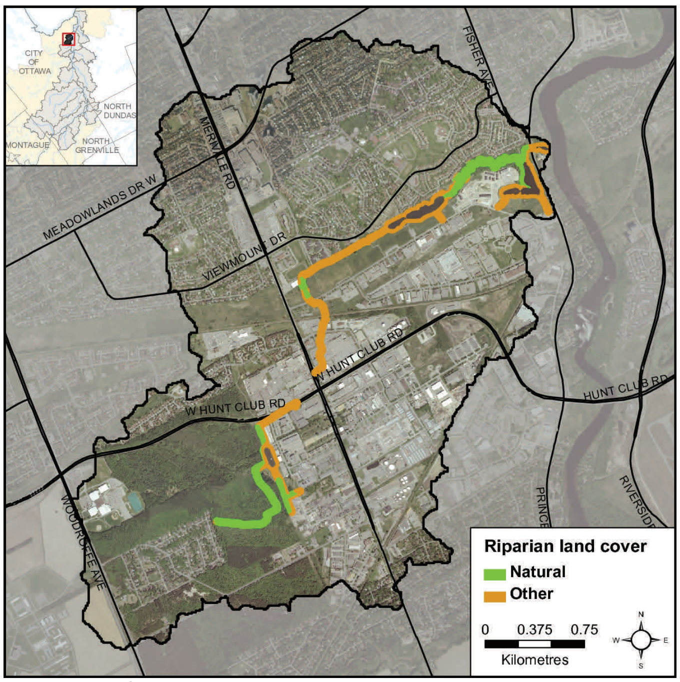


Figure 13. Catchment land cover in the riparian zone

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 20 (100 metre long) sections along Nepean Creek in 2012.

Riparian Buffer along Nepean 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. Nepean Creek had a buffer of greater than 30 metres along 41 percent of the left bank and 46 percent of the right bank.

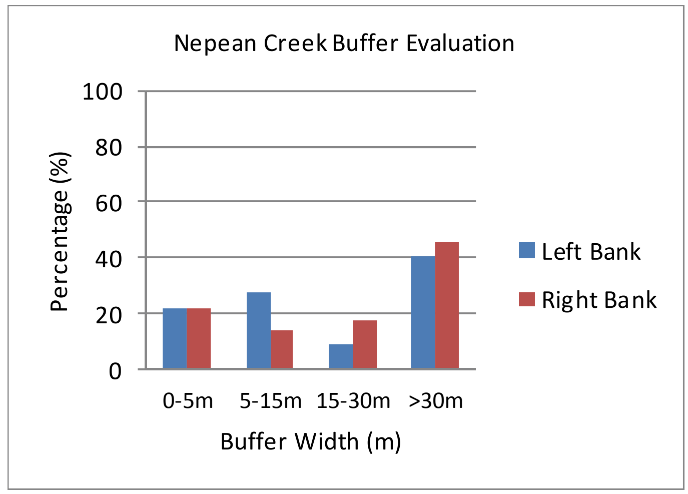


Figure 14. Vegetated buffer width along Nepean Creek

Land Use beside Nepean Creek

The RVCA's Macrostream Survey Program identified seven different land uses beside Nepean 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 43 percent of the stream, characterized by wetland, forest, scrubland and meadow. The remaining land use consisted of residential, infrastructure, and recreational.

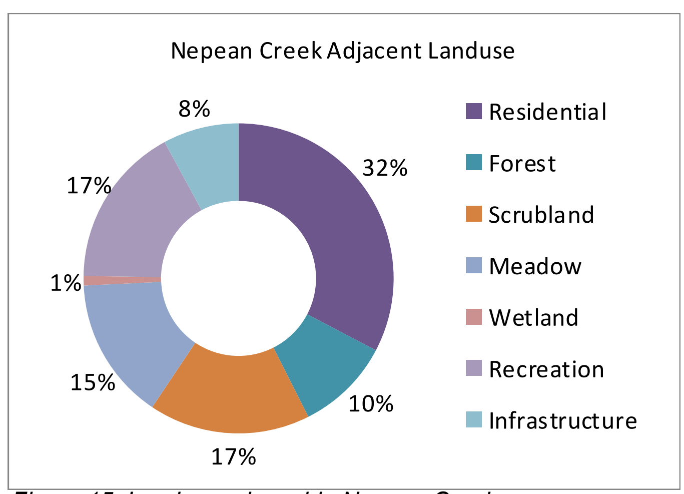


Figure 15. Land use alongside Nepean Creek

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 Nepean Creek.

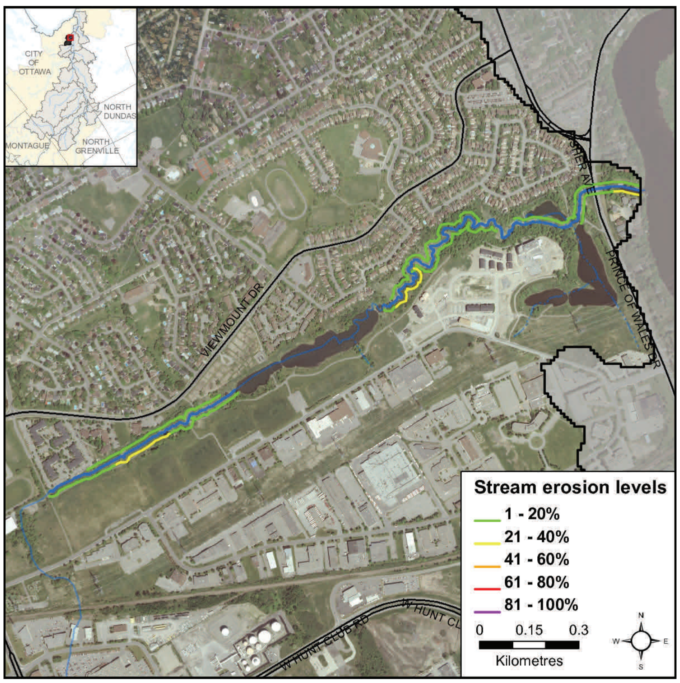


Figure 16. Erosion along Nepean Creek

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 Nepean Creek had several locations with identified undercut banks.

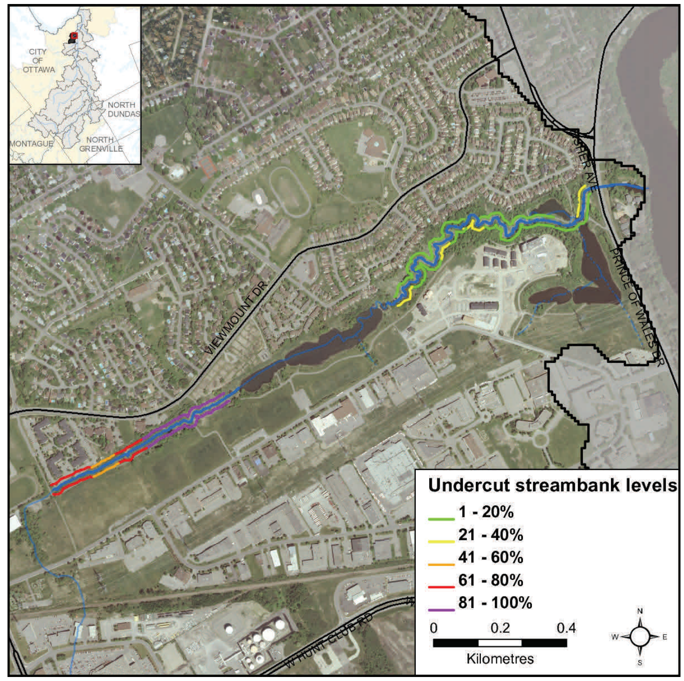


Figure 17. Undercut streambank along Nepean Creek

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 18 shows the stream shading locations along Nepean Creek.

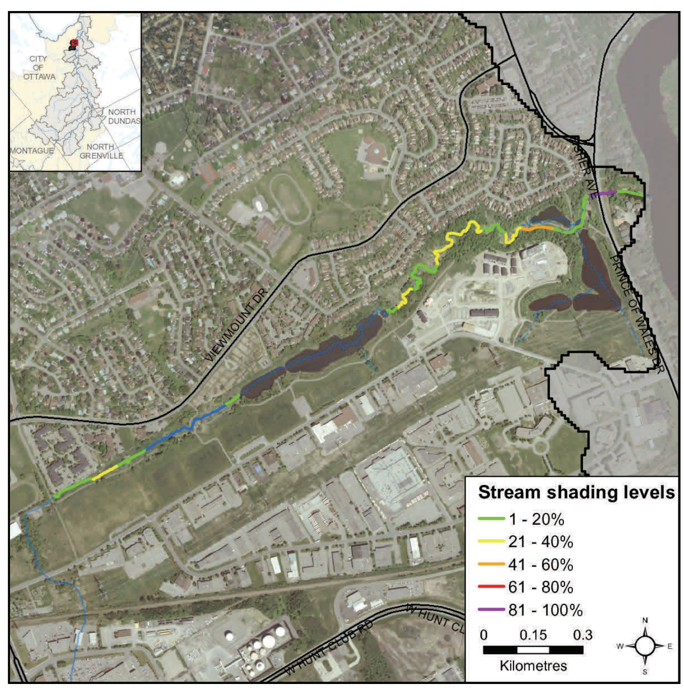


Figure 18. Stream shading along Nepean Creek

Human Alterations

Figure 19 shows that 25 percent of Nepean Creek remains “unaltered.” Sections considered “natural” with some human changes account for five percent of sections. "Altered" sections accounted for 20 percent of the stream, with the remaining 50 percent of sections sampled being considered “highly altered” (e.g., includes road crossings, shoreline/instream modifications and little or no buffer).

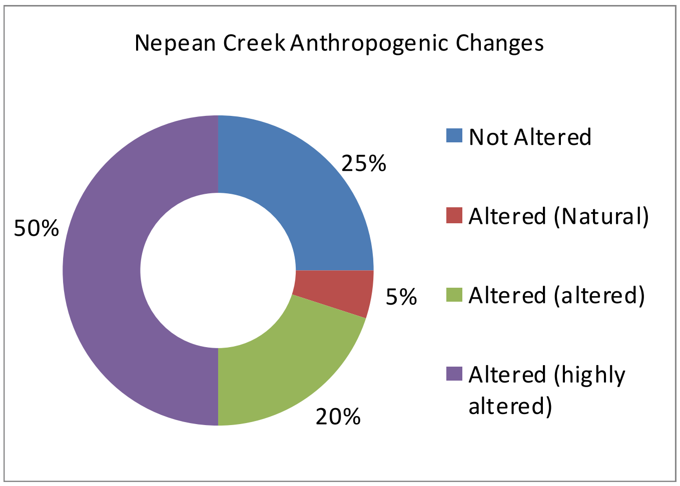


Figure 19. Alterations to Nepean Creek

Overhanging Trees and Branches

Figure 20 shows that the majority of Nepean 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.

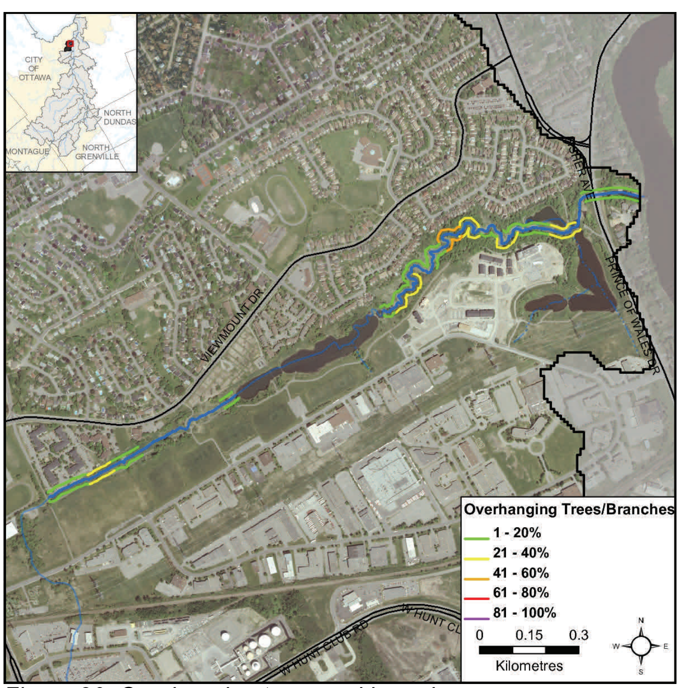


Figure 20. Overhanging trees and branches

Instream Woody Debris

Figure 21 shows that the majority of Nepean Creek had low to moderate 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.

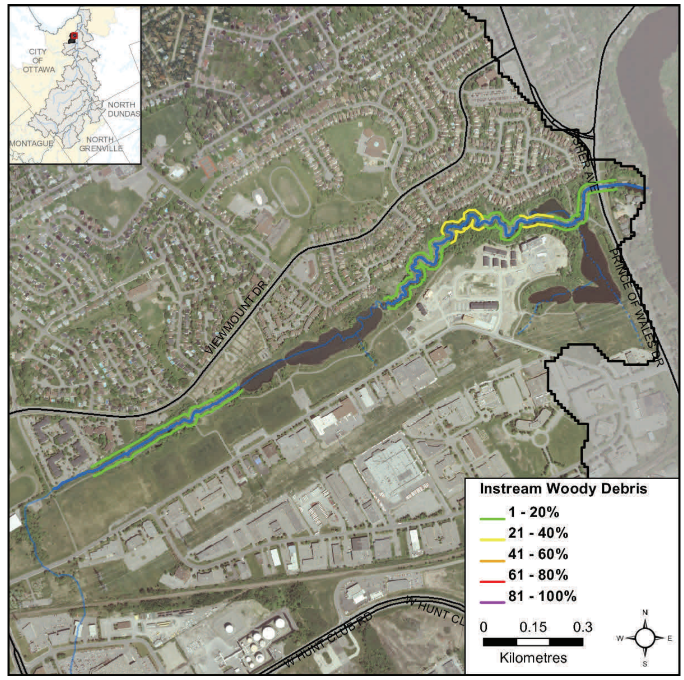


Figure 21. Instream woody debris

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. A high percentage of habitat complexity (heterogeneity) typically increases the biodiversity of aquatic organisms within a system. Forty-five percent of Nepean Creek was considered heterogeneous, as seen in Figure 22.

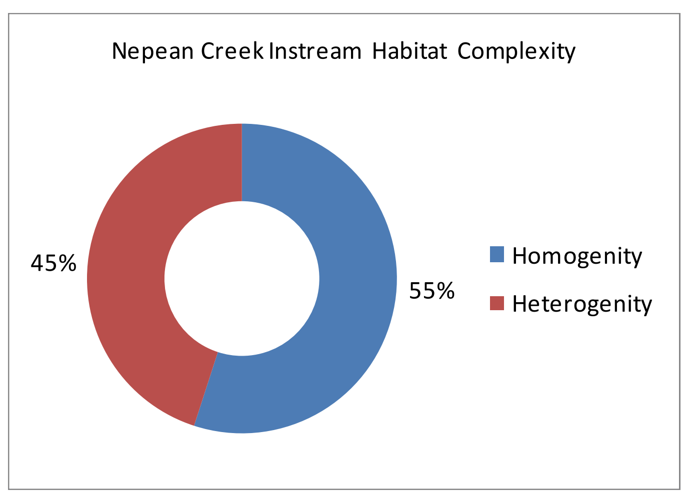


Figure 22. Instream habitat complexity in Nepean Creek.

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 shows the instream substrate diversity for Nepean Creek.

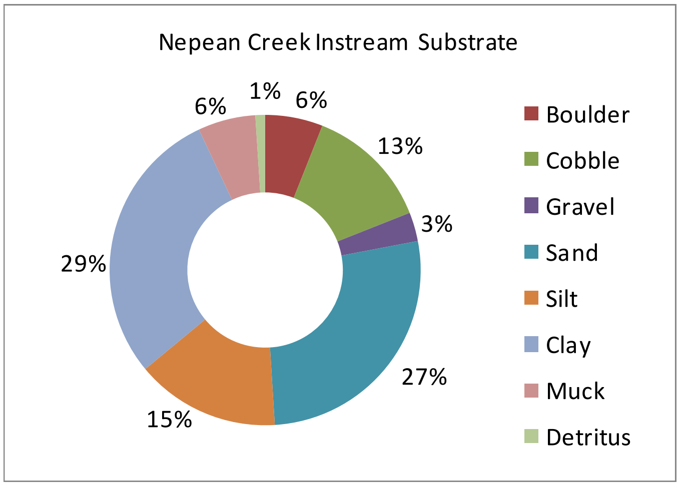


Figure 23. Instream substrate in Nepean Creek

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 Nepean Creek.

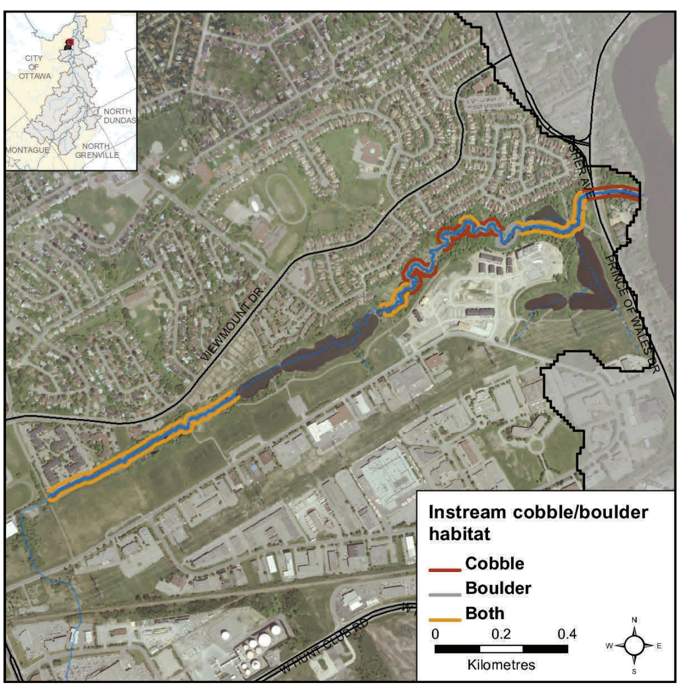


Figure 24. Instream cobble and boulder habitat along Nepean Creek

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 Nepean Creek was fairly uniform; 85 percent consisted of runs, nine percent pools and six percent riffles.

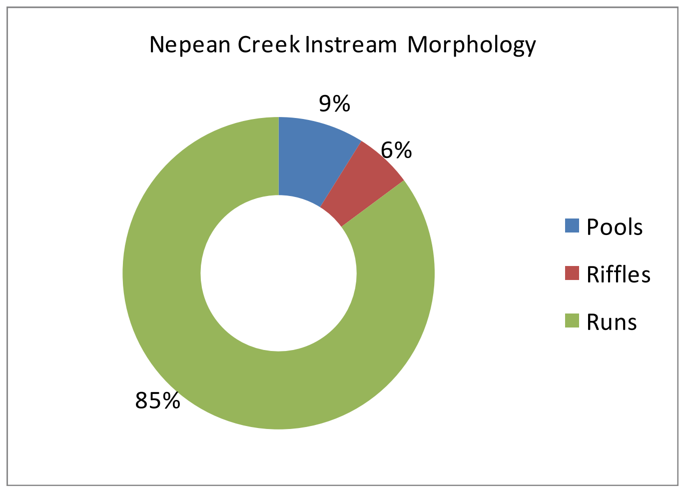


Figure 25. Instream morphology in Nepean Creek

Types of Instream Vegetation

Nepean Creek had limited diversity of instream vegetation, which is likely a function of the dominance of clay substrate(Figure 26). The dominant vegetation type recorded at fifty-seven percent consisted of algae. Submerged vegetation was recorded at 19 percent. A total of seven percent of broad emergent vegetation was recorded and six percent recorded narrow emergent vegetation. Robust emergents were recorded at five percent. Free floating and floating vegetation made up the remaining six percent of the vegetation community.

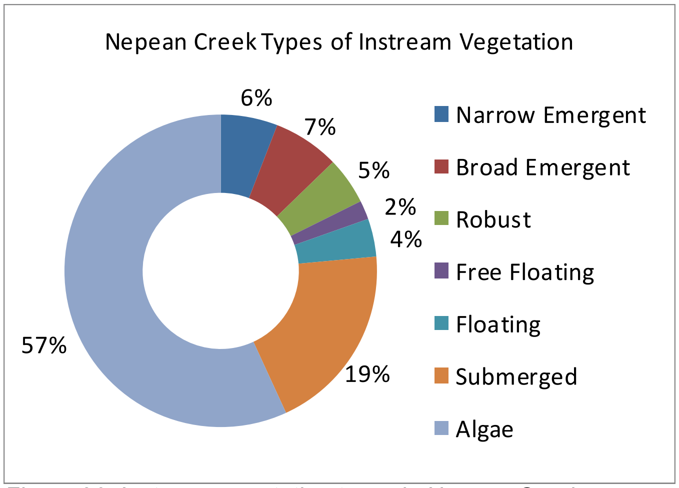


Figure 26. Instream vegetation types in Nepean Creek.

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 Nepean Creek had a variety of instream vegetation levels for most of its length.

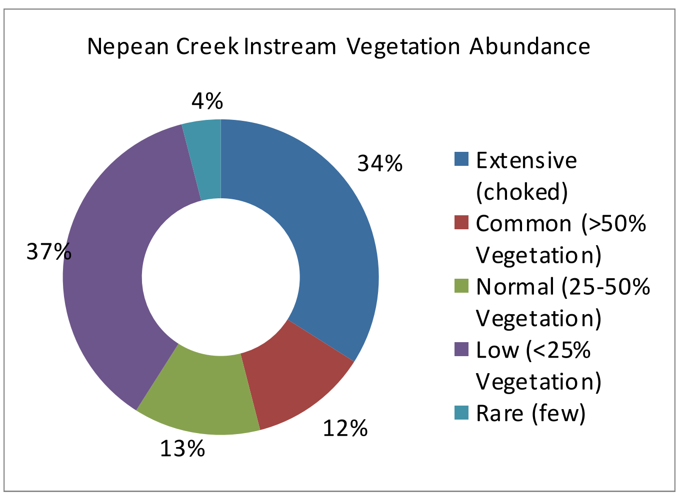


Figure 27. Vegetation abundance in Nepean Creek

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.

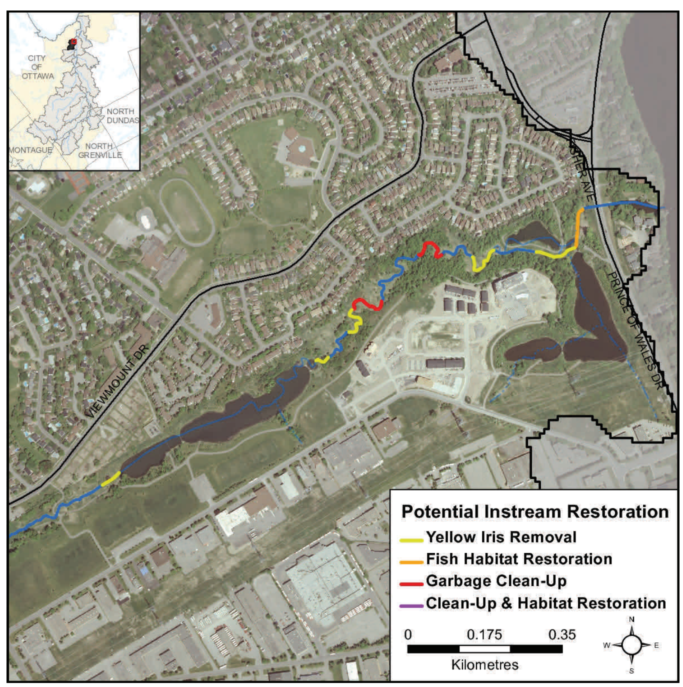


Figure 29. Instream restoration opportunities

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. Ninety percent of the sections surveyed along Nepean Creek had invasive species (Figure 30). The species observed in Nepean Creek were purple loosestrife, garlic mustard, Chinese mystery snail, yellow iris, zebra mussels, Manitoba maple and buckthorn spp.

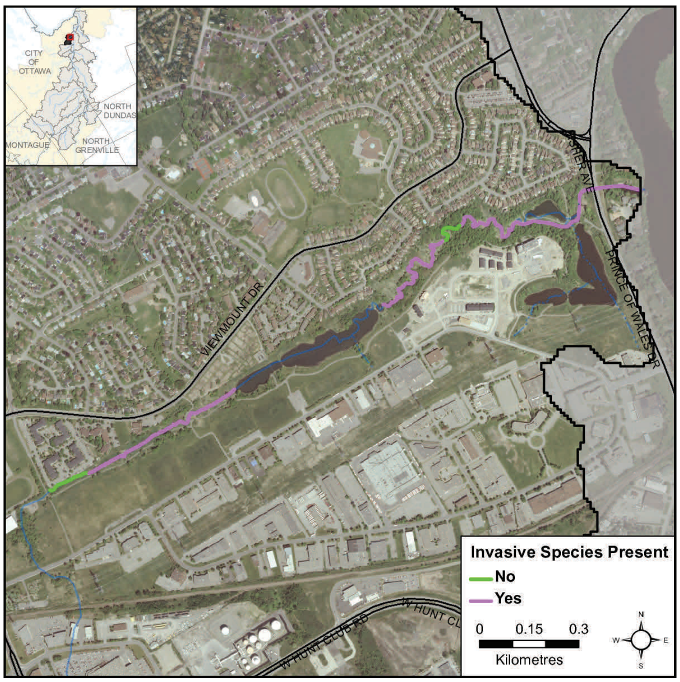


Figure 30. Invasive species along Nepean Creek

Thermal Classification

Temperature is an important parameter in streams as it influences many aspects of physical, chemical and biological health. Three temperature dataloggers were deployed in Nepean Creek from April to late September 2012 (Fig. 31) to give a representative sample of how water temperature fluctuates. 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 Nepean Creek is a warmwater system with coolwater reaches.

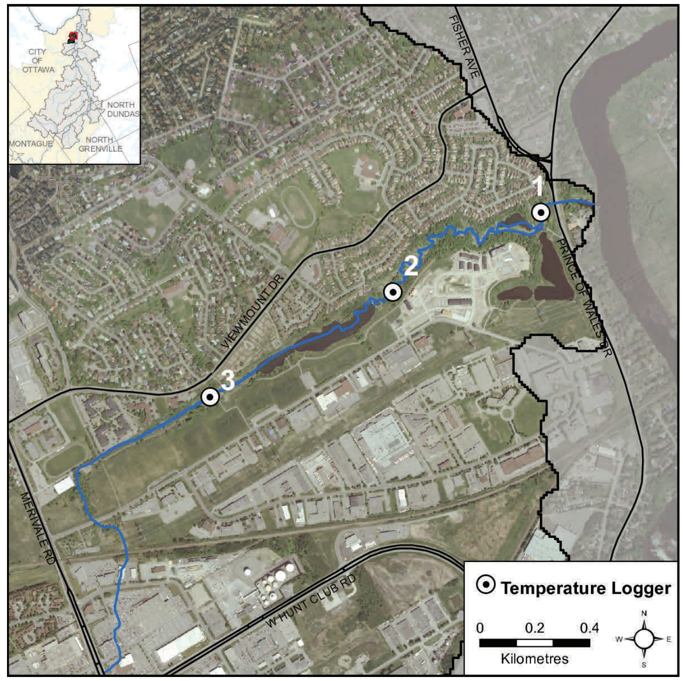


Figure 31. Temperature dataloggers along Nepean Creek

Fish Sampling

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

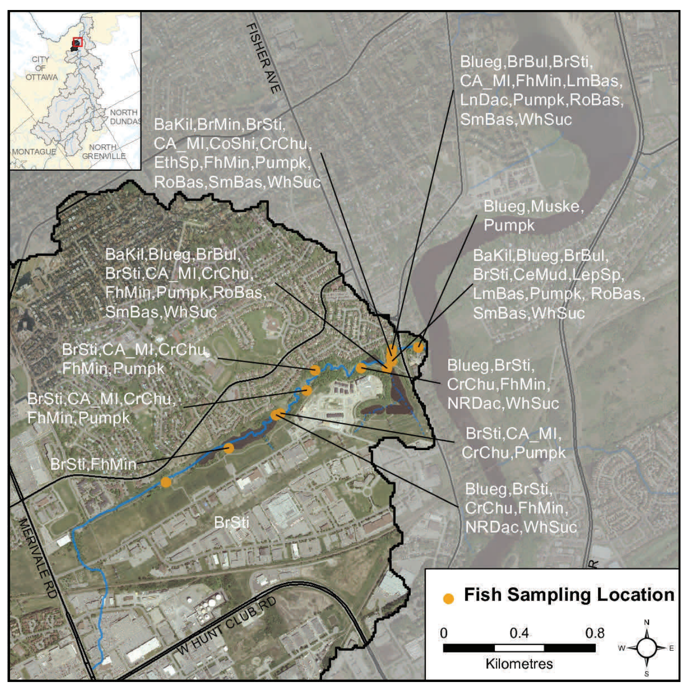


Figure 32. Fish species observed along Nepean Creek

Table 6. Fish species observed in Nepean Creek

BaKil **banded killifish**	Blueg **bluegill**	BrSti **brook stickleback**	BrBul **brown bullhead**
CeMud **central mudminnow**	CrChu **creek chub**	FhMin **fathead minnow**	LmBas **largemouth bass**
Muske **muskellunge**	NRDac **northern redbelly dace**	Pumpk **pumpkinseed**	RoBas **rock bass**
SmBas **smallmouth bass**	WhSuc **white sucker**	CA_MI **carps and minnows**	LepSp. **lepomis spp.**
EthSp **etheostoma species**	BrMin **brassy minnow**	CoShi **common shiner**	LnDac **longnose dace**

Migratory Obstructions

It is important to know the locations of migratory obstructions because these can prevent fish from accessing important spawning and rearing habitat (Figure 33). Migratory obstructions can be natural or manmade, and they can be permanent or seasonal. There were three migratory obstructions within the Nepean Creek catchment at the time of the survey.

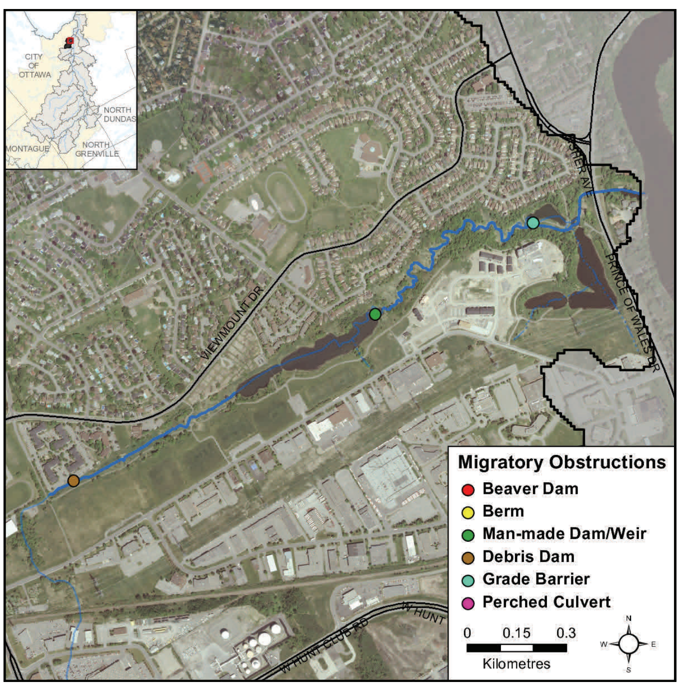


Figure 33. Migratory obstructions in Nepean Creek

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.

2012 data for these three parameters is summarized in Table 7.

Table 7. 2012 Water chemistry collected along Nepean Creek

Month	Range	DO (mg/L)	DO (%)	Conductivity (µs/cm)	pH
May	low	7	80.04	969	8.27
	high	9.04	103.37	1175	8.4
June	low	6.9	74.31	458	7.08
	high	14.13	152.18	2670	8.95
July	low	-	-	-	0
	high	-	-	-	0
August	low	4.34	48.42	385	7.43
	high	8.18	91.26	1595	7.77

RVCA retrieving a seine net from Nepean Creek

3) ***Land Cover***

Settlement is the dominant land cover type in the catchment as shown in Table 8 and displayed in the land cover map on the front cover of the report.

Table 8. Catchment land cover type

Cover Type	Area (ha)	Area (% of Cover)
Settlement	683	64
Transportation	196	18
Woodland	173	16
Crop & Pasture	9	1
Water	6	1

Woodland Cover

The Nepean Creek catchment contains 173 hectares of woodland (Fig.34) that occupies 16 percent of the drainage area. This figure is less 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.

Twelve (55%) of the 22 woodland patches in the catchment are very small, being less than one hectare in size. Another nine (41%) of the wooded patches ranging from one to less than 20 hectares in size tend to be dominated by edge-tolerant bird species.

The other woodland patch in the drainage area (at 110 ha.) exceeds 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. No patch tops 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 conditions.

Forest Interior

The same 22 woodlands contain six forest interior patches (Fig.34) that occupy five percent (53 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.

Most patches (5) have less than 10 hectares of interior forest, four of which have small areas of interior forest habitat less than one hectare in size. Conversely, one patch (at 46 hectares) has greater than 10 hectares of interior forest.

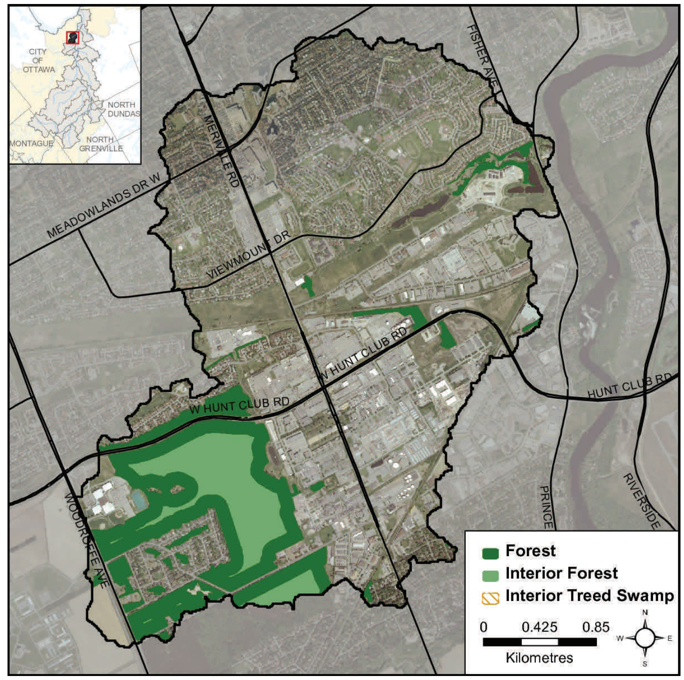


Figure 34. Catchment woodland cover and forest interior

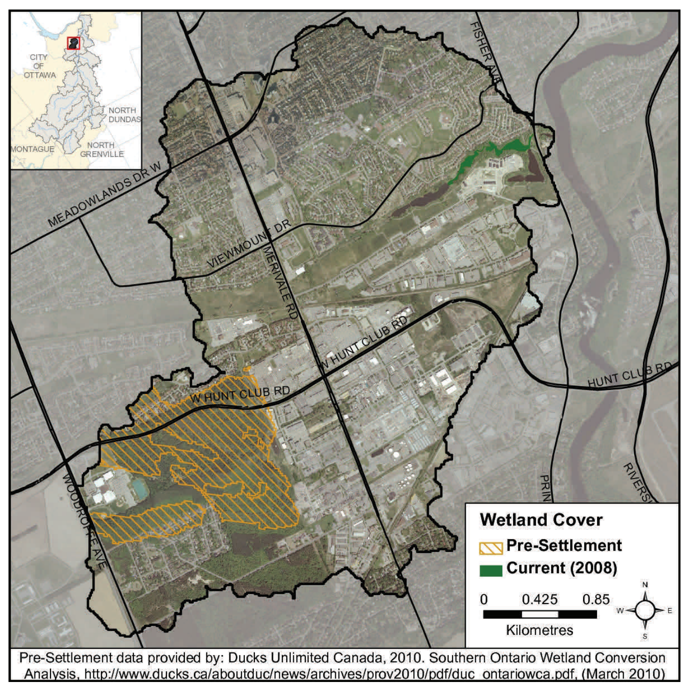


Figure 35. Pre-settlement and present day wetland cover

4) Protection

Valley, Stream, Wetland and Hazard Land Regulation Limit and Source Water Protection Zones

Less than one square kilometre of the catchment drainage area is within the regulation limit of Ontario Regulation 174/06 (Fig.36), 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 200 metres of streams (representing three percent of all streams in the catchment).

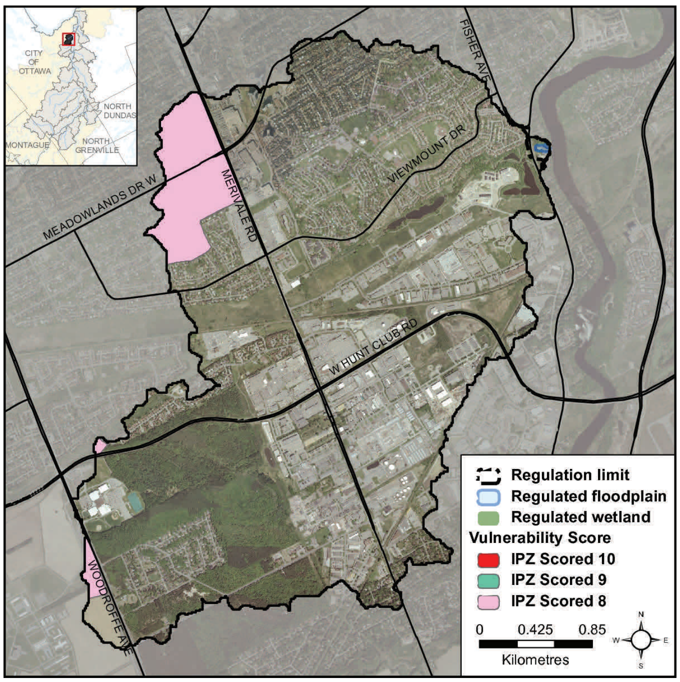


Figure 36. RVCA regulation limits and intake protection zones

Plotting of the regulation limit on the remaining 5.4 km (or 97 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.

Also within the catchment drainage area is the Intake Protection Zone for the Britannia Water Purification Plant. Zones where new policies will give protection to local municipal drinking water are shown in Figure 36 (zones scored eight to ten). Please refer to the Mississippi-Rideau Source Protection Plan at www.mrsourcewater.ca to see what activities are regulated in these areas.

5) Issues

- Marginal slope stability
- Minor erosion and meandering in the remnant creek valley
- Floodplain mapping not available
- Limited public access to the creek corridor for recreational use
- Loss of headwater tributaries due to urban drainage practices
- Removal of natural riparian vegetation
- Altered hydrology causing in-stream erosion and loss of aquatic habitat
- Reduced biodiversity
- Increased presence and abundance of invasive species
- Nutrient, metal and few E.coli exceedances observed in water samples taken

6) Opportunities for Action

- Improve access to the corridor for public use and recreation
- Apply adequate development setbacks to avoid risk associated with marginal slope stability and to improve the functionality of the riparian corridor
- Engage community associations and other groups for creek cleanup, invasive species removal and riparian planting
- 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 Nepean Creek riparian corridor
- Add an Ontario Benthos Biomonitoring Network site to monitor stream health from a biological perspective