The BRWP RiverWatch Program

Harris Creek

Catchment Report

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"Helping Ourselves to a Healthy Environment"

Harris Creek Catchment Report

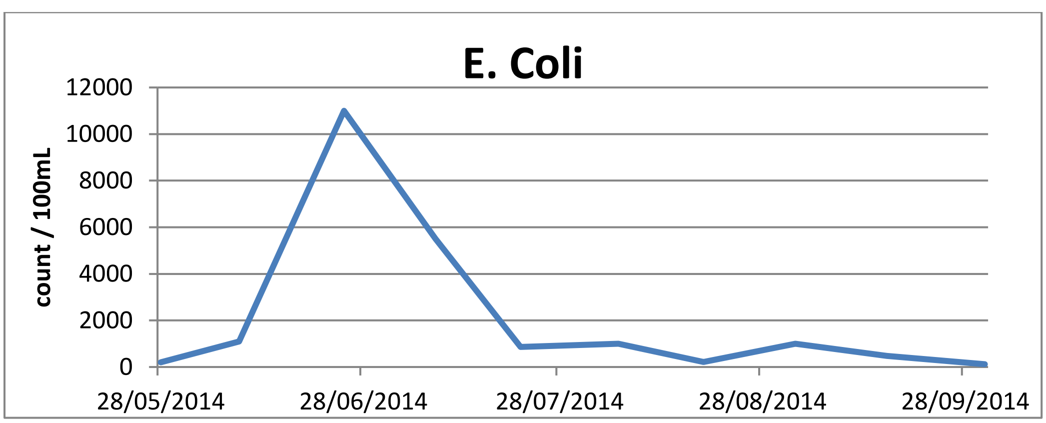
2014 analysis

Water Quality:

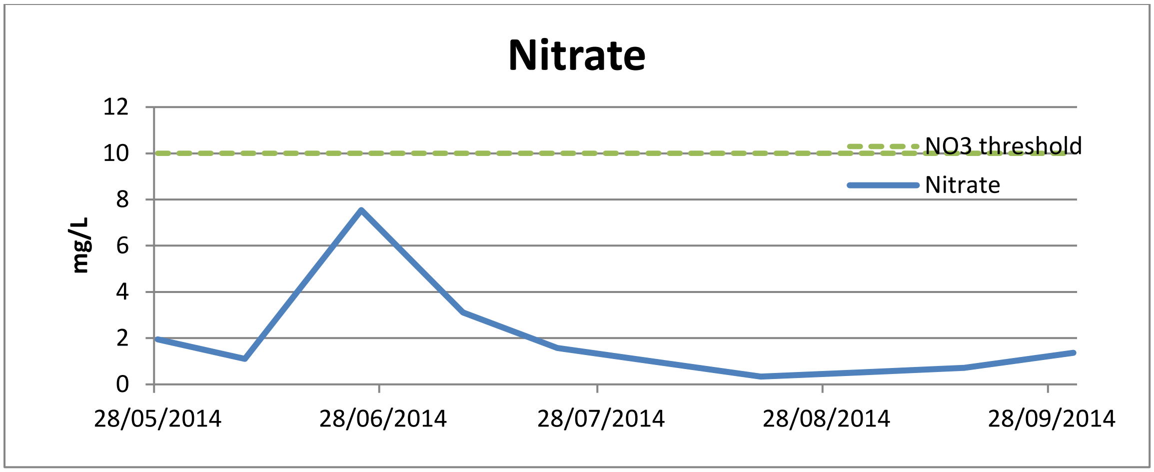
Looking at how the water quality parameters change sample –to-sample can reveal seasonal trends in environmental conditions. Harris Creek was sampled bi-weekly from late May until early October 2014. Samples were sent to a Ministry of Environment and Climate Change (MOECC) laboratory for analysis. Analysis of these samples allows us to create a time series for multiple water quality parameters, showing how water quality fluctuates as the season progresses.

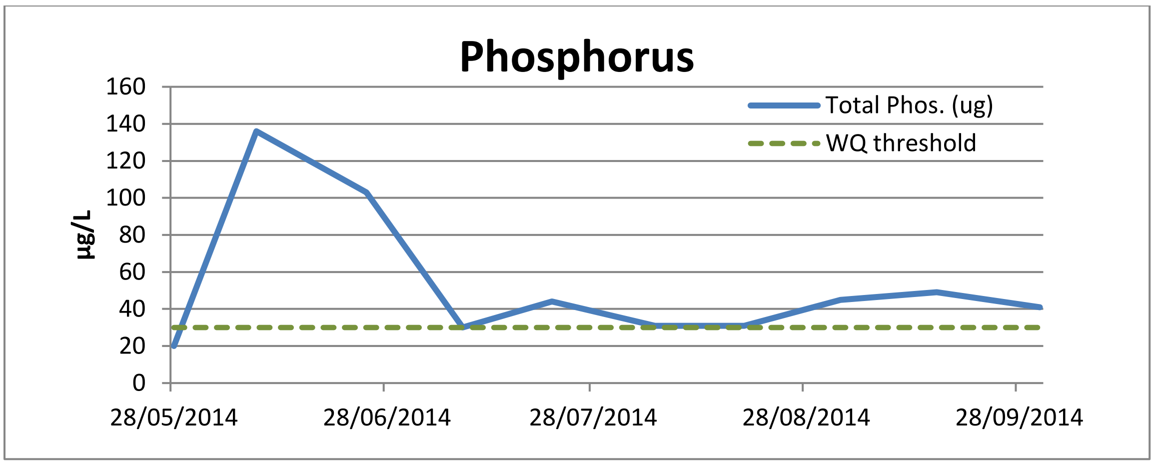
The relationship between extreme rain events and agricultural runoff is well documented. As rain flows from the land to the creek, it carries with it mobile elements and compounds in the soil, many of which can contaminate freshwater systems. Nutrients (especially Nitrogen and Phosphorus), and E Coli are examples of common contaminants in agricultural areas. Rainfall washes fertilizers and manure away from field and pasture. Surface and sub-surface (via tile drains) flow carries contaminants into receiving streams.

Lab analysis shows a significant spike in many of the water quality parameters of concern: Nutrient levels (Nitrogen, Phosphorus, and Potassium), and E Coli levels were the highest of the season on June 25th. Referencing weather station records, we can recall that the previous day (June 24) saw 56mm of rain (accuweather.com), field notes recall high water during collection of the sample. Harris Creek showed a spike in nutrients and E Coli in the aftermath of the heavy rainstorm. E. Coli is a major indicator of fecal contamination in water, high concentrations can have impacts on human health. E Coli is a concern in Harris Creek, as the seasonal average of 2100 count/100mL is twenty times higher than the acceptable limit (100 count/100mL) set by the province. It is clear that the heavy rain on June 24th caused a spike in E Coli in the next day's sample. The bacteria are most abundant in the substrate, but can easily become suspended in water as heavy rain and runoff stirs up sediment. It is difficult to limit the presence of E Coli in the catchment, especially due to the high percentage of farmland in the area.



Nutrients are significant pollutants to aquatic systems. Nutrients are introduced to receiving water bodies as rainfall drains agricultural inputs from the surface and underground. Nitrogen and phosphorus are major constituents of most fertilizers, as plants need these nutrients for growth. Most elements are not stable unless they combine with other elements to form larger molecules called compounds. For example, nitrogen commonly forms compounds with oxygen to form nitrites (NO2) and nitrates (NO3). When these elements are introduced to aquatic systems, they make it possible for aquatic plants to flourish. This can lead to excessive plant or algae growth and become a concern for ecosystem health and aesthetics. Provincial and national water quality monitoring networks (PWQMN, CWQG) have established standards or thresholds for common nutrients and metals. Thresholds are set to provide a guideline for stakeholders and to understand how different water quality parameters can be influenced by environmental factors. In an undisturbed environment, aquatic plant growth is usually limited by a lack of available nitrogen and especially phosphorus. When the concentrations of these elements increases as a result of agricultural runoff, aquatic plants are no longer limited by nutrient availability and can grow rapidly. When plant and algae growth gets out of control, it has significant consequences for the ecosystem. Eutrophication, as it is called, refers to the state of a water body that has received excess of nutrients (usually phosphorus). Available nutrients allow algae and plants to flourish. When these plants die, oxygen is consumed by the decomposing bacteria, reducing the oxygen available to other forms of aquatic life. These ‘hypoxic’ conditions can create dead zones where there is insufficient oxygen for anything other than aquatic plants to survive. Muskrat Lake in Cobden is one local example of a eutrophic system, as unsightly weeds choke stagnant water. Indeed, observations from Harris Creek in years past indicated that the vegetation is very thick. Reports of a slimy, filamentous algae clinging to every substrate indicate that the nutrients in the creek are allowing for excessive plant growth. Provincial Water Quality Monitoring Network (PWQMN) has set the target threshold for nitrates at 10 mg/L. Phosphorus targets are 30 μg/L, above which plant and algae growth can reach nuisance levels and impact stream health. Harris Creek was below the nitrates threshold all season, although levels approached the level of concern in the aftermath of the heavy rainstorm on June 24th. Phosphorus levels in the creek are well above the PWQMN threshold for freshwater systems. Lab analysis confirms high levels of phosphorus in Harris Creek, which is the likely cause of the excessive algae growth observed there.





BRWP – Harris Creek Report Card components

Harris Creek in the Bonnechere River Watershed

Purpose (Conservation Ontario, 2011):

This is a report on watershed health though use of environmental indicators. It is designed to allow the BRWP and partners to better target programs and measure environmental change in the watershed. An additional outcome of the development of this report card is the identification of several areas where data is missing or unavailable. Identifying data gaps is an important part of the process as it can allow the organization to explore opportunities to fill the gaps through additional sampling and analysis in the future.

BRWP chose to focus on the Harris Creek catchment for this report card for several reasons. First, Harris Creek has a fairly comprehensive collection of historical data as a result of past sampling efforts. Second, in previous analyses of sub-watershed health, Harris Creek was identified as an impaired system and a good candidate for further study. Third, BRWP was able to gain support for accredited laboratory analysis of samples in the summer of 2014. This report aggregates all available historical data and includes the most recent data from 2014 sampling. Fourth, Harris Creek was selected as an area of interest for its unique hydrological condition. The stream is primarily a tributary of the Bonnechere River. However, at some point in the mid-late twentieth century, a new drain was created at the headwaters of the stream that carried some of the surface water in Harris Creek northward. This diversion acts essentially as an irrigation ditch and tile drain outflow. This north spur of the creek actually drains into the Snake River via Mink Creek, and is ultimately part of the Muskrat River watershed. The BRWP focus on Harris Creek was designed to coincide with sampling efforts being conducted on the Snake River and Muskrat River during the summer of 2014. The diversion of Harris Creek occurs at a high point of land towards the northern edge of the watershed boundary (45°34'58.91"N, 76°55'44.00"W). Most of the flow travels south-east for approximately 12km until it reaches the Bonnechere River. The diverted flow travels north-west for roughly 5km as the land gently slopes into the Snake River

Why Measure? Measuring helps us better understand our watershed. It helps us to focus our efforts where they are needed most and track progress. It also helps us to identify healthy and ecologically important areas that require protection or enhancement (MVCA, 2013).

Grading: A excellent, B good, C fair, D poor, F very poor

Harris Creek quick facts (BRWP, 2012) (McIntosh, 2012):

- 70.1% agricultural usage (Hay/Pasture +Corn +Soybeans +Cereals
- <0.1% wetland cover
- 2.7% Tile drains
- 1.9% aggregate sites
- Soils: 21.8% shallow till and rock ridges, 65.4% clay plains, 12.8% till plains/moraines

Report Card grades (Conservation Ontario, 2011):

Surface Water Quality overall **D**	**Forest Conditions** overall **D**	**Groundwater Quality** Data not available
Total Phosphorus: 0.054 mg/L or 54 µg/L **D**	% Forest Cover: 18.5% **C**	Nitrite and Nitrate: Data not available
E Coli: 2148 count/100mL **F**	% Forest Interior: <1% **F**	Chloride: Data not available
Benthic Invertebrates: HBI 5.91 **D**	% Riparian Zone Forested: <10% **F**	

Surface Water Quality:

Clean water is essential for good quality drinking water and supporting diverse aquatic habitats. It leads to healthy and appreciated recreational areas and the aesthetic appreciation of the natural environment. Metrics used to assess surface water quality include: Total Phosphorus concentration, E. Coli count/100mL, and Benthic macro-invertebrate diversity indices.

Phosphorus occurs naturally in our lakes and rivers and is necessary for the healthy development of plants and animals. However, high concentrations of phosphorus from human sources (sewage, pesticides, fertilizers, industry) can quickly elevate phosphorus to unhealthy levels.

Benthic Macro-invertebrates are the bugs that live in the stream sediment, and are excellent indicators of stream health. Macro-invertebrate population analysis is a well established method of understanding the health of aquatic ecosystems. The organisms that live in the stream and are directly impacted by its habitat quality can tell us a lot about the overall health of the system. By collecting and identifying invertebrates in the studied watershed, it is possible to use what we know about the population assemblage and the tolerances of key invertebrates to determine the health of the stream.

Conservation Ontario recommends a minimum of monthly data for calculation of indicators. 30 or more data points over the 5 year assessment period are recommended for trend analysis. Bi-weekly sampling was conducted on Harris Creek during the summer of 2014. However, prior to 2014, E. Coli analysis was not conducted. Total Phosphorus analysis is also limited by a lack of long-term data.

There are also limitations to the benthic invertebrate data represented here. BI samples were collected during the summers of 2010, 2011, and 2014. Identification of the samples was conducted to a reasonably high taxonomic resolution that meets provincial standards set out in the Ontario Benthos Biomonitoring Network (OBBN) (OMOE, 2007). Although the identification was conducted to standard, the 2011 samples were collected using an outdated method (Rapid Bioassessment), whereas the 2010 and 2014 sampling was conducted to OBBN standard. The Rapid Bioassessment approach can produce a sampling bias towards the collection and identification of larger biota, and subsequent under-representation of those taxa which are more difficult to see with the naked eye. Efforts have been made to ensure future benthic samples are conducted to the OBBN standard.

Forest Conditions:

Good forest conditions are essential to the health of the watershed and an integral part of the ecosystem. Forests literally hold it all together. They provide habitat and shade, filter water and clear the air. The status of our forests is evaluated based on the amount of forest cover, forest interior, and forested riparian zones.

Forest cover is the total area of the watershed covered by trees. Forest interior refers to forested areas that are 100m from the forest edge – well sheltered and undisturbed land and forest that is required by certain species, especially birds. Forest interiors are typically less humid, have less light, and fewer invasive species and predators. Due to increasing fragmentation of existing woodlots, forest interior is becoming increasingly rare, making it a key habitat for preservation efforts. The percentage of forested riparian zone is a measure of the amount of forest cover within a 30m zone adjacent to streams and lakes. Forested riparian zones improve water quality by filtering surface runoff before it enters the stream. They also provide connecting corridors which can be used by local fauna to move safely between habitat used for food, breeding, shelter, etc.

It is a common practice for landowners, often unaware of the importance of riparian zones, to clear their shorelines of native vegetation in favour of lawns, gardens, or retaining walls. This has had a negative effect of fish and wildlife habitat and water quality. Natural shoreline vegetation helps prevent erosions and improve water quality by binding nutrients before they can enter the lake or stream.

Forest conditions were analyzed primarily using data from a 2012 geospatial analysis of the Bonnechere River Watershed. Land use data for the watershed were aggregated and reported in *Geospatial Characterization of the Bonnechere Watershed* (McIntosh, 2012).

Forest Interior is defined as the portion of a woodlot that remains when a 100 metre buffer is removed from the inside perimeter of a woodlot (i.e. 100m in from the outside edge). Forest interior refers to the protected core area found inside a forest required by species (especially birds) to nest and breed successfully. The outside edge (100m perimeter) is more prone to sun and wind damage, invasive species, and higher predation than forest interior, (Clewell and Aroson, 2007); (Conservation Ontario, 2011). Harris creek features practically no riparian buffer for its entire length. The creek is essentially an agricultural drain for the first 5km (BRWP, 2014).

Additional resources are required to ensure accuracy and proper reporting of GIS data including ground-truthing.

Groundwater Quality:

At present, the BRWP lacks the resources to implement a comprehensive groundwater sampling regime that could inform this section of the report card. There are no Provincial Ground Water Monitoring Network (PGWMN) stations established in the sub-watershed. Groundwater monitoring stations have not been established, and the BRWP is lacking in the financial and technical resources to collect such data.

There is the potential to expand our knowledge of groundwater systems and quality in this sub-watershed. Bing a rural area, most properties operate wells for water usage (drinking, livestock, etc.). In theory a well-water testing regime could be implemented that would allow locals to track the water quality in their wells, and at the same time be used as a extensive data collection method for groundwater resources. Water level, nutrient, and other contaminant information could be tested at multiple wellheads in the sub-watershed, and results transferred to BRWP to include in a groundwater assessment. It is not the purpose of this report to speculate on the details of such an arrangement.

Land use in the Harris Creek sub-watershed

Land use breakdown (McIntosh, 2012)**:**

46.2% Hay/Pasture, 12% Mixed Forest Trees, 9.5% Shrubland, 9.6% Corn, 9.4% Soybeans, 6% Deciduous Trees, 5.9% Cereals, 0.6% Exposed Land, 0.5% Coniferous trees, 0.3% Developed, 0.1% Wetland

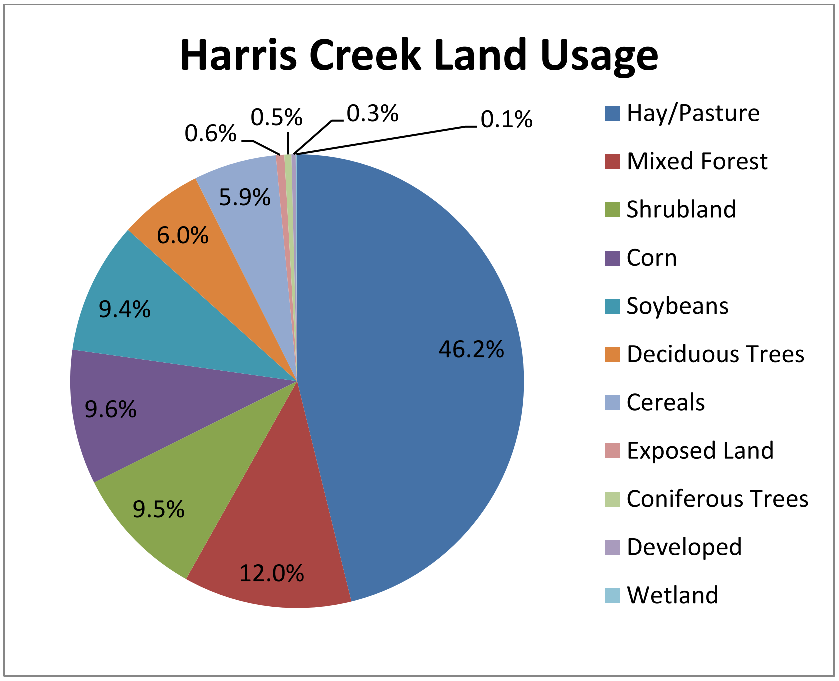


Figure 1 Land usage in the Harris Creek sub-watershed (McIntosh, 2012).

Study Limitations

- Precise location of Harris drain diversion (45°34'58.91"N, 76°55'44.00"W)
- Access to information (Hawkins report not available/no good data)
- Mapping &GIS capabilities – newer geodatabases? Forest interior calculations
- GW monitoring capabilities
- Do we have enough data points to draw conclusions
- Harris outlet information – no data collection at outlet (limited access)
- DEM mapping of Harris Drainage basin (better understand flow diversion)

Identify data gaps: groundwater, high-resolution land-use data,

Optional Features:

- Additional text explaining grade results
- Watershed features that help explain conditions that affect grades (land use chart)(stream flow, soil erosion, land use, population, tiling and drainage, wetland cover)
- Recommended actions for improvements (BMPs, etc.)
- Highlights of progress
- Contact information

Acknowledgements

Alex McIntosh – for a thorough geospatial characterization of the BRW

Holly Gardiner – analytical report on the water quality data

BRWP – previous year's field data, 2014 sampling

MoE – OBBN for BI standards, lab analysis for 2014

Municipalities – GIS, land use information

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