



Rideau Lakes Subwatershed Report 2014

BLACK LAKE CATCHMENT



The RVCA produces individual reports for eight catchments in the Rideau Lakes 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 Black Lake 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 Rideau Lakes catchments and the *Rideau Lakes Subwatershed Report*, please visit the RVCA website at www.rvca.ca.

What's Inside

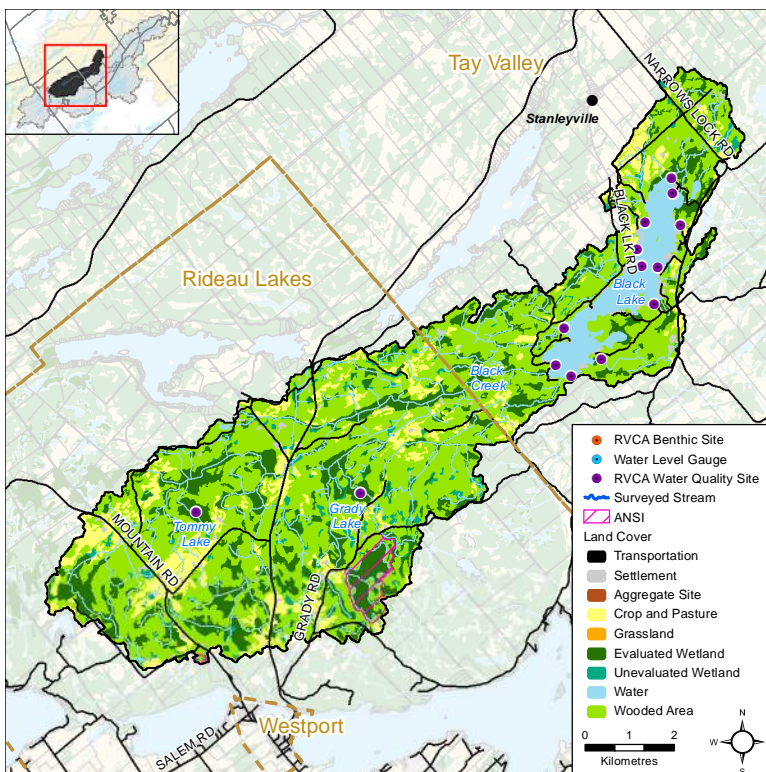
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Catchment Facts

General Geography

- The Rideau Lakes are a very popular seasonal tourist and residential destination because of its diverse natural amenity, cultural history associated with the Rideau Waterway, close proximity to a number of large cities and towns and ease of access via the Rideau Canal. Residents and vacationers flock to the Rideau Lakes in the summer to take advantage of its natural

- heritage and recreational opportunities such as boating, fishing and swimming. Cottages, houses, campgrounds, B&Bs and marinas now stretch extensively along the shoreline that was once largely untouched, putting pressure on the natural resources that support the Rideau Lakes many uses and users
- Black Lake catchment is within the Frontenac Arch Biosphere Reserve (Frontenac Axis), an important intra-regional landscape feature, which supports a wide variety of species and their movements between Algonquin Park in Central Ontario and Adirondack Park in Upper New York State



Physical Geography

- The Black Lake catchment and the majority of the Rideau Lakes subwatershed resides within the Algonquin Highlands, which is an ancient (Precambrian) hilly area made up of thin and variable glacial deposits overlying igneous and metamorphic rock ridges and knolls. Here, these rocks are granitic gneisses with smaller areas of marble. The sediment overlying the bedrock is generally thin and composed primarily of mixed glacial sediment often referred to as drift. Organic deposits are also found within the catchment where bogs, swamps and marshes are situated
- Sixty-seven percent of the catchment lies within the Township of Rideau Lakes and 33 percent within Tay Valley Township
- Black Lake catchment drainage area is 67 square kilometres and occupies about 15 percent of the Rideau Lakes subwatershed and less than two percent of the Rideau Valley watershed
- Dominant land cover is woodland (55 percent) followed by wetland (24 percent), crop and pastureland (11 percent), water (six percent), settlement areas (two percent) and transportation routes (two percent)

Vulnerable Areas

- The Assessment Report developed under the Ontario *Clean Water Act* identified the catchment area as a Highly Vulnerable Aquifer

Development/Trends

- There are about 210 properties on Black Lake: approximately 80 percent are occupied seasonally, 20 percent year-round. Many of these properties have been held in ownership by the same family for generations with the average age of residents being over 60 years of age. As younger families begin to take up occupancy, there is a move towards redevelopment, where cottages are being replaced with large permanent residences on small lots. New lot development also occurs on marginal lands (steep slopes, shallow soils, narrow waterfronts, low lying poorly-drained lands) where remaining lands have been fully developed. This can put additional stress on the lake environment because large development envelopes on smaller lots leave less space for natural processes (runoff, infiltration and retention, nutrient uptake, erosion control and shading) and natural features (trees, shrubs and plants) that support a healthy lake environment. Minor variances are frequently triggered because the lots do not have sufficient area to provide for a minimum 30 metre development setback from the lake
- Land use in the catchment within the Township of Rideau Lakes is predominately Rural (RU); in Tay Valley Township, the zoning is predominately Seasonal Residential (RS) and Limited Services Residential (RLS) around Black Lake and "Rural" elsewhere

Conditions at a Glance

- Surface water quality rating in Black Lake and Tommy Lake is "Fair"
- In the Black Lake catchment, the riparian buffer (30 metres wide strip along the shoreline of all lakes and streams) is comprised of wetland (51 percent), woodland (39 percent), crop and pastureland (six percent), settlement areas (three percent) and transportation routes (one percent)
- Around Black Lake itself, the shoreline buffer is made up of woodland (47 percent), settlement areas (37 percent), wetland (14 percent), transportation routes (one percent) and crop and pastureland (one percent)
- Around Grady Lake, the shoreline buffer is made up of woodland (72 percent), wetland (18 percent), crop and pastureland (five percent) and transportation routes (five percent)
- Around Tommy Lake, the shoreline buffer is made up of woodland (89 percent), wetland (10 percent) and crop and pastureland (one percent)
- Along streams, the riparian buffer is comprised of wetland (52 percent), woodland (39 percent), crop and pastureland (seven percent), settlement areas (one percent) and transportation routes (one percent)
- Woodland cover proportion has changed/increased by three percent (199 hectares) from 2002 to 2008, due to a combination of changes in land cover/land uses and/or applied digital classification methods
- Development on Black Lake occurs on private wells (of which there are about 187 water well records in the catchment) and septic systems

Catchment Care

- RVCA has monitored surface water quality in the Black Lake catchment through its Watershed Watch Program since 2002. In 2006, the program was altered to gain consistent, year to year data for the set of lakes being monitored. In response to the 2009 Rideau Lakes Watershed Plan action to "Develop a more intensive and coordinated water quality monitoring program for the Rideau Lakes," RVCA monitors surface water quality in: Tommy Lake four times of the year at one deep point site (four samples annually); Black Lake four times of the year at one deep point site (four samples annually) and twice a year at five shoreline sites (10 samples annually) and twice at an additional six shoreline sites every fifth year (12 samples in total)

- RVCA provides septic system re-inspection at the request of the Township of Rideau Lakes (since 2007) and Tay Valley Township (since 2004)
- Township of Rideau Lakes septic system voluntary re-inspections were undertaken on 80 Black Lake properties in the catchment by the Mississippi Rideau Septic System Office. Remedial/maintenance work was advocated for 39 of those properties
- Six stewardship projects have been completed with assistance from the RVCA's Rural Clean Water and Tree Planting Programs (see Section 4 of this report for details)
- RVCA completed littoral zone mapping around Black Lake in 2013, identifying substrate type, vegetation and habitat features along with opportunities for shoreline enhancements
- The mission of the Black Lake Property Owners Association is to identify and maintain an interest in issues of broad-based concern that may impact the value of owning property abutting Black Lake, while promoting or undertaking activities that will help foster a community spirit. Association objectives include: Helping preserve and/or enhance the quality of life for all residents of Black Lake by providing a forum to collectively discuss and, if possible, resolve issues of common concern and providing a unified voice in all matters pertaining to and directly affecting Black Lake's water, shoreline, watershed and adjacent lands
- Black Lake Association issues of on-going interest include, but are not limited to the health of the environment, crime prevention, fire safety, road maintenance, safety in/on the water, noise/light pollution and development activity and monitoring the activity of and liaise with the Township of Tay Valley, the Rideau Valley Conservation Authority, government agencies and other lake associations, as appropriate to identify and/or comment on the potential impact of an issue or initiative (visit <http://blacklakeassociation.ca/>)
- A watershed model developed by the RVCA in 2009 was used to study the hydrologic function of wetlands in the Rideau Valley Watershed, including those found in the Black Lake catchment
- Two Permits to Take Water have been issued for wetland conservation projects
- Tay Valley Township and the Township of Rideau Lakes have land use planning policies and zoning provisions (on lake capacity, water setbacks, frontage and naturalized shorelines and wetland protection) and use site plan control to implement these policies and provisions. Together with RVCA, they work with landowners on a case by case basis to achieve net environmental gains (particularly with respect to shoreline vegetation protection and rehabilitation) through the use of shoreline best management practices. Collectively, the Townships and the agencies request conditions on planning approvals to ensure that development and redevelopment is appropriate for the property, impacts on neighbours are minimized (particularly on very small lots) and development setbacks for the shoreline are maximized
- Development in and adjacent to Provincially Significant Wetlands and some locally significant wetlands is subject to Ontario Regulation 174-06 (entitled "Development, Interference with Wetlands and Alterations to Shorelines and Watercourses") that protects the hydrologic function of the wetland and also protects landowners and their property from natural hazards (flooding, fluctuating water table, unstable soils) associated with them
- *Rideau Lakes Basin Carrying Capacity Study* (1992) evaluated the capacity of the Rideau Lakes to support development with respect to lake trophic state (level of phosphorus and chlorophyll a) and shoreline development. Results have been used to provide land-use planning policy direction and guidance (in the form of a site evaluation guideline) to the municipalities of Rideau Lakes and Tay Valley and the Conservation Authority. Using phosphorus as the determinant for lake capacity, the study attempted to identify how much development was

permissible to retain the “no net loss” in water quality principle (no net increase in phosphorus loading). Recommendations from it included the need to set water quality targets for each lake of concern, requiring buildings to be set no closer than 30 metres from water (with greater widths being recommended in areas with poor phosphorus retention based on soil type, slope and geological conditions), minimizing disturbance to shoreline vegetation and no alteration to the soil mantle within the protective setback area. An update to the abovementioned site evaluation guide is currently underway and is to be made available in 2015

- The shoreline of Black Lake, Grady Lake and Tommy Lake (and other catchment lakes) is held in private ownership, so that the best opportunity for shoreline restoration/enhancement rests with private landowners. RVCA offers its Shoreline Naturalization Program to landowners living in the Black Lake catchment, to assist with shoreline re-vegetation (an enhanced delivery program has been put into place in response to the *2009 Rideau Lakes Watershed Plan* action to “Increase funding for the RVCA Shoreline Naturalization Program”)



1. Surface Water Quality Conditions

Surface water quality conditions in the Black Lake catchment are monitored by the Rideau Valley Conservation Authority's (RVCA) Watershed Watch Program. Watershed Watch monitors watershed lakes to assess nutrient concentrations, water clarity, dissolved oxygen availability and pH. The locations of monitoring sites are shown in Figure 1 and Table 1.

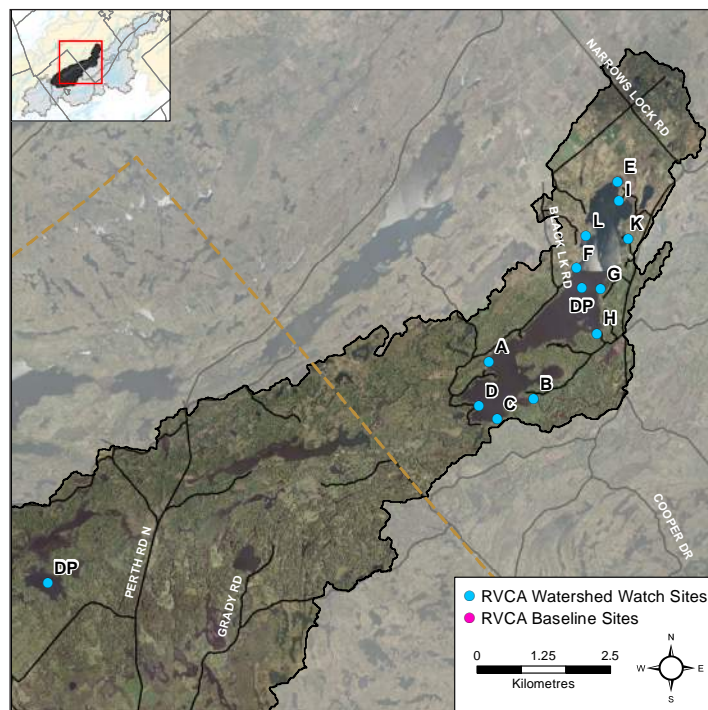


Figure 1 Water quality monitoring sites on Tommy Lake and Black Lake

Tommy Lake and Black Lake are the two waterbodies monitored in this catchment. The water quality rating is “Fair” for both lakes (Table 1) as determined by the CCME Water Quality Index. Each parameter is evaluated against established guidelines to determine water quality conditions. Those parameters that frequently exceed guidelines are presented below. There is limited data available for the majority of lakes prior to 2006, with the exception of Black Lake; therefore the 2002-2007 rating for Black Lake will also be discussed. Table 1 shows the overall rating for the monitored surface water quality sites within the Black Lake catchment and Table 2 outlines the Water Quality Index (WQI) scores and their corresponding ratings.

Table 1 Water Quality Index Ratings for Black Lake catchment

Sampling Site	Location	2002-2007	Rating
RVL-41	Tommy Lake	NA	NA
RVL-11	Black Lake	53	Poor
Sampling Site	Location	2008-2013	Rating
RVL-41	Tommy Lake	65	Fair
RVL-11	Black Lake	65	Fair

Table 2 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

1) a. Tommy Lake Water quality

Surface water quality conditions in Tommy Lake (RVL-41) have been monitored by RVCA's Watershed Watch Program since 2005. Data from the deep point site has been used to calculate the WQI rating for Tommy Lake, which was determined to be “Fair” (Table 1). Moderate nutrient concentrations, good oxygen availability, clear water and occasionally elevated pH levels contributed to the rating. The following discussion explains how each of the monitored water quality parameters contributes to the lake's water quality.

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) is used as the TP Guideline and states that in lakes, concentrations greater than 0.020 mg/l indicate an excessive amount of TP within the water column.

Total Kjeldahl nitrogen (TKN) is used as a secondary indicator of nutrient loading. RVCA uses a guideline of 0.500 mg/l to assess TKN¹ within surface waters.

At the Deep Point

One deep point site is monitored within this lake. Average nutrient concentrations are summarized in Table 3 as well as the proportion of results that meet the guideline.

Table 3 Summary of nutrient results for Tommy Lake, 2008-2013. Highlighted values indicate average concentrations exceed the guideline

Total Phosphorus 2008-2013			
Site	Average (mg/l)	Below Guideline	No. Samples
RVL-41	0.021	74%	23
Total Kjeldahl Nitrogen 2008-2013			
Site	Average (mg/l)	Below Guideline	No. Samples
RVL-41	0.416	83%	23

TP and TKN sampling results are presented in Figures 2 and 3. The majority of samples (74 percent) analyzed for TP were less than the TP guideline and the average concentration just exceeded the guideline at 0.021 mg/l (Table 3). TKN concentration were generally low with 83 percent

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

of results below the TKN guideline and an average concentration at 0.416 mg/l (Table 3). Average year to year concentrations have varied for both TP and TKN but are continually below their respective guidelines with the exception of TP in 2011 (Figure 4 and 5). Overall, the data presented indicates that moderate nutrient concentrations, particularly TP, are a feature of Tommy Lake.

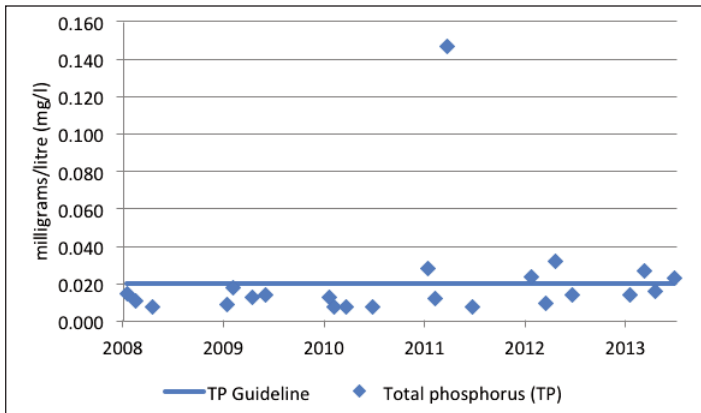


Figure 2 Total phosphorus sampling results at the deep point in Tommy Lake, 2008-2013

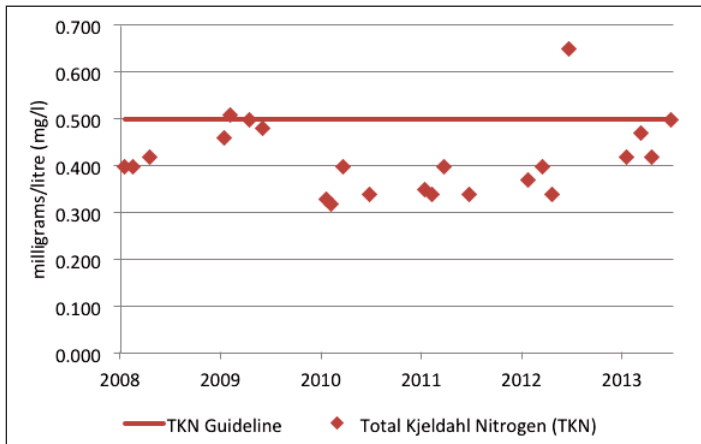


Figure 3 Total Kjeldahl nitrogen sampling results at the deep point in Tommy Lake, 2008-2013

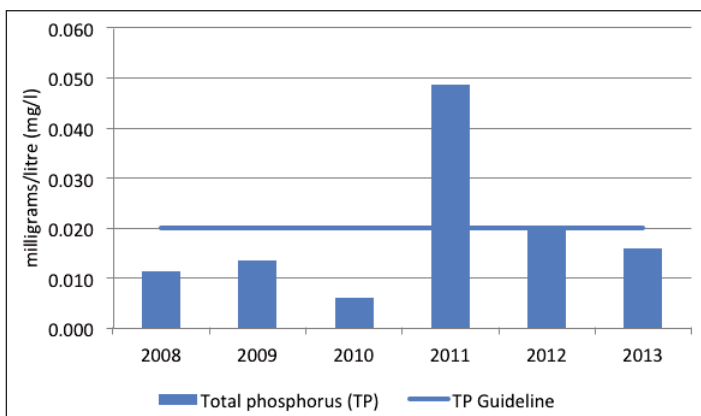


Figure 4 Average total phosphorus at the deep point in Tommy Lake, 2008-2013

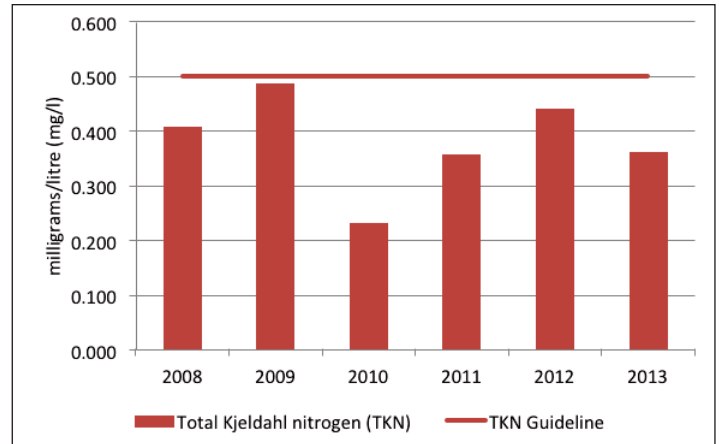


Figure 5 Average total Kjeldahl nitrogen at the deep point in Tommy Lake, 2008-2013

Summary

There is very little development around the lake and what does exist is isolated to the south shore. There is a small wetland that does drain to the lake which may be the source of some nutrient inputs, particularly during periods of high flows. Aging of the lake can be slowed with the help of all catchment residents by reducing nutrient inputs through practices such as proper maintenance of septic systems, keeping shorelines natural, minimizing runoff and using phosphate free soaps and detergents.

Water Clarity

Water clarity is measured using a Secchi disk during each deep point sample. Table 4 summarizes the recorded depths and shows that all readings have exceeded the minimum PWQO of 2 metres indicating good water clarity; the average Secchi depth is 5.4 metres Figure 8 shows that no individual reading has been below the guideline and measured depths range from 2.25 to 9 metres In many cases around the watershed; water clarity has been influenced by the colonization of zebra mussels; however, at this time there is no evidence of an established population in Tommy Lake.

Table 4 Summary of Secchi depths recorded at the deep point in Tommy Lake, 2008-2013

Secchi depth 2008-2013			
Site	Average (m)	Above Guideline	No. Samples
RVL-41	5.4	100%	18

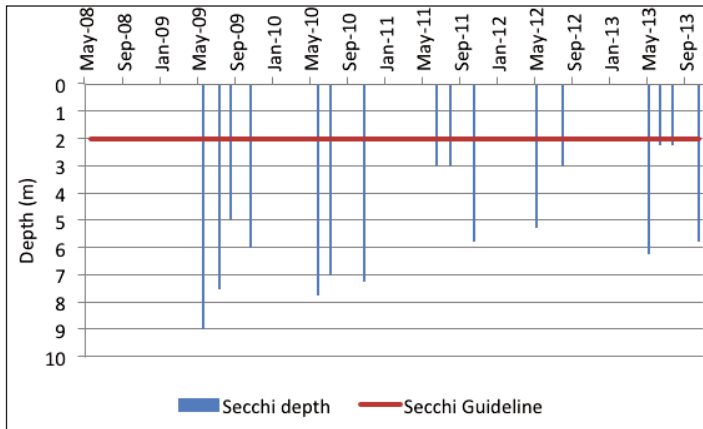


Figure 6 Recorded Secchi depths at the deep point site in Tommy Lake, 2008-2013

Summary

This data indicates that waters are clear and adequate sunlight is able to penetrate the water column to support aquatic life and provide sufficient visibility for safe recreational use (boating, swimming).

Fish Habitat

Two other factors, dissolved oxygen/temperature and pH were also assessed to provide an overall sense of the health of Tommy Lake from a fish habitat perspective.

Dissolved Oxygen and Temperature

The red bars in Figure 7 show the depths where suitable conditions exist for warm water fish species (temperature less than 25°C and dissolved oxygen greater than 4 mg/l) at the monitored point. The vertical axis represents the total lake depth at each site where the profile is taken. Suitable oxygen and temperatures exist over an average depth of 10 metres.

There is some evidence of a reduction of suitable habitat conditions in the summer-early fall due to limited oxygen availability (Figure 7).

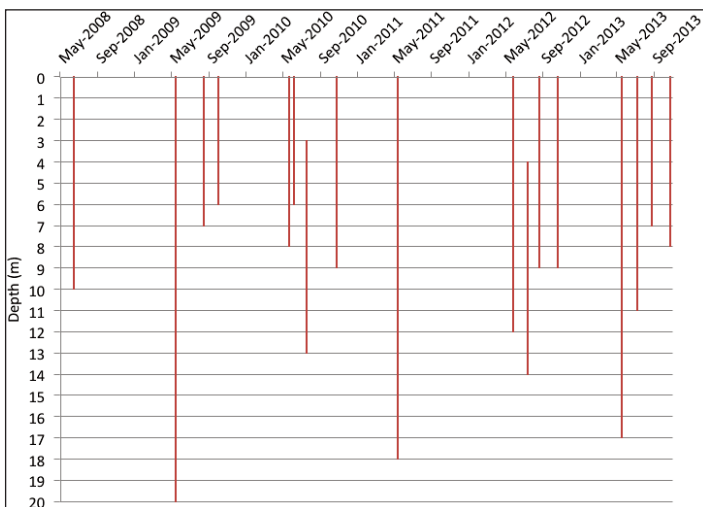


Figure 7 Depths suitable for warm water fish species at the deep point in Tommy Lake, 2008-2013

pH

pH is a basic water quality parameter used to assess the acidity of water, an important factor for aquatic life. Figure 8 shows pH concentrations in Tommy Lake and Figure 9 summarizes average concentrations by year.

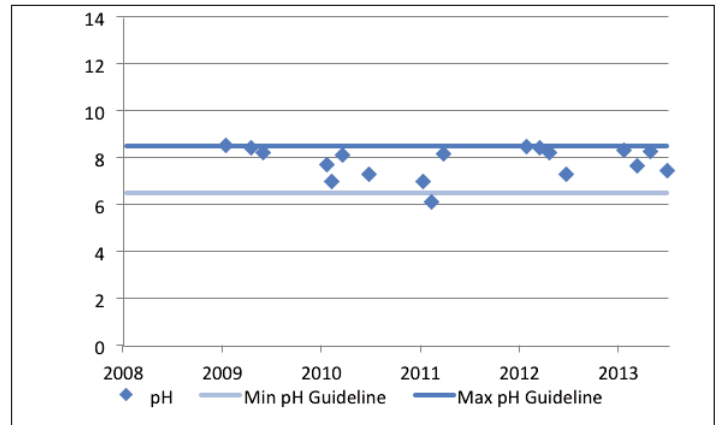


Figure 8 pH concentrations at the deep point in Tommy Lake, 2008-2013

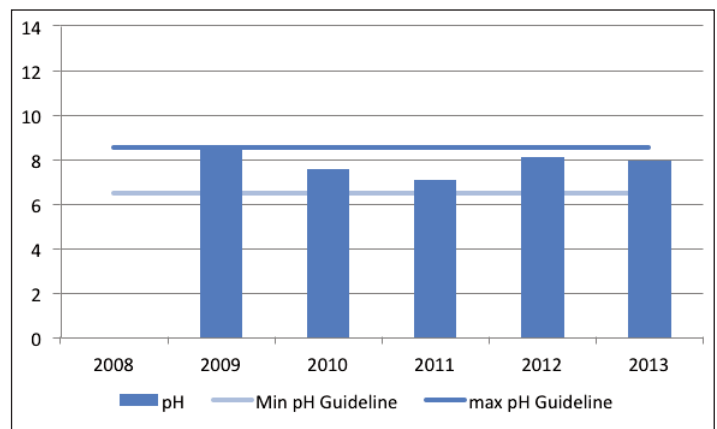


Figure 9 Average pH concentrations at the deep point in Tommy Lake, 2008-2013

Eighty-three percent of samples (Table 5) were within guidelines established by the PWQO which state that pH should be between 6.5 and 8.5 to protect aquatic life and prevent irritation for anyone using the waters for recreational purposes.

Table 5 Summary of pH results for the deep point site in Tommy Lake, 2008-2013

Secchi depth 2008-2013			
Site	Average (m)	Within Guideline	No. Samples
RVL-41	7.8	83%	18

In some areas of the Rideau Lakes subwatershed, surface waters tend to be more alkaline (higher pH) which can generally be attributed to geology rather than anthropogenic activities; biological activities such as photosynthesis may also affect pH.

Summary

Overall the water chemistry data at the deep point describes good habitat conditions for warm water fish species such as pickerel, bass and pike. The warming of the water column in summer months may limit the amount of habitat available and cause stress to some aquatic communities. pH conditions are generally within the range recommended for the protection of aquatic life, indicating a healthy environment for aquatic species.

1) b. Black Lake Water Quality

Surface water quality conditions in Black Lake (RVL-11) have been monitored by RVCA's Watershed Watch Program since 2002. Data from one deep point site has been used to calculate the WQI rating over two time periods which improved from "Poor" to "Fair" (Table 1). Occasional nutrient exceedances, few periods of limited oxygen conditions for fish habitat, clear water and occasionally elevated pH levels contributed to the rating. The following discussion explains how each of the monitored water quality parameters contributes to the lake's water quality.

This report also considers data from 10 additional sites that are monitored around the lake. These sites have not been included in the calculation of the CCME WQI rating as they are not monitored with the same frequency as deep point sites. However, they do provide important information on water quality conditions in the near shore areas. For locations of shoreline sites please see Figure 1.

The 2002 *Black Lake State of the Lake Environment Report* (Rideau Valley Conservation Authority, 2004) noted that Black Lake had a moderate concentration of nutrients and suitable fish habitat was available based on oxygen and temperature data. The data presented in this report indicates that this continues to be the case and that a proactive cautionary program of best management practices is important to ensure the protection of the lake environment.

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) is used as the TP Guideline and states that in lakes, concentrations greater than 0.020 mg/l indicate an excessive amount of TP within the water column.

Total Kjeldahl nitrogen (TKN) is used as a secondary indicator of nutrient loading. RVCA uses a guideline of 0.500 mg/l to assess TKN² within surface waters.

At the Deep Point

One deep point site is monitored on the lake. Average nutrient concentrations at this site are summarized in Table 6 as well as the proportion of results that meet the guideline.

Table 6 Summary of nutrient results for Black Lake over two monitoring periods (2002-2007 and 2008-2013)

Total Phosphorus 2002-2007			
Site	Average (mg/l)	Below Guideline	No. Samples
RVL-11	0.016	90%	29
Total Phosphorus 2008-2013			
Site	Average (mg/l)	Below Guideline	No. Samples
RVL-11	0.012	91%	23
Total Kjeldahl Nitrogen 2002-2007			
Site	Average (mg/l)	Below Guideline	No. Samples
RVL-11	0.471	62%	29
Total Kjeldahl Nitrogen 2008-2013			
Site	Average (mg/l)	Below Guideline	No. Samples
RVL-11	0.386	100%	23

TP and TKN sampling results are presented in Figures 10 to 13. In the 2002 to 2007 period, 90 percent of samples analyzed for TP were less than the TP guideline and stayed consistent at 91 percent in 2008 to 2013. The average concentration decreased from 0.016 mg/l to 0.012 mg/l. TKN concentrations were fairly minimal; 62 percent of reported results were below the TKN guideline in the first period (2002-2007); this improved to 100 percent of samples in the 2008 to 2013 period. The average concentration declined from 0.471 mg/l to 0.386 mg/l. (Table 6).

Average year to year concentrations have varied for both TP and TKN (Figures 14-17) and provide evidence of a decline in concentrations from 2002 to 2007 and 2008 to 2013. All average results are below guidelines with the exception of TP in 2011. Overall, the data presented indicates that nutrient concentrations may be considered low to moderate in the mid-lake, deep water site on Black Lake.

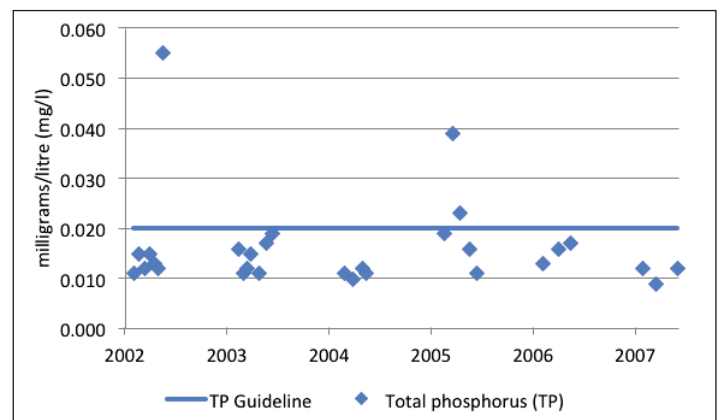


Figure 10 Total phosphorus sampling results at the deep point in Black Lake, 2002-2007

² 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

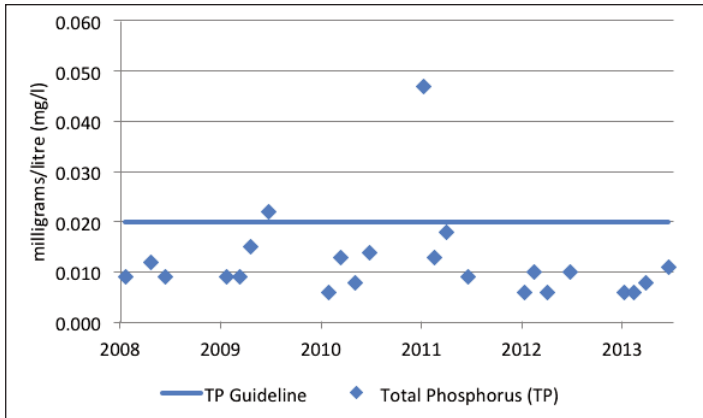


Figure 11 Total phosphorus sampling results at the deep point in Black Lake, 2008-2013

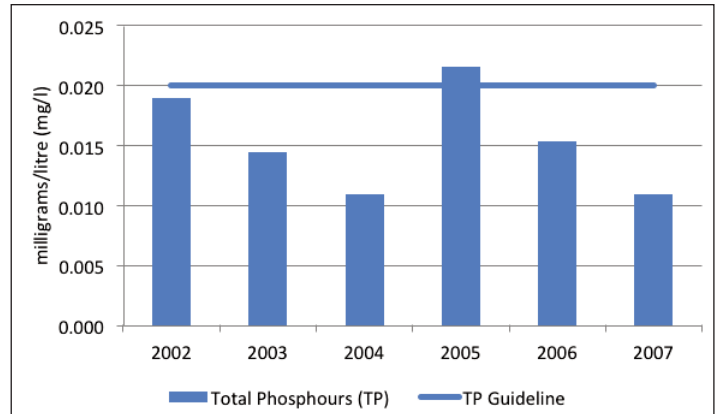


Figure 14 Average total phosphorus at the deep point in Black Lake, 2002-2007

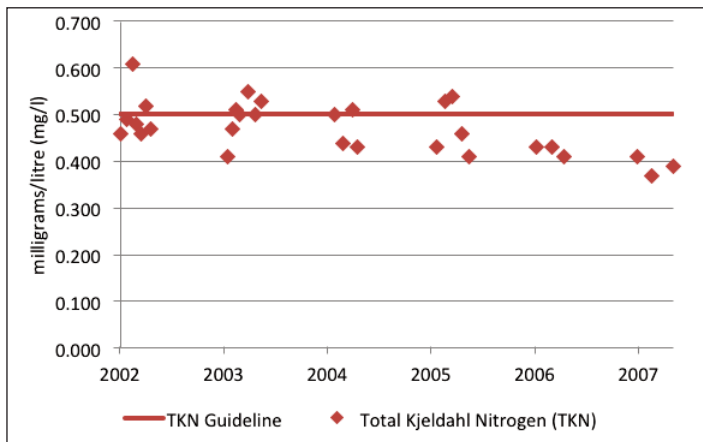


Figure 12 Total Kjeldahl nitrogen sampling results at the deep point in Black Lake, 2002-2007

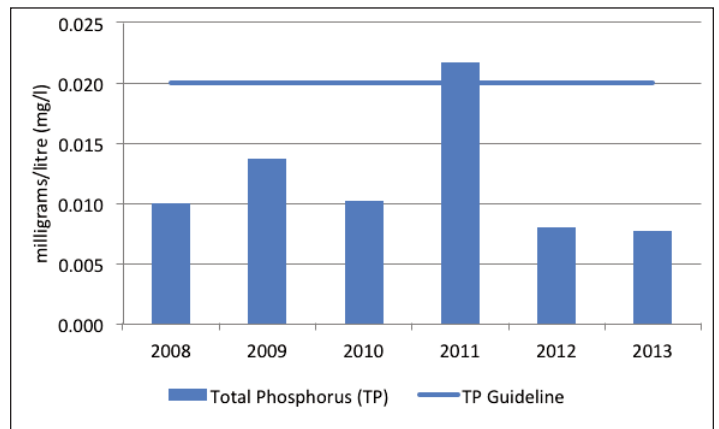


Figure 15 Average total phosphorus at the deep point in Black Lake, 2008-2013

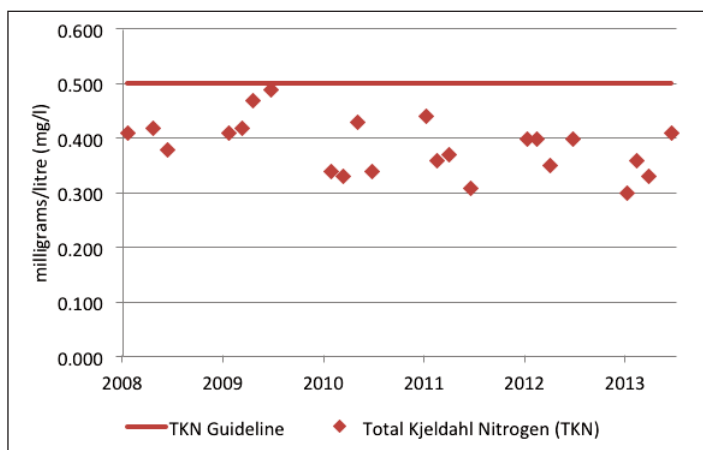


Figure 13 Total Kjeldahl nitrogen sampling results at the deep point in Black Lake, 2008-2013

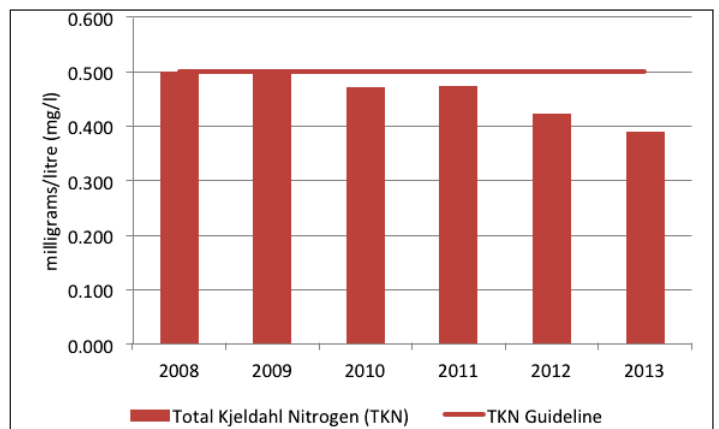


Figure 16 Average total Kjeldahl nitrogen at the deep point in Black Lake, 2002-2007

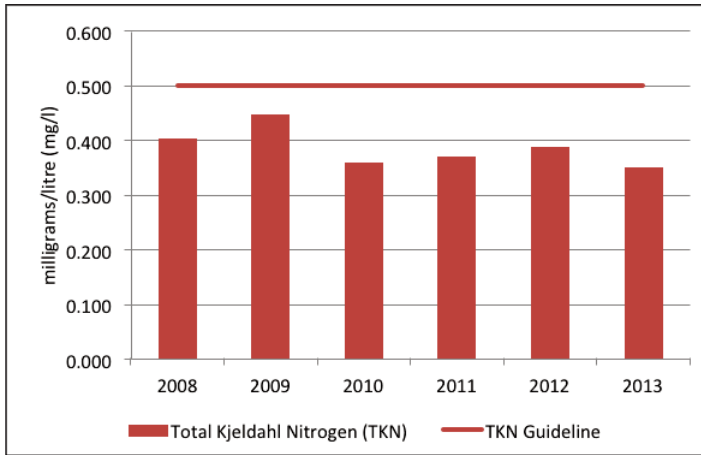


Figure 17 Average total Kjeldahl nitrogen at the deep point in Black Lake, 2008-2013

Around the Lake

The average nutrient concentrations at monitored sites around the lake vary from year to year (Figures 18-21). Please note that sites A, F, H, K and L are monitored each year while other sites (B, C, D, E, G and I) are monitored every fifth year.

Average total phosphorous concentrations are below the TP guideline at all sites with the exception of site A and site E in 2012 (Figure 19), indicating nutrient enrichment does not appear to be a problem in the monitored near shore areas. Elevated TP and TKN concentrations at this site have been previously attributed to inflow from Black Creek (2002 Black Lake State of the Lake Environment Report. Rideau Valley Conservation Authority, 2004).

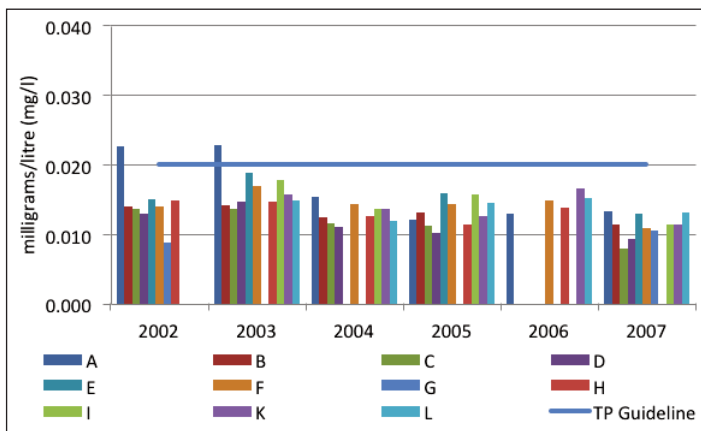


Figure 18 Average total phosphorus concentration at additional monitoring sites on Black Lake, 2002-2007

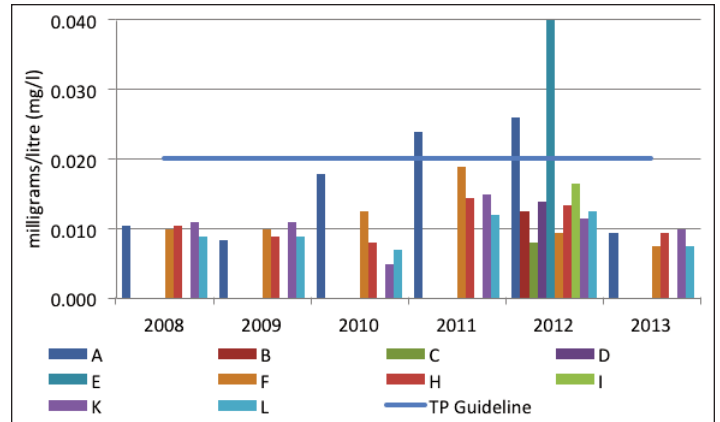


Figure 19 Average total phosphorus concentration at additional monitoring sites on Black Lake, 2008-2013

TKN concentrations were also below the guideline at the majority of sites; in some years elevated results are observed at sites A, F and E. In comparing Figures 20 and 21 it would appear that there has been a decline in concentrations since 2005. These results provide further support that nutrient enrichment is limited along the shoreline.

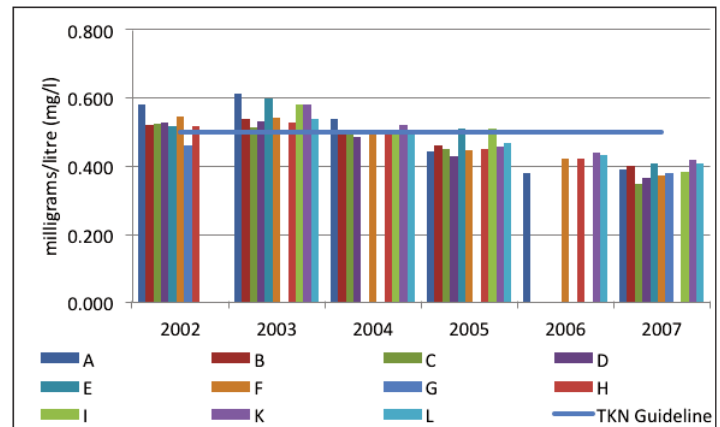


Figure 20 Average total Kjeldahl nitrogen concentration at additional monitoring sites on Black Lake, 2002-2007

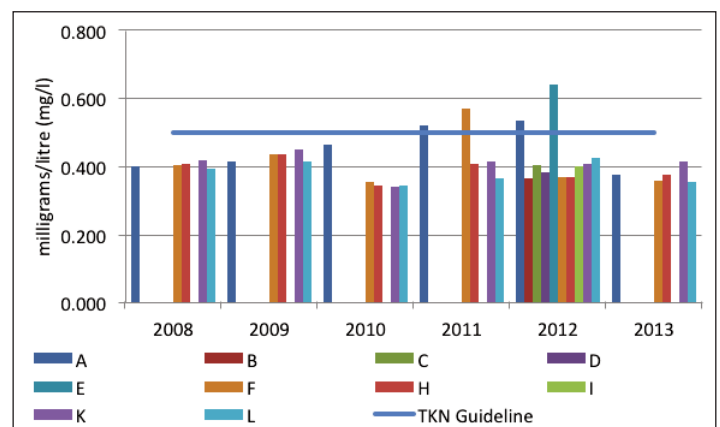


Figure 21 Average total Kjeldahl nitrogen concentration at additional monitoring sites on Black Lake, 2008-2013

Summary

Within Black Lake nutrient concentrations generally meet guidelines. Average TP concentrations (Table 6) are comparable to the 2002 Black Lake State of the Lake Environment Report (Rideau Valley Conservation Authority, 2004) which reported TP concentrations of about 0.012 mg/l.

Efforts such as the diversion of runoff and enhanced shoreline buffers are important to continue to protect and enhance water quality and reduce the frequency of nutrient exceedances. Nutrient exceedances may be partially attributed to the natural aging of a lake and its basin characteristics. The lake is fairly shallow; the shallow basin and organic rich soils make internal loading of nutrients possible if oxygen becomes depleted from the deep waters. All residents can help reduce their impact on the lake by reducing nutrient inputs through practices such as proper maintenance of septic systems, keeping shorelines natural and using phosphate free soaps and detergents.

Water Clarity

Water clarity is measured using a Secchi disk during each deep point sample. Table 7 summarizes the recorded depths and shows that all readings have exceeded the minimum PWQO of 2 metres indicating good water clarity; the average Secchi depth increased from 4.7 metres (2002-2007) to 5.8 metres (2008-2013). Figures 22 and 23 show that no individual reading has been below the guideline and measured depths range from 2.5 metres (Figure 23) to 8.32 metres (Figure 22). It should be noted that Secchi depths in many waterbodies have been influenced by the colonization of zebra mussels resulting in clearer waters than may have been seen prior to the introduction of this species; zebra mussels have been reported in Black Lake since 2010.

Table 7 Summary of Secchi depths recorded at the deep point in Black Lake, 2002-2007 and 2008-2013

Secchi depth 2002-2007			
Site	Average (m)	Above Guideline	No. Samples
RVL-11	4.7	100%	22
Secchi depth 2008-2013			
Site	Average (m)	Above Guideline	No. Samples
RVL-11	5.8	100%	20

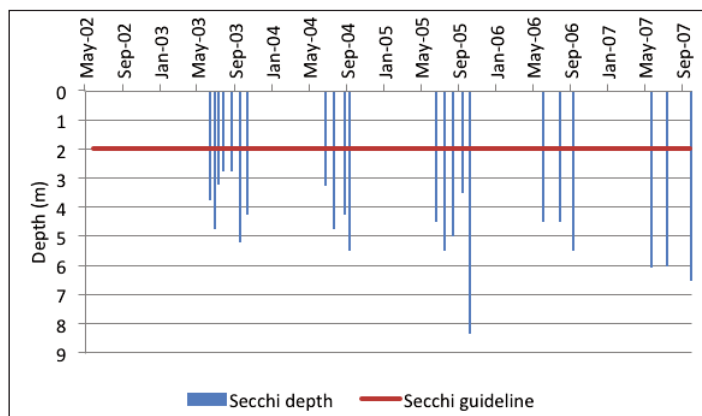


Figure 22 Recorded Secchi depths at the deep point in Black Lake, 2002-2007

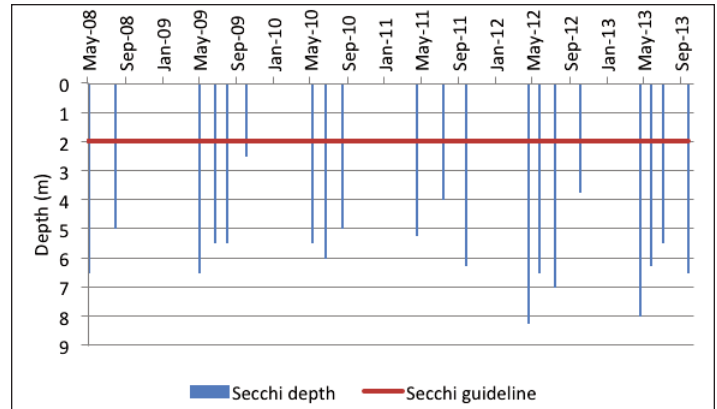


Figure 23 Recorded Secchi depths at the deep point on Black Lake, 2008-2013

Summary

This data indicates that waters are very clear and sufficient sunlight is able to penetrate the water column to support aquatic life and provide sufficient visibility for safe recreational use (boating, swimming). The 2002 Black Lake State of the Lake Environment Report (Rideau Valley Conservation Authority, 2004) reported Secchi depths between 3 and 4.9 metres; the increase in water clarity can likely be attributed to zebra mussels which are known to be in the lake.

Fish Habitat

Two other factors, dissolved oxygen/temperature and pH were also assessed to provide an overall sense of the health of Black Lake from a fish habitat perspective.

Dissolved Oxygen and Temperature

The red bars in Figures 24 and 25 show the depths where suitable conditions exist for warm water fish species (temperature less than 25°C and dissolved oxygen greater than 4 mg/l) at the monitored deep point. The vertical axis represents the total lake depth at each site where the profile is taken. Suitable habitat conditions increased over the two time periods from an average from 6 metres (Figure 24) to 10 metres (Figure 25).

There are typically good conditions for fish habitat, but as temperatures warm throughout the summer available habitat becomes very limited in some years; this is due to warming of surface waters and/or the depletion of oxygen at the deeper depths.

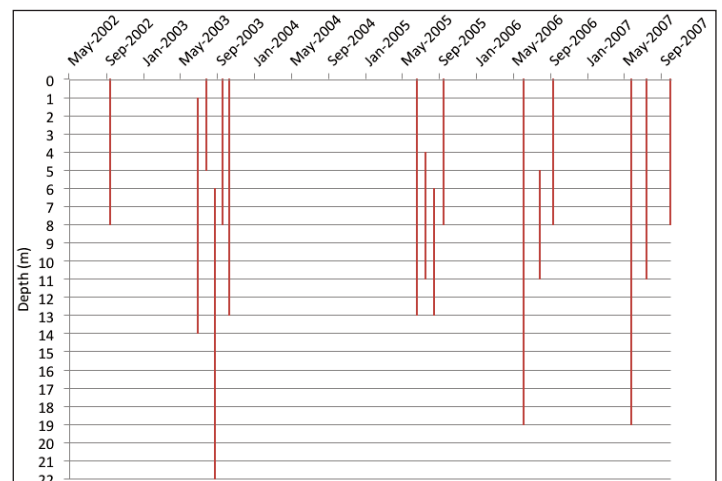


Figure 24 Depths suitable for warm water fish at the deep point in Black Lake, 2002-2007

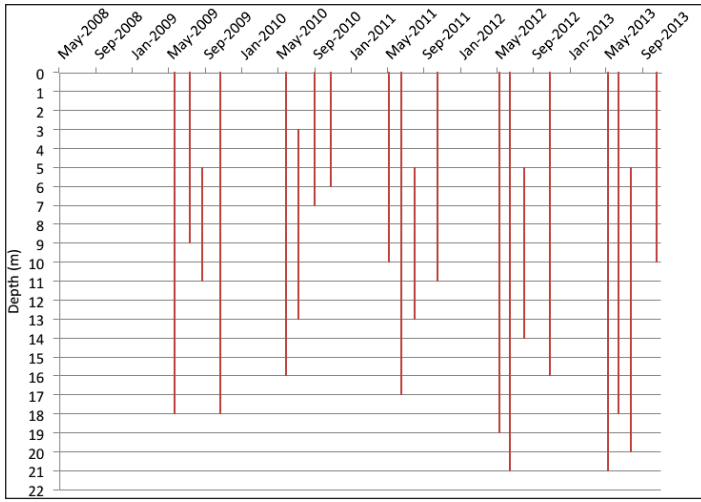


Figure 25 Depths suitable for warm water fish at the deep point in Black Lake, 2008-2013

pH

pH is a basic water quality parameter used to assess the acidity of water, an important factor for aquatic life. Figures 26 and 27 show pH concentrations in Black Lake while Figures 28 and 29 summarize average concentrations by year.

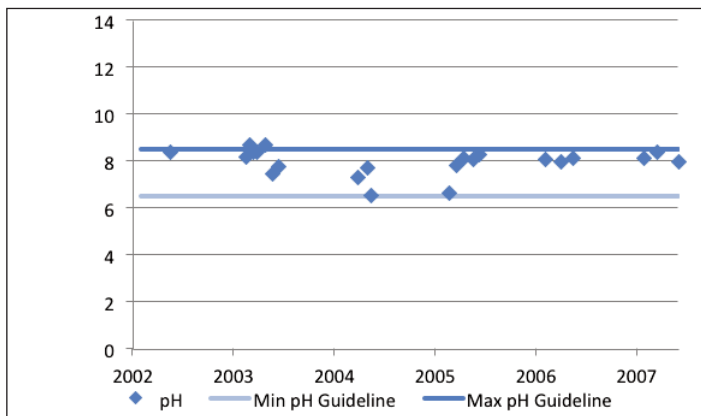


Figure 26 pH concentration at the deep point in Black Lake, 2002-2007

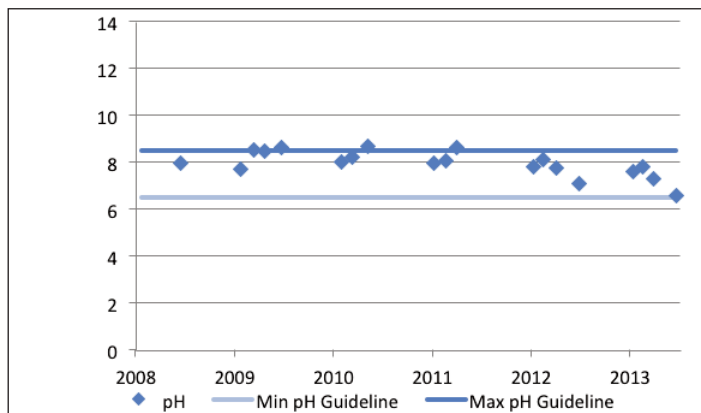


Figure 27 pH concentration at the deep point in Black Lake, 2008-2013

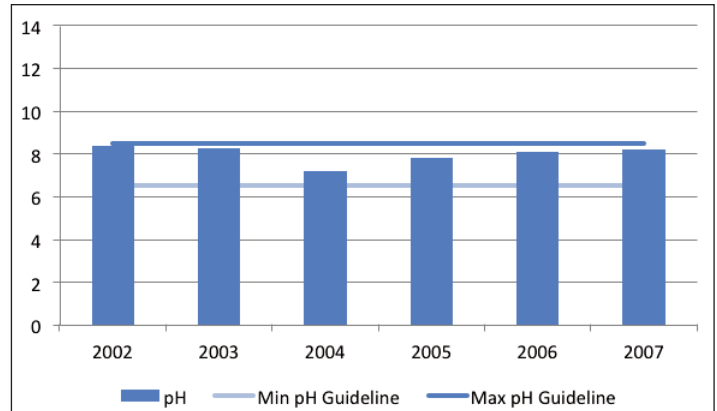


Figure 28 Average pH concentration at the deep point in Black Lake, 2002-2007

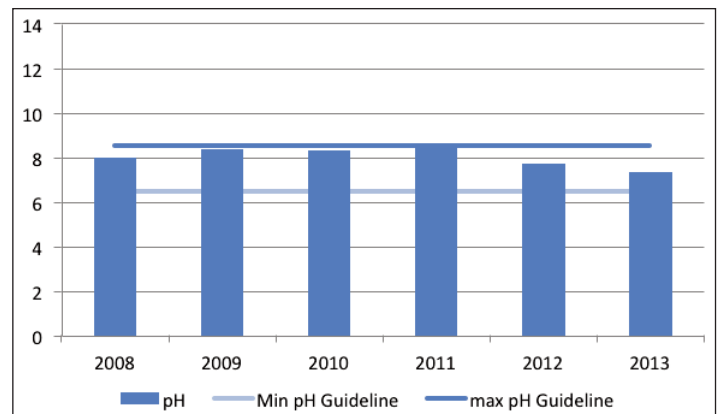


Figure 29 Average pH concentration at the deep point in Black Lake, 2008-2013

The majority of samples for both time periods were within guidelines established by the PWQO which state that pH should be between 6.5 and 8.5 to protect aquatic life and prevent irritation for anyone using the waters for recreational purposes (Table 8). Average results border on the upper limit of the guideline and did not change between either period indicating that elevated pH is a feature of this lake.

Table 8 Summary of pH results for the deep point in Black Lake, 2002-2007 and 2008-2013

pH 2002-2007			
Site	Average	Within Guideline	No. Samples
RVL-11	8.0	91%	22
pH 2008-2013			
Site	Average	Within Guideline	No. Samples
RVL-11	8.0	74%	19

In some areas of the Rideau Lakes subwatershed, surface waters tend to be more alkaline (higher pH) which can generally be attributed to geology rather than anthropogenic activities; biological activities such as photosynthesis may also affect pH.

Summary

Overall the water chemistry data at the deep point describes suitable habitat conditions for warm water fish species. There is some evidence that the warming of the water column in the mid-summer may limit the amount of habitat for some sensitive species. pH conditions are typically on the upper end of the range recommended for the protection of aquatic life. Overall, the data indicates a healthy environment for aquatic species.

E. coli

E. coli is sampled at monitored shoreline sites twice each sampling season. *E. coli* data was not used in the calculations of the WQI rating for the lake due to differences in sampling frequency and site locations. In the first monitoring period (2002-2007) all samples were below the *E. coli* guideline of 100 colony forming units (CFU) per 100 ml set by the PWQO; across the lake the count at the geometric mean³ was only 4 CFU/100ml (Table 9). In the following period 94 percent of samples were below the guideline and the count at the geometric mean was 6 CFU/100 ml.

Table 9 Summary of *E. coli* results for Black Lake, 2002-2007 and 2008-2013

E. coli 2002-2007			
Site	Geometric mean (CFU/100ml)	Below Guideline	No. Samples
RVL-11	4	100%	213
E. coli 2008-2013			
Site	Geometric mean (CFU/100ml)	Below Guideline	No. Samples
RVL-11	6	94%	65

Figures 30 and 31 show the distribution of counts across sites. Site A was identified having higher counts in the 2002 *Black Lake State of the Lake Report* (Rideau Valley Conservation Authority, 2004). This site also reported two exceedances above the PWQO in the 2008 to 2013 period. High counts at this site have been attributed to the wetland characteristics at this site, more wildlife spends time here and as a result there are higher counts associated with faecal matter.

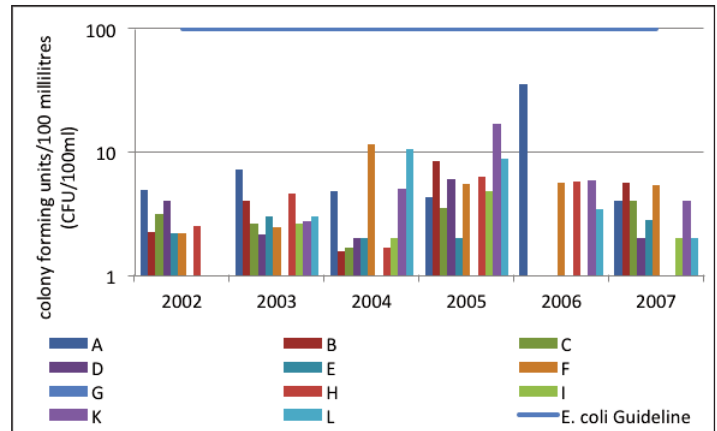


Figure 30 Geometric mean of shoreline sites monitored on Black Lake, 2002-2007

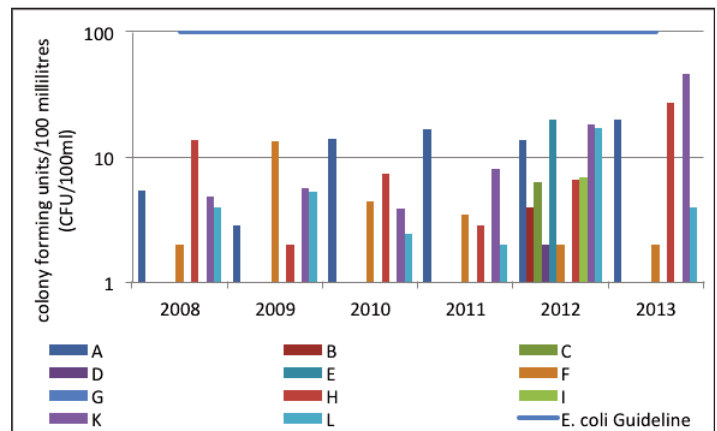


Figure 31 Geometric mean of shoreline sites monitored on Black Lake, 2008-2013

Summary

The results presented above provide evidence that bacterial contamination is not a significant concern in Black Lake and the water should be safe for recreational activities such as swimming and boating.

³ 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

2. Riparian Conditions

Shoreline Buffer Land Cover Evaluation

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 32 shows the extent of the naturally vegetated riparian zone in the catchment, 30 meters along the shoreline of waterbodies and watercourses. This analysis from the RVCA's Land Cover Classification Program (derived from 2008 DRAPE imagery) shows that the riparian buffer (30 metres wide strip) in the Black Lake catchment is comprised of wetland (51 percent), woodland (39 percent), crop and pastureland (six percent), settlement areas (three percent) and transportation routes (one percent).

Around Black Lake itself, the shoreline buffer is made up of woodland (47 percent), settlement areas (37 percent), wetland (14 percent), transportation routes (one percent) and crop and pastureland (one percent).

Around Grady Lake, the shoreline buffer is made up of woodland (72 percent), wetland (18 percent), crop and pastureland (five percent) and transportation routes (five percent).

Around Tommy Lake, the shoreline buffer is made up of woodland (89 percent), wetland (10 percent) and crop and pastureland (one percent).

Along streams, the riparian buffer is comprised of wetland (52 percent), woodland (39 percent), crop and pastureland (seven percent), settlement areas (one percent) and transportation routes (one percent).

Headwaters Drainage Features Assessment

The RVCA Stream Characterization program assessed Headwater Drainage Features for the Rideau Lakes subwatershed in 2013. This protocol measures zero, first and second order headwater drainage features (HDF). It is a rapid assessment method characterizing the amount of water, sediment transport, and storage capacity within headwater drainage features (HDF). RVCA is working with TRCA and the MNR to implement the protocol with the goal of providing standard datasets to support science development and monitoring on both the interim guideline for headwater drainage features and existing mitigation strategies. An HDF is a depression in the land that conveys surface flow. Additionally, this module provides a means of characterizing the connectivity, form and unique features associated with each HDF (OSAP Protocol, 2013). An initiative is underway to evaluate how these data can help understand the cumulative contributions of individual headwater drainage features on the downstream watershed state (see Stanfield et al., 2013). In 2013 the program sampled 17 sites in the Black Lake catchment area. Figure 33 shows the headwater drainage features sampling locations in the catchment.

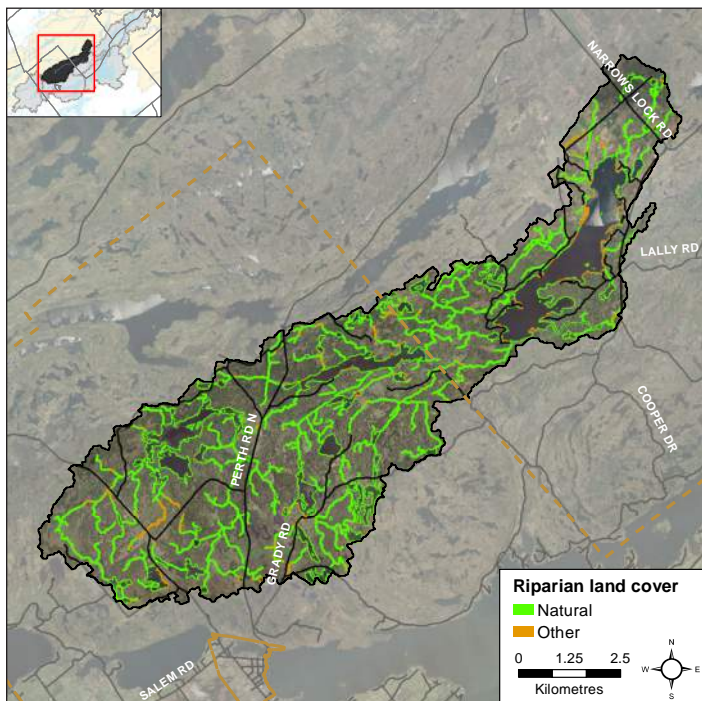


Figure 32 Natural and other riparian land cover in the Black Lake catchment

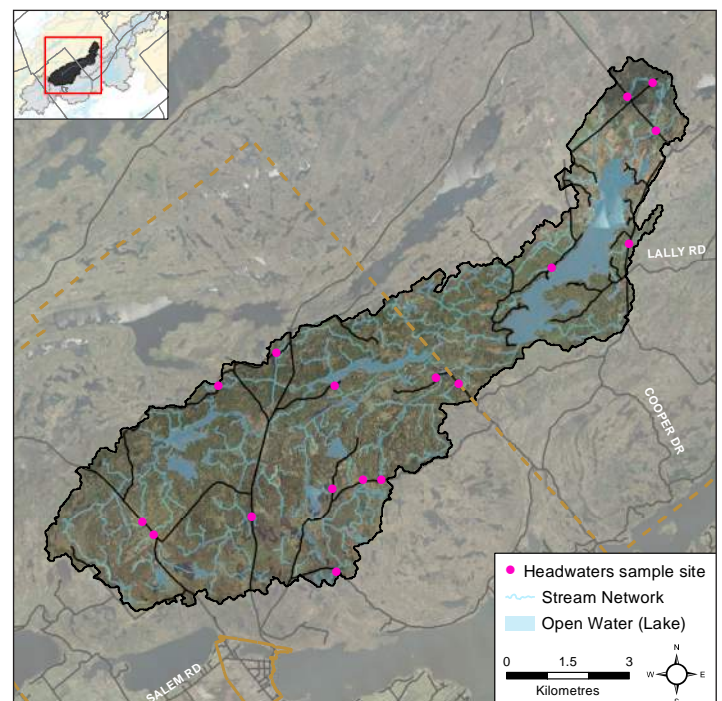


Figure 33 Headwater drainage features sampling sites in the Black Lake catchment



Two headwater drainage features sampled in the Black Lake catchment

Fisheries

The Black Lake catchment is classified as a warm/cool water recreational and baitfish fishery with 14 species observed. The following is a list of species in the watershed (Source: MNR/RVCA).

walleye
northern pike
smallmouth bass
largemouth bass
yellow perch

pumpkinseed
bluegill
black crappie
rock bass
white sucker

brown bullhead
northern redbelly dace
brook stickleback
central mudminnow



3. Land Cover

Woodland is the dominant land cover type in the catchment, as shown in Table 10 and displayed in the map on the front cover of the report.

Table 10 Catchment land cover type

Cover Type	Area (ha)	Area (% of Cover)
Woodland *	3,655	55
Wetland**	1,634	24
Crop & Pasture	753	11
Water	381	6
Settlement	123	2
Transportation	151	2

* Does not include treed swamps ** Includes treed swamps

Woodland Cover

The Black Lake catchment contains 3655 hectares of upland forest and 82 hectares of lowland forest (treed swamps) (Fig.34) that occupies 56 percent of the drainage area (versus the 44 percent of woodland cover in the Rideau Lakes 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 eleven (54 percent) of the 204 woodland patches in the catchment are very small, being less than one hectare in size. Another 71 (35 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 22 (11 percent of) woodland patches range between 21 and 1467 hectares. Fourteen 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 (four percent) of the 204 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. Three 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 204 woodlands contain 151 forest interior patches (Figure 34) that occupy five percent (370 hectares) of the catchment land area (versus the five percent of interior forest in the Rideau Lakes 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 (137) have less than 10 hectares of interior forest, 88 of which have small areas of interior forest habitat less than one hectare in size. Conversely, 14 patches contain interior forest ranging between 10 and 34 hectares in area.

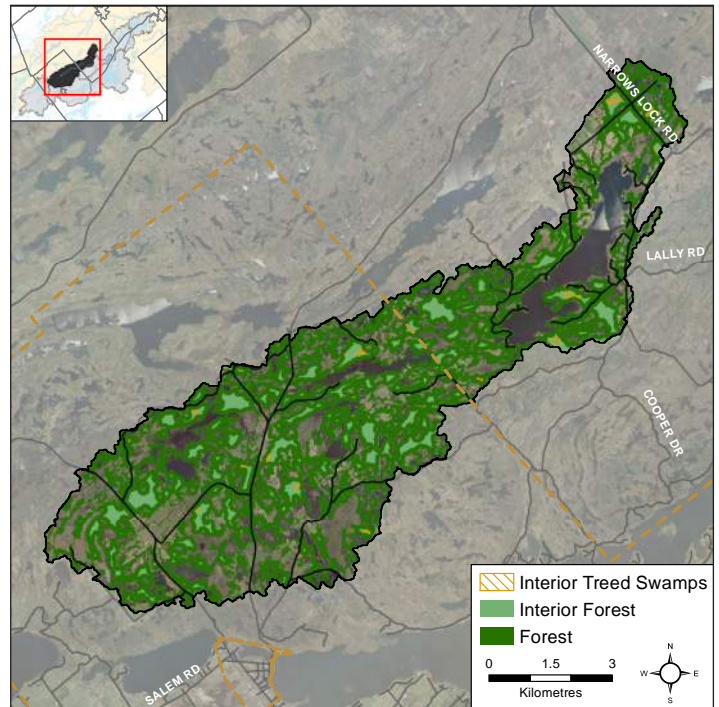


Figure 34 Catchment woodland cover and forest interior

Wetland Cover

Figure 35 shows pre-settlement wetland cover (Ducks Unlimited Canada 2010) versus current wetland cover (DRAPE 2008) in the catchment.

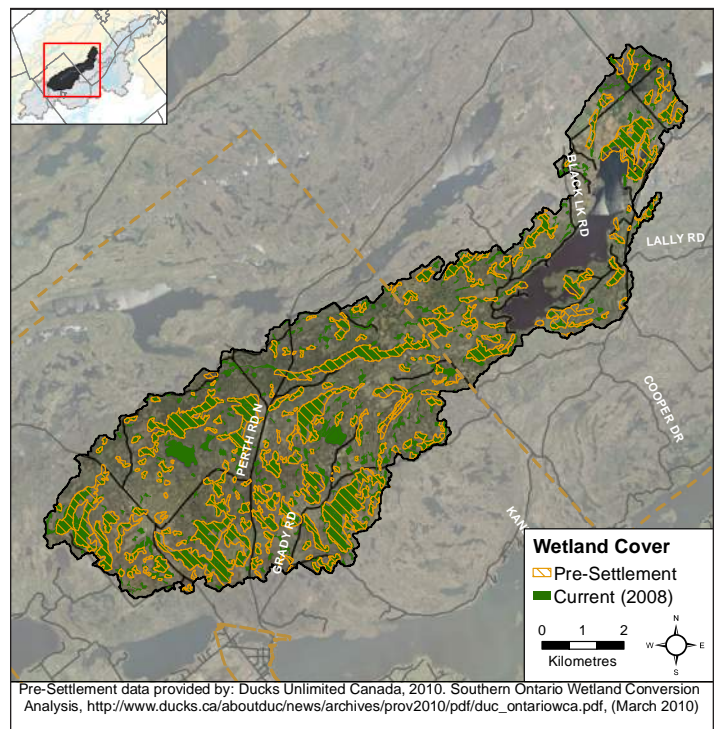


Figure 35 Catchment wetland cover

4. Stewardship and Protection

The RVCA and its partners are working to protect and enhance environmental conditions in the Rideau Lakes subwatershed.

Rural Clean Water Projects

Figure 36 shows the location of Rural Clean Water Projects in the Black Lake drainage area. From 2008 to 2013, one septic system repair was completed with the RVCA contributing \$1,000 in grant dollars towards the total project cost of \$15,320.

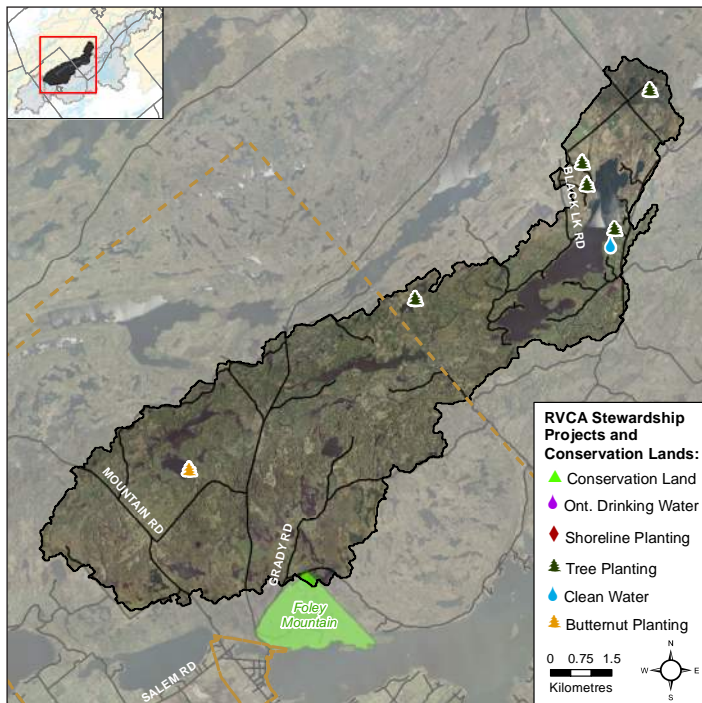


Figure 36 RVCA stewardship program project locations

Tree Planting Projects

The location of all tree planting projects is also shown in Figure 36. Prior to 2008, 55,500 trees were planted at five sites through the RVCA Tree Planting Program. Project value is \$27,830 with \$14,015 of that amount coming from other fundraising sources. No projects were undertaken between 2008 and 2013.

Septic System Re-Inspections

From 2009 to 2014, the Mississippi Rideau Septic System Office performed 80 septic system re-inspections (63 cottages and 17 houses) on Black Lake in Tay Valley Township. Remedial/maintenance work (pump outs, baffle replacement, work that generally does not require a permit) was recommended for 39 (or 49 percent) of those properties that were inspected, a septic system replacement at another property with more information provided to an additional landowner with identified septic system concerns.

Valley, Stream, Wetland and Hazard Land Regulation

Thirty-one square kilometres or 47 percent of the catchment drainage area is within the regulation limit of Ontario Regulation 174/06 (Figure 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 10.3 square kilometres of wetlands (representing 63 percent of all wetlands in the catchment) and 100.4 kilometers of streams (representing 55 percent of all streams in the catchment). Some of these regulated watercourses (75.4 km or 41 percent of all streams) flow through regulated wetlands.

Regulation limit mapping has been plotted along 25 kilometres (or 25 percent) of the streams that are outside of wetlands. Plotting of the regulation limit on the remaining 82.3 kilometres (or 45 percent) of streams requires identification of flood and erosion hazards and valley systems.

Within the regulation limit, “development” and “site alteration” require RVCA permission. The “alteration to waterways” provision of Ontario Regulation 174/06 applies to all watercourses.

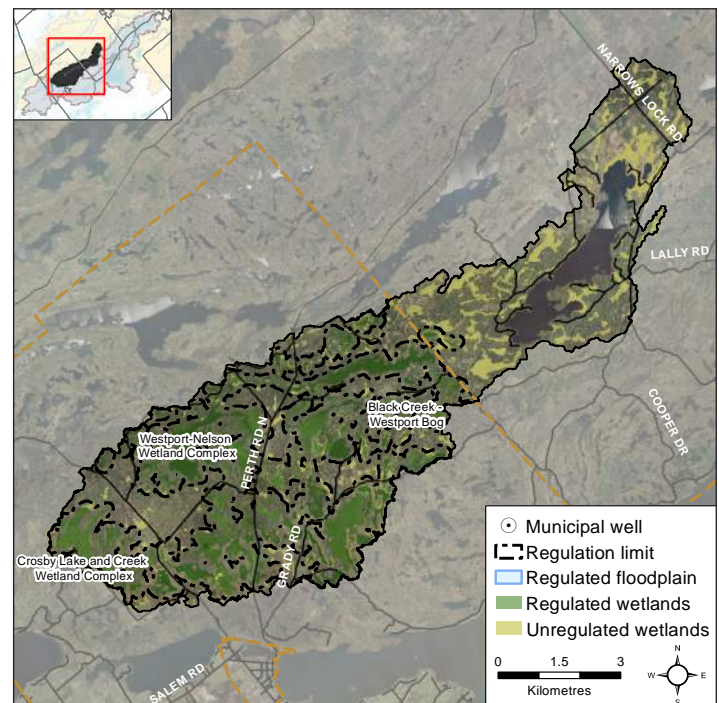


Figure 37 RVCA regulation limits

Vulnerable Drinking Water Areas

The Black Lake catchment area is considered to have a Highly Vulnerable Aquifer. This means that the nature of the overburden (thin soils, fractured bedrock) does not provide a high level of protection for the underlying groundwater making the aquifer more vulnerable to contaminants released on the surface. The Mississippi-Rideau Source Protection Plan includes policies that focus on the protection of groundwater region-wide due to the fact that most of the region, which encompasses the Mississippi and Rideau watersheds, is considered Highly Vulnerable Aquifer.

5. Issues

Water Quality

- Thirty-nine (of 80) Tay Valley Township septic system voluntary re-inspections conducted from 2009 to 2014 revealed the need for additional maintenance/remedial/replacement works to be performed on septic systems around Black Lake. Those properties with concerns are identified in the yearly report submitted by the Mississippi Rideau Septic System Office to the Township
- RVCA's 2013 Algae and Aquatic Plant Survey for Eastern Ontario Lakes and Rivers notes that a majority of the respondents in the Rideau Lakes subwatershed have noticed an increase in algae blooms and aquatic plants on their lake

Development

- Traditional cottage character of Black Lake is being slowly altered by the scale of development and the trend toward larger year-round dwellings. This transition is taking place either through re-development of an existing cottage lot or incremental alterations (additions, sleeping cabins, gazebos, decks, sheds, boat houses, garages, lawns, docks)
- Many waterfront properties contain existing non-complying dwellings with respect to minimum water frontage and lot area and are often located within 30 metres of the water that require minor variances for expansion and/or reconstruction of dwellings where standard development setbacks from water are difficult to achieve. In these cases, of which there are many, municipal staff and the Conservation Authority often meet with resistance and push back when attempts are made to implement standards for development setbacks, vegetated shorelines and septic systems
- Monitoring implementation of conditions of planning and regulatory approvals is challenging due to a lack of resources

Shorelines

- Around Black Lake, the 30 metre wide riparian, shoreline buffer contains (39 percent) non-natural land cover (comprised of waterfront cottages, homes and roads) and 61 percent natural land cover (made up of wetland and woodland), which is below the recommended 75 percent naturally vegetated riparian, shoreline buffer target
- Emerald ash borer poses a significant threat to the ecology of the subwatershed, given the prominence of ash trees along shorelines and in riparian and wetland areas. Many tree stands are predominantly ash and with their anticipated loss, it is unclear what will replace them and the overall effect of their collective demise on the physical and natural functions/values they provide for erosion, water quality and fish and wildlife habitat protection

Lake Planning

- This report outlines some issues and concerns regarding the health of the Black Lake catchment. However, there is limited knowledge of the overall issues and concerns about natural resource management, use and the health of Black Lake and its watershed
- The Black Lake community might consider working together to undergo the lake planning process. The lake planning process allows for valuable information about the current health of the lake and its watershed, as well as an overview of all the issues and concerns facing the lake to be collected together. The lake planning process requires involvement and input from the whole lake community which includes lake residents, users, businesses, municipalities, non-governmental organizations, agency partners and other stakeholders. The process ensures that the lake community's issues and concerns are gathered into one action-oriented document, which can guide the many stakeholders that care about Black Lake to help tackle lake health concerns in partnership

6. Opportunities

Water Quality

- Continue efforts to reduce pollutant loadings to Black Lake and Tommy Lake through application of shoreline, stormwater and agricultural best management practices; also consider using low impact development (LID) methods to improve the quality and reduce the amount of stormwater runoff reaching the lake ecosystem. This may be particularly beneficial in areas of high density development with extensive impervious surfaces (i.e., asphalt, concrete, buildings, and severely compacted soils) or on sensitive waterfront properties (with steep slopes/banks, shallow/impermeable soils)
- Continue to promote the protection of the water resources of Black Lake through implementation of municipal and agency land use and development policies and practices
- Continue to promote septic system re-inspections by the Mississippi Rideau Septic System Office to assess the physical condition and performance of existing septic systems
- Continue to offer septic repair/replacement project funding provided by the Rideau Valley Rural Clean Water Program to waterfront landowners
- Review monitoring of surface water quality in Black Lake along with other Rideau Lakes before the next round of the Watershed Watch monitoring cycle begins in 2016, to determine if there is a need to “develop a more intensive and coordinated water quality monitoring program for all Rideau Lakes” (an identified action in the *2009 Rideau Lakes Watershed Plan*)

Development

- Collectively work with approval authorities (Township of Rideau Lakes, Tay Valley Township, Conservation Authority, the Health Unit and Mississippi-Rideau Septic System Office) to consistently implement current land use planning and development policies for water quality and shoreline protection adjacent to lakes and streams (e.g., a minimum 30 metre development setback from water)
- Explore ways and means to more effectively enforce and implement conditions of land-use planning and development approval to achieve net environmental gains (particularly with respect to rehabilitating or protecting naturally vegetated shorelines and water quality)
- Encourage Committees of Adjustment to take advantage of technical and environmental information and recommendations forthcoming from planning and environmental professionals
- Municipal and agency planners together with development proponents are to use the 2014 Site Evaluation Guidelines⁴ to inform decision-making about the application of development setbacks on lots with shallow soils/bedrock, steep slopes and sparse vegetation cover along with the use of the appropriate, development related, best management practices
- Utilize RVCA subwatershed and catchment reports to help develop/revise official plan policies to protect surface water resources and the natural environment (including woodlands, wetlands and shoreline cover)
- Continue to promote the Mississippi Rideau Septic System Office Re-inspection Program to ensure that sewage disposal systems are functioning properly and advocate for the replacement of faulty septic systems in accordance with current Ontario Building Code standards

Shorelines

- RVCA and its partners (including the municipalities of Rideau Lakes and Tay Valley and the Black Lake Association) are to continue educating landowners about waterfront property best management practices with respect to shoreline use and development, septic system installation/maintenance and shoreline vegetation retention and enhancement
- Protect the riparian buffer along the shoreline of Black Lake, other catchment lakes and streams during the development approvals process through adherence to and enforcement of municipal land-use policies and zoning standards
- Consider an assessment of shoreline conditions around Black Lake (using the MAPLE protocol) to monitor the effect of future changes to the lake ecosystem
- Target shoreline restoration at sites identified in this report (as shown in Figure 32 as “Other” riparian cover)
- Promote the RVCA’s Shoreline Naturalization Program and other similar initiatives to enhance natural vegetation cover around Black Lake where it is lacking

Lake Planning

A Lake Plan:

- Is an action plan developed by a lake community (which includes lake residents, users, businesses, municipalities, non-governmental organizations, agency partners and other stakeholders) that identifies and preserves the natural and social characteristics that are valued by the lake community for future generations
- Helps to promote community discussion, education and action
- Sets goals and objectives for the protection and enhancement of the lake
- Recommends land use policies/practices that influence development on the lake
- Promotes stewardship actions to improve the environmental conditions of a lake so it can be enjoyed by future generations

Consider the need for a community-driven lake management plan for Black Lake that can:

- Bring the lake community together
- Engage the community beyond the lake residents and lake association members and develops partnership
- Identify and bring together common values and concerns
- Provide a baseline of data on water quality, land-use activities, shoreline development, fisheries management, etc., that can help to inform water resources management, land use planning and stewardship actions
- Range in complexity from a comprehensive living document to a simplified list of priorities that can be carried out by the lake community to protect the lake environment

⁴ Hutchinson Environmental Sciences Ltd. 2014. *Assessment of Municipal Site Evaluation Guidelines in Eastern Ontario’s Lake Country*. Prepared for: Mississippi Valley Conservation Authority, Rideau Valley Conservation Authority and Cataraqui Region Conservation Authority