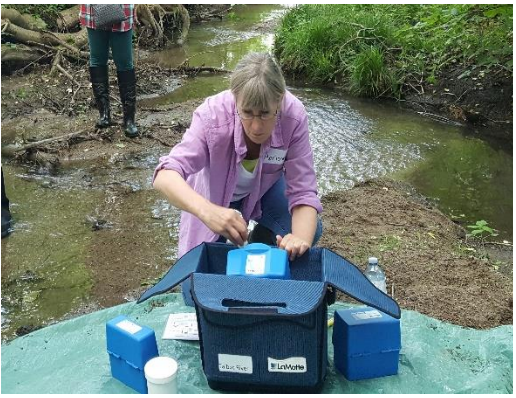
The Couchiching Conservancy

Water Quality Monitoring Program

Summary of Findings and Recommendations

January 1 to December 31, 2016



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Summary of Findings and Recommendations

January 1 to December 31, 2016

Written by Meagan Coughlin and Dorthea Hangaard

Thanks to Dr. Sreekumar Kurissery at Lakehead University, Orillia Campus, for many consultations, Doug Forder, Larissa Schiffmann, and Krystal McLeish at Ontario Streams, Brook Schryer from the Ontario Federation of Anglers & Hunters, Ben Longstaff and Andrea Gynan at the Lake Simcoe Region Conservation Authority, Danielle Aulenback at MNRF, the weather data team at MNRF, Severn Sound Environmental Association, Kawartha Conservation, and the Nottawasaga Valley Conservation Authority.

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Water Team Refresher Course April 2016 at Grant's Woods

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Executive Summary

In 2016, the Conservancy's Water Quality Monitoring Project experienced significant growth. From seven sites and fourteen volunteers monitoring one sub-watershed in 2015, we now have 19 sites and 40 volunteers monitoring streams throughout the Couchiching Region (and have renamed the Project "Couchiching Conservancy Water Quality Monitoring project"). This exceeded our goals for the year, with monitoring sites taking in nine sub-watersheds including: Oro-Medonte, Severn, Carden, and Ramara Township as well as the City of Orillia. In addition, the grade eleven chemistry class of Patrick Fogarty Secondary School added water quality monitoring to their curriculum, and took on the monitoring of one of our sites.

Over 100 cattle were permanently removed from creeks in Carden and Ramara Township, through fencing projects and the installation of alternative watering systems. We added a new monitoring site below a ranch that is allowing cattle to access the steam for drinking water.

An extensive drought took hold of our region throughout the summer and fall, and water teams collected data on water depth that will be critical to the study of climate change in our region. This information taught us which streams are more resistant to drought, and makes a case for the protection of cold-water streams/headwaters.

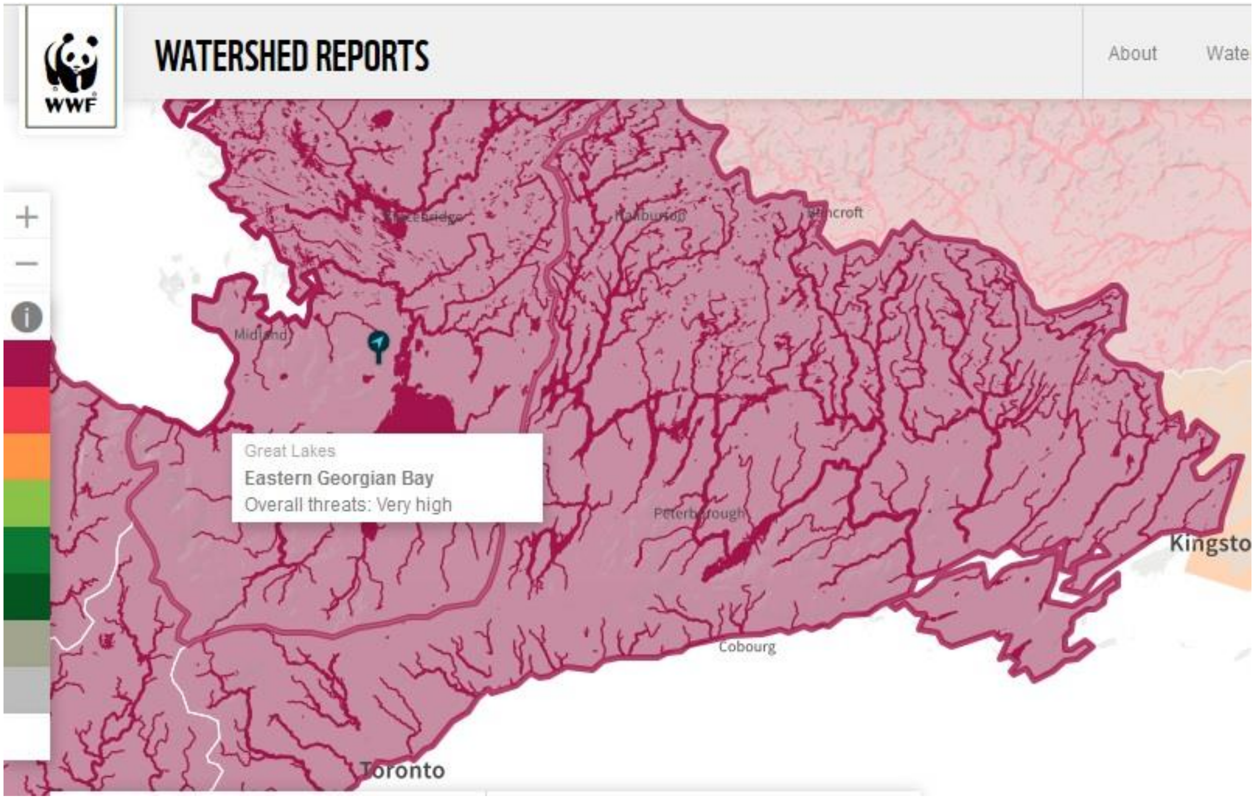
In 2016, we became more familiar with the City of Orillia's cold-water streams. Historically there were five cold-water streams, but only three remain, and the Conservancy is monitoring two of them: Sundial Creek and Mill Creek. Sundial Creek, within a kilometre of the downtown core, became a significant monitoring site for us when we discovered consistently elevated Nitrate-Nitrogen levels from an unknown source, along with heavy siltation. Sundial Creek supports a population of Brook Trout and we have seen Trout-Perch, the evolutionary link between Trout and Perch before they divided into two distinct species. Volunteers enthusiastically stepped up efforts at this site and conducted extensive research, culminating in a presentation to the City of Orillia's Environmental Advisory Committee who are now working on solutions to these pollution problems.

Sundial Creek flows through a Conservancy-owned Wetland and the establishment of this water-monitoring project is having a positive impact on how we view the management of this property. This creek is also serving as a water quality education site for the grade 11 Chemistry Class of Patrick Fogarty Secondary School, who have added water monitoring to their chemistry curriculum.

Copeland Forest Friends joined our project in 2016. We trained their volunteers, assisted in site-selection, collected data, and present their results in this report. Two cold-water creeks in Copeland Forest represent important "natural capital" in our region, but sit beside a sewage-settling lagoon, a golf course, and a ski resort, and therefore require constant monitoring. The Severn Sound Environmental Association is now a partner in this initiative and are collaborating on monitoring results and assisting with stream mapping.

Introduction

Figure 1: The Couchiching Region falls within an area of Canada listed as having good overall water health but "very high" overall threats in the World Wildlife Fund Watershed Report Card for Canada:



The main factors contributing to this extreme rating are Pollution, Habitat Fragmentation, Overuse of Water, and Invasive Species. Climate Change and Habitat Loss are considered of "Moderate" concern in our region, and the concern over Alteration of Flow is rated as a "Very Low" concern.

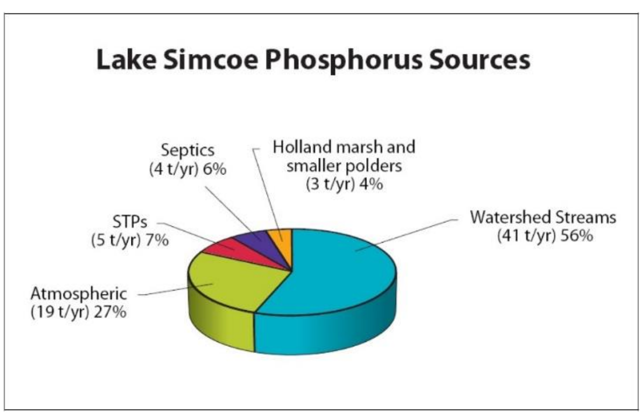


Figure 2: Phosphorus has also been identified as extremely high in the Lake Simcoe Watershed, and 56% of all sources entering Lake Simcoe are from watershed streams. Urban, industrial, and agricultural run-off are the primary sources, and our monitoring program targets all three.

Source: LSRCA & MOE data on phosphorus 2002-2007

This year we sharpened our focus to streams that flow through Conservancy-managed properties, but broadened our area of interest to the entire Couchiching region:

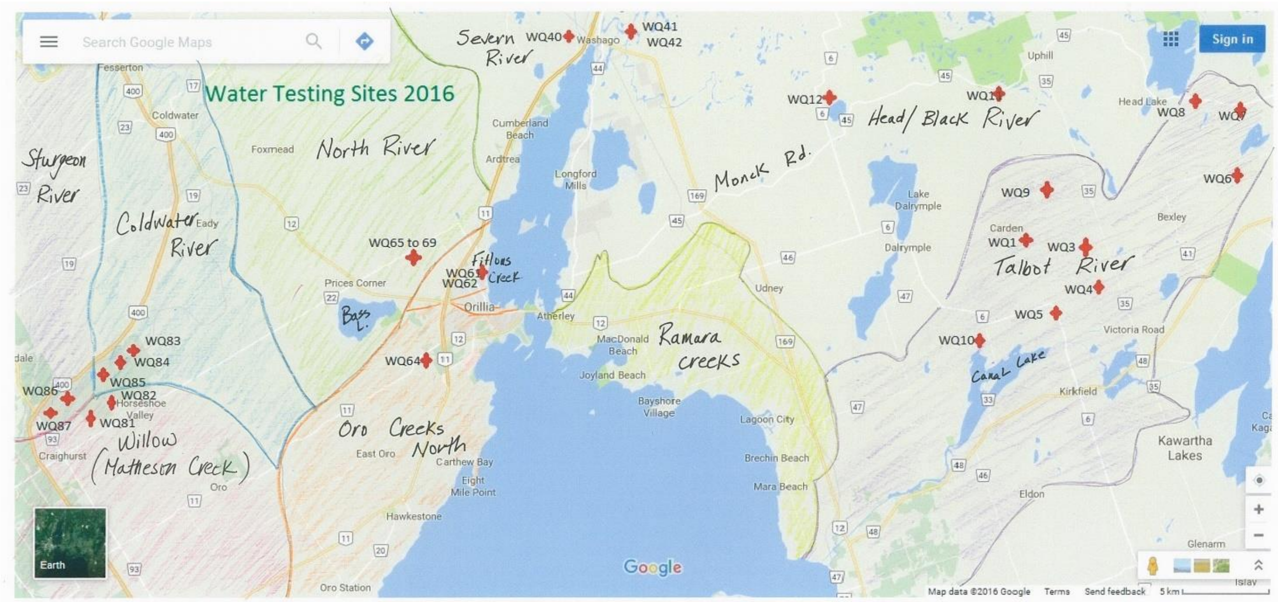


Figure 3: 2016 Testing Sites and Sub-Watersheds

Water Team volunteers test for eight water quality parameters, record data on fish and invertebrates, and contribute this information to our ever-growing list of partners. Over 40 volunteers have contributed 1,300 hours in 2016, and turned in 142 monitoring sheets. The monitoring sites include seven headwaters and at least three cold-water streams.

Our experience with citizen science water quality monitoring has taught us that volunteers place a high premium on experiential learning and that providing meaningful, hands-on opportunities helps people better-understand environmental impacts while empowering them to do something about it. We have witnessed people directly experience the beauty of a cold-water stream with Brook Trout swimming by and then viscerally react when their test results show pollutants. The connection between human action and environmental impact is profound.

The benefits of this water quality program for our Region are:

- Sound data allowing us to make critical decisions regarding the management of our properties, and which we make available to provincial and national decision-makers.
- Information that can influence land-use planning and protect water.
- Data that can be used in the study of climate change.
- Determining whether or not agricultural run-off is a significant issue in our area.
- Acting on our results to assist ranchers in fencing cattle out of waterways.
- A program design that we are making available to other Land Trusts to encourage similar studies.

Methodology

This Citizen Science Project trains volunteers to use Lamotte Education Water Test Kits at the stream site for:

- **Air and Water Temperature**
- **Depth**
- **Turbidity**
- **Alkalinity**
- **pH**
- **Phosphates**
- **Nitrate-Nitrogen**
- **Dissolved Oxygen**

We have also obtained two **Chloride** kits to test for winter road salt and will begin using these kits in 2017.

Volunteers are assigned a permanent site to monitor, and visit either once or twice per month. In the first year at a new site, we encourage testing twice per month to establish a solid baseline of data. After a full year, if the data from the site indicates no problems, we drop to once per month.

Equipment includes: Lamotte Kit, protocols and monitoring sheets, chest waders, a throw rope, road cones, first aid kit, distilled water, and safety vests. After testing they return monitoring sheets and equipment to the Couchiching Conservancy for data entry, cleaning & maintenance. If there has been precipitation within the past 48 hours, we look up the rainfall amount for our area at the nearest MNRF weather station and record this information.

Following up on a recommendation from last year, a new protocol was added in 2016: If a Nitrate-Nitrogen or a Phosphate reading falls outside the healthy range, a water sample is collected and sent to a local lab for analysis.

This protocol was established to quell the concerns of volunteers that the tests are working correctly, and to ensure our partners will have faith in our data. Lab samples were collected twice in 2016, and in both instances the results were within .5 parts per million (ppm) of each other.

A refresher course was held for the seven returning volunteers from 2015, and three day-long training sessions were held for new volunteers. The first training session was carried out by staff from Ontario Streams. At that point our Project Manager, Intern, and an experienced volunteer, Lisa Neville, had taken the training three times and were confident to start providing the training sessions themselves.

Lisa Neville has a background in aquatic sciences and fisheries who worked as a Biologist for Environment and Climate Change Canada and Fisheries and Oceans Canada providing water quality expertise on a diversity of projects. She is now working with Project Manager Dorthea Hangaard to provide the day-long training sessions to volunteers.

Intern Meagan Coughlin has an Environmental Science degree from University of Guelph with a specialty in Ecology. She has been providing valuable support the project for two years by organizing and analyzing the data, maintaining water test kits and supplies, and helping to deliver training to volunteers.

Dorthea Hangaard is Project Manager for the Couchiching Conservancy and established this Water Quality Monitoring Program. She has a degree in Environmental Studies from the University of Waterloo and a background in Community Development and Ocean Conservation. She has been the Sustainable Fisheries Campaign Manager for Living Oceans Society, co-authored the only analysis on the Ecological Impacts of Canadian Fishing Gear (How We Fish Matters), and organized the Finding Coral Deep Sea Expedition, which was instrumental in the protection of British Columbia's Deep Sea Corals.

Figure 4: LaMotte Water Quality Educator and Monitoring Kit. From left to right (top): Nitrate-nitrogen, dissolved oxygen, turbidity, pH. Left to right (bottom): Alkalinity, low range phosphate

Water Temperature

Water Temperature is one of the most important factors influencing fish survival and performance. The body temperature of a fish is equal to or within a few fractions of a degree of the surrounding water temperature. Temperature is an important determinant of reproductive success, and increases of even 2 degrees Celsius above normal can decrease reproductive success.

	2015	2016
Site	Water Temp Range Degrees Celsius	Water Temp Range Degrees Celsius
WQ1 – McGee Creek at Sedge Wren	8 - 21	11.5
WQ3- Perch Creek at Doyle Road	5 - 16	8.5 - 16
WQ4 – Talbot River at Doyle Road	3 – 22.5	12 – 26.5
WQ5 – Talbot River at Upton Bridge	3 - 24	3 - 22
WQ6 – Talbot River south of Talbot Lake	4 – 25.5	2 - 23
WQ7- Talbot Headwaters	4 - 22	2 - 19
WQ8 - Perch Creek Headwaters	4 - 16	1 - 23
WQ9- McGee Creek at Shrike Rd	---	5 - 24
WQ42 – Boyd Creek at A.H.S.	---	9
WQ61- Sundial Creek at Grant Wetland	---	3 - 17
WQ62 - Bay Street Drainage at Grant Wetland	---	8 – 16.5
WQ64- Mill Creek Bridge, Scout Valley	---	0 - 7
WQ65 – Grant's Woods Bridge "A"	---	7
WQ66 – Grant's Woods West Creek	---	4 – 10.5
WQ68 – Grant's Woods East Creek	---	6 - 15
WQ81 – Copeland "Pump House"	---	5
WQ82 – Coldwater R. Grand Allee	---	4 - 12
WQ83 – Coldwater R. 5th Line	---	7 – 12.5
WQ84 – Coldwater R. Parking Lot 2	---	7.5 - 12
WQ85 – Coldwater R. at Ingram	---	2 - 14
WQ86 – Sturgeon R. at Ingram	---	2 - 5
WQ87 – Matheson Cr. At Ingram	---	4 - 12

There are generally three thermal preference classes occupied by fish:

Warm Water Creeks have a temperature greater than 25 degrees Celsius in summer.
Cool Water Creeks have a temperature between 19 and 25 degrees Celsius in summer.
Cold Water Creeks have a temperature lower than 19 degrees Celsius in summer.

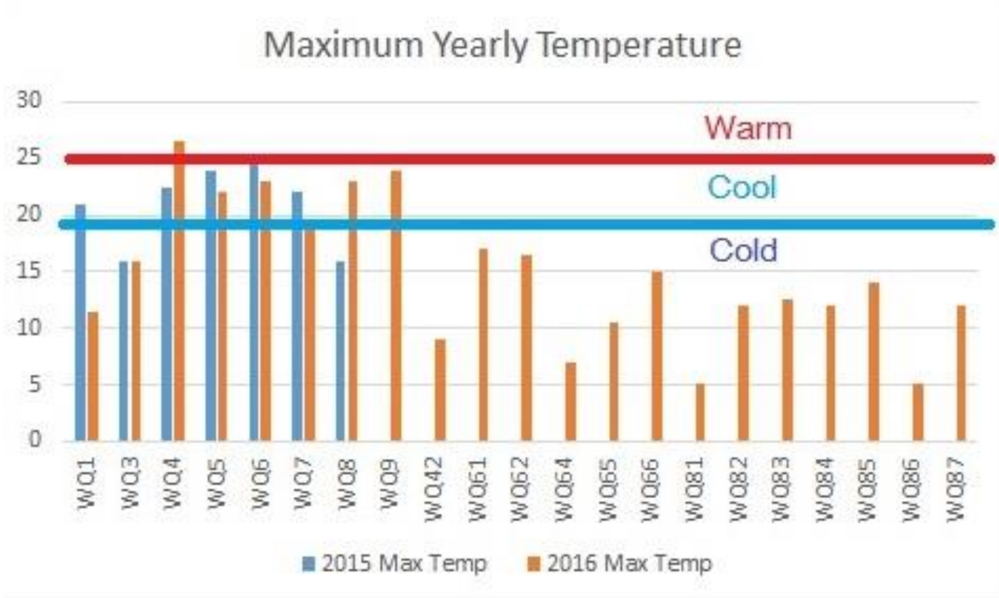


Figure 5: Maximum Yearly Temperature for 2015 and 2016

Considering these definitions, the 2016 drought, and sites for which we have adequate summer temperature data, we have confidence in classifying the following streams for 2016:

Cold Water Streams:

- WQ3: Perch Creek at Doyle Road
- WQ61: Sundial Creek at Grant Wetland
- WQ62: Bay Street Drainage at Grant Wetland

Cool Water Streams:

- WQ1: McGee Creek at Sedge Wren Marsh
- WQ5: Talbot River at the Upton Bridge
- WQ6: Talbot River South of Talbot Lake
- WQ7: Talbot Headwaters
-

Streams that may have experienced temperature stress due to the drought:

- WQ8: Perch Creek Headwaters
- WQ4: Talbot River at Doyle Road
- WQ9: McGee Creek at Shrike Road

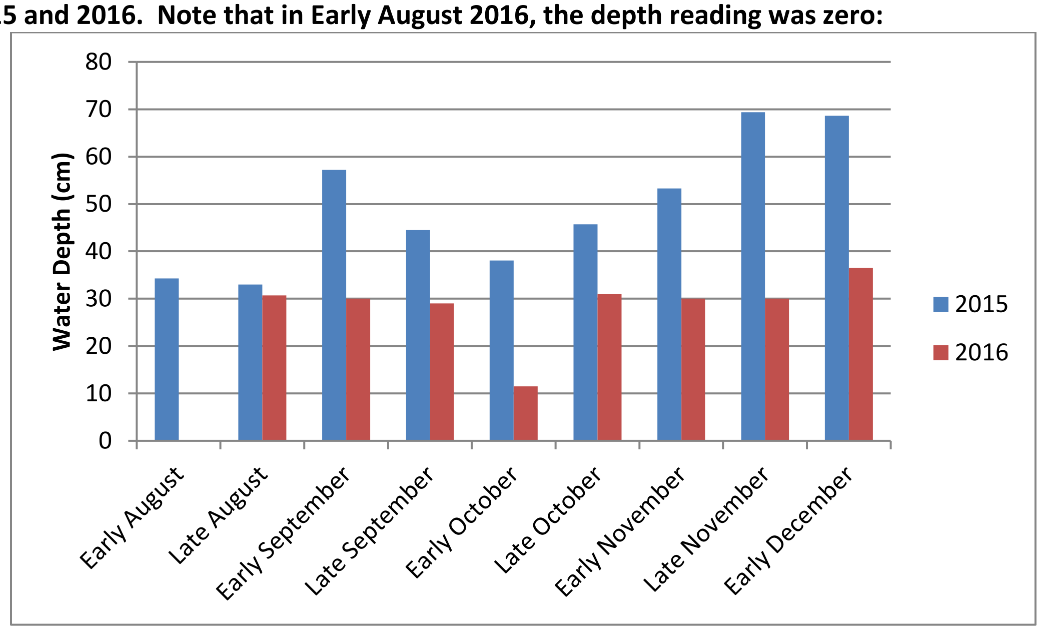
It is highly likely that all Streams in Copeland Forest, Mill Creek (Scout Valley), and Grant's Woods, will be either Cold Water or Cool Water, but summer data is needed and we will make that determination in the years to come.

Three out of four monitoring sites along the Talbot River had overall lower average temperatures in 2016 than in 2015. The Talbot River/Doyle Road site had overall higher average temperatures in 2016 than in 2015.

Water Depth

From April to September, our region and all of southern Ontario experienced a severe drought. As we watched water depth dwindle in the streams we monitor, we realized the importance of measuring depth at our sites and quickly added metre sticks to the equipment list. It was a missed opportunity to compare 2015 to 2016, but we are able to comment on the Perch Creek headwaters, and on the robustness of Cold Water Streams compared to Cool and Warm Water Streams that we monitor.

Figure 6: A comparison of depth readings taken at the Perch Creek Headwater site from August to December for both 2015 and 2016. Note that in Early August 2016, the depth reading was zero:

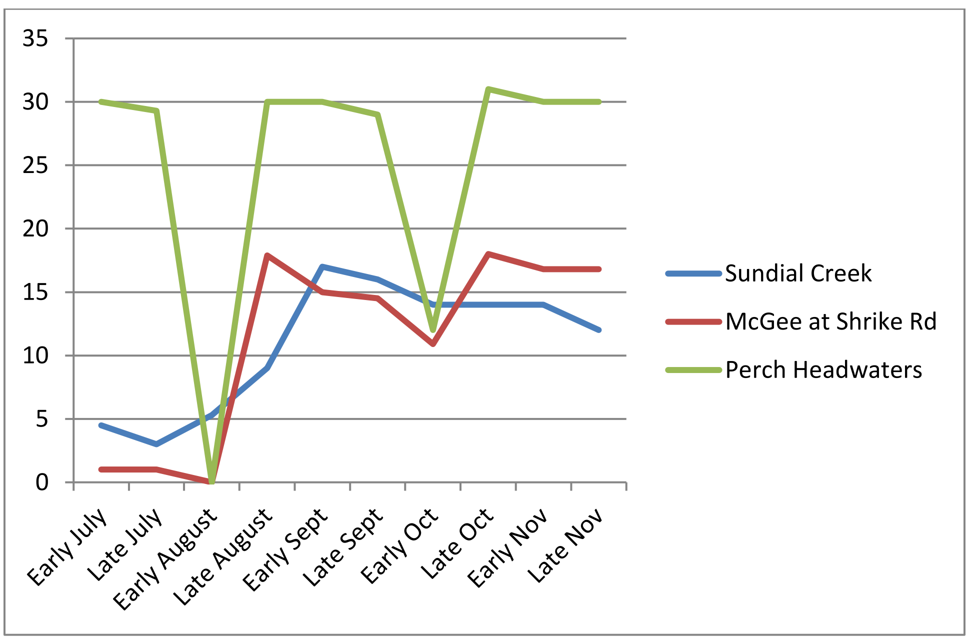


Perch Creek is a Cold Water Stream *and* headwaters, but went completely dry on August 12, 2016. While its source is groundwater, keeping water temperature cool year-round, the fact that it dried out this year tells us that its groundwater source sits higher up on the water table and is more vulnerable to drought than other cold-water creeks we are monitoring.

Though rains later in the season revitalized the creek, it still maintained an overall lower depth than the previous year.

Perch Creek on March 29, 2016 at its height, and on August 12, 2016, reduced to muck.

Figure 7: Depth measurements for three sites we have adequate data for: July to November 2016. Sundial Creek is Cold Water, Perch Creek was Cold throughout 2015 but became Cool in the summer of 2016, and McGee Creek was a Cool Water Creek in 2016:



While Sundial Creek was never completely dry like the other two sites, water levels were dramatically lower during the summer.

Phosphate and Nitrate-Nitrogen (Table 1)

	2015		2016	
Site	Phosphate (ppm)	Nitrate (mg-N/L)	Phosphate (ppm)	Nitrate (mg-N/L)
WQ1 – Sedge Wren Marsh	0	0 – 2	0	0
WQ3- Perch Creek at Doyle Road	0	0	0	0
WQ4 – Talbot River at Doyle Rd	0	**0 - 1**	0	**0 - 1**
WQ5 – Talbot River at Upton Bridge	0	0	0	0
WQ6 – Talbot River S. of Talbot Lake.	**0 - 0.2**	**0 - 2**	0	0
WQ7- Talbot Headwaters	**0 - 0.2**	**0 - 1**	0	0
WQ8 - Perch Creek Headwaters	0	0	0	0
WQ9- McGee Creek at Shrike Rd	---	---	**0 - .2**	0 - 0.5
WQ61- Sundial Creek at Grant Wetland	---	---	0	**0 - 4**
WQ62 – Bay Street Drainage at Grant Wetland	---	---	0 – **.2**	**1 - 4**
WQ64- Mill Creek at Scout Valley	---	---	0	0
WQ65 – Grant's Creek Bridge "A"	---	---	---	0
WQ81 – Copeland "Pump House"	---	---	0	0
WQ82 – Coldwater R. Grand Allee	---	---	0	0 - 1
WQ83 – Coldwater R. 5th Line	---	---	0	0
WQ84 – Coldwater R. Parking Lot 2	---	---	0	0
WQ85 – Coldwater R. at Ingram	---	---	0	0 - 2
WQ86 – Sturgeon R. at Ingram	---	---	**0.2**	0
WQ87 – Matheson Cr. At Ingram	---	---	**0.2**	0

Low Range Phosphate: Total phosphate levels higher than 0.03 ppm contribute to increased plant growth (eutrophication). Total phosphate levels above 0.1 ppm may stimulate plant growth sufficiently to surpass natural eutrophication rates.

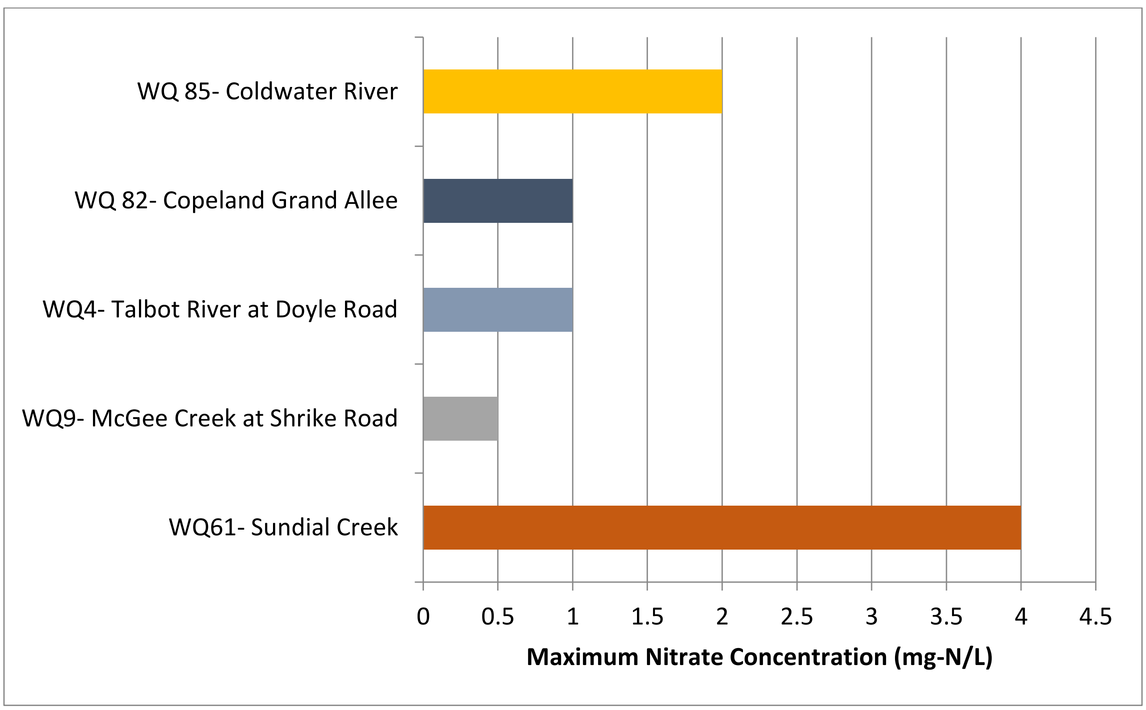
Nitrate-Nitrogen: Unpolluted waters generally have a nitrate-nitrogen level below 1 ppm. Nitrate-nitrogen levels above 10 ppm are considered unsafe for drinking water.

Four monitoring sites had Low Range Phosphate readings of 0.2 ppm in 2016 and should be monitored closely. The protocol for collecting a water sample for lab testing was not followed and we will work with volunteer teams in 2017 to ensure this protocol is understood.

We have two streams with Nitrate-Nitrogen levels above 1 ppm: WQ85 – The Coldwater River, and WQ61 – Sundial Creek. Sundial Creek has consistently high Nitrate-Nitrogen levels and is the subject of an extensive investigation into the sources. Water samples have been collected and sent to the lab and our kit results are within lab test results by 0.5 ppm.

The other three sites with readings of 1 ppm or below could be the result of plant-die off—a naturally occurring process.

Figure 8: Sites with Nitrate-nitrogen concentrations above zero in 2016:



Alkalinity (Table 2)

	2015	2016
Site	Alkalinity (ppm)	Alkalinity (ppm)
WQ1 – McGee Creek at Sedge Wren	184 - 294	196
WQ3- Perch Creek at Doyle Road	160 - 244	168 - 236
WQ4 – Talbot River at Doyle Road	100 - 180	100 - 148
WQ5 – Talbot River at Upton Bridge	140 - 220	120 - 180
WQ6 – Talbot River at Talbot L. S.	105 - 160	92 - 214
WQ7- Talbot Headwaters	192 - 245	110 - 260
WQ8 - Perch Creek Headwaters	175 - 248	158 - 240
WQ9- McGee Creek at Shrike Rd	---	164 - 262
WQ61- Sundial Creek at Grant Wetland	---	200 - 316
WQ62 – Bay Street Drainage at Grant Wetland	---	220 - 320
WQ64- Mill Creek at Scout Valley	---	14 - 340
WQ81 – Copeland "Pump House"	---	164 - 180
WQ82 – Coldwater R. Grand Allee	---	216 - 246
WQ83 – Coldwater R. 5th Line	---	156 - 182
WQ84 – Coldwater R. Parking Lot 2	---	180 - 212
WQ85 – Coldwater R. at Ingram	---	128 - 224
WQ86 – Sturgeon R. at Ingram	---	116 - 172
WQ87 – Matheson Creek at Ingram	---	120 - 184

Alkalinity: High Alkalinity in a body of water means that it is more stable and resistant to changes in pH. A Total Alkalinity of 100 to 200 ppm will stabilize the pH in a stream. Levels between 20 and 200 ppm are typically found in fresh water.

While there have been fluctuations in the range of alkalinity values recorded at all of the original 2015 monitoring sites, most of them fall within the typical range of 100 - 200 ppm seen in freshwater streams, and all of them are well above the minimum value for sustaining freshwater life at 20 ppm. The Mill Creek Bridge site in Scout Valley has a range that includes a value below the 20-ppm minimum.

pH (Table 3)

	2015	2016
Site	pH	pH
WQ1 – Sedge Wren Marsh	7.0 – 7.5	7.0
WQ3 – Perch Creek at Doyle Road	7.0 – 8.0	7.0 – 7.5
WQ4 - Doyle Road at Raven Lake & Talbot River	7.5 - 8.0	7.5 - 8.0
WQ5 - Upton Bridge	7.0 - 8.0	7.5 - 8.0
WQ6 - Talbot Lake South	7.0 - 8.0	7.0 - 8.0
WQ7- Talbot Headwaters	6.5 - 7.5	6.5 - 7.5
WQ8 - Perch Creek Headwaters	7.0 - 8.0	7.0 - 7.5
WQ9- McGee Creek & Shrike Rd	---	7.0 - 7.5
WQ61- Grant Wetland - Sundial Creek	---	7.5 - 8.5
WQ62 – Grant Wetland- Bay Street Drainage	---	7.5 – 8.5
WQ64- Scout Valley Mill Creek Bridge	---	7.5 - 8.0
WQ81 – Copeland Pump House	---	7.0 – 8.0
WQ82 – Coldwater R. Grand Allee	---	8.0
WQ83 – Coldwater R. 5th Line	---	7.0 – 8.0
WQ84 – Coldwater R. Parking Lot 2	---	6.5 –7.25
WQ85 – Coldwater R. at Ingram	---	6.5 – 7.5
WQ86 – Sturgeon River at Ingram	---	6.5 – 7.0
WQ87 – Matheson Creek at Ingram	---	7.0 – 7.5

pH: A range of 6.5 – 8.2 is optimal for most organisms, and up to 9.0 is safe. Rapidly growing algae or Submerged Aquatic Vegetation remove carbon dioxide from the water during photosynthesis. This can result in a significant increase in pH levels.

Most sites have a pH range that falls within the ideal value of 6.5 - 8.2. The Grant Wetland site has had observations of values that slightly exceed the optimal range at 8.5, but are still within safe limits.

Turbidity (Table 4)

	2015	2016
Site	Turbidity (JTU)	Turbidity (JTU)
WQ1 – McGee Creek at Sedge Wren	0 - 10	0
WQ3- Perch Creek at Doyle Road	0	0
WQ4 – Talbot River at Doyle Road	0 - 5	0
WQ5 – Talbot River at Upton Bridge	0	0
WQ6 – Talbot River S. of Talbot Lake	0 - 5	0 - 5
WQ7- Talbot Headwaters	0 - 5	0 - 5
WQ8 - Perch Creek Headwaters	0	0 - 20
WQ9- McGee Creek at Shrike Rd	---	0
WQ61- Sundial Creek at Grant Wetland	---	**0 - 40**
WQ62 – Bay Street Drainage at Grant Wetland	---	0 - 15
WQ64- Mill Creek at Scout Valley	---	0.05 – 5.0
WQ81 – Copeland "Pump House"	---	0
WQ82 – Coldwater R. Grand Allee	---	0 - 20
WQ83 – Coldwater R. 5th Line	---	0 – 7.5
WQ84 – Coldwater R. Parking Lot 2	---	0
WQ85 – Coldwater R. at Ingram	---	0
WQ86 – Sturgeon R. at Ingram	---	0 - 5
WQ87 – Matheson Cr. at Ingram	---	0

Turbidity: The ideal range for turbidity in stream water is between 0 and 40 Jackson Turbidity Units (JTU).

Dissolved Oxygen (Table 5)

	2015	2016
Site	Dissolved Oxygen	Dissolved Oxygen
WQ1 – McGee Creek at Sedge Wren Marsh	**2.2**	6.2
WQ3- Perch Creek at Doyle Road	4.8 – 10.4	5.0 – 9.4
WQ4 – Talbot River at Doyle Road	**1.8** – 12	4.6 – 9.2
WQ5 – Talbot River at Upton Bridge	4.6 – 11.2	5 - 11
WQ6 – Talbot River at Talbot Lake S.	5.8 – 10.8	3.8 – 12.5
WQ7- Talbot Headwaters	**1.4** – 8.4	**1.4** – 9.4
WQ8 - Perch Creek Headwaters	5.0 – 10.6	5.4 – 11.2
WQ9- McGee Creek at Shrike Rd	---	4.0 – 14.0
WQ61- Sundial Creek at Grant Wetland	---	7.4 - 15.4
WQ62 – Bay Street Drainage at Grant Wetland	---	**2.4** – 10.0
WQ64- Mill Creek at Scout Valley	---	**2.8** – 15.0
WQ81 – Copeland "Pump House"	---	7.8 – 15.0
WQ82 – Coldwater R. Grand Allee	---	9.6 – 12.0
WQ83 – Coldwater R. 5th Line	---	5.3 – 6.7
WQ84 – Coldwater R. Parking Lot 2	---	8.0 – 8.9
WQ85 – Coldwater R. at Ingram	---	7.4 – 11.3
WQ86 – Sturgeon R. at Ingram	---	11.4 – 14.0
WQ87 – Matheson Cr. at Ingram	---	7.8 – 15.0

Dissolved Oxygen: The minimum level of DO required for growth and activity of aquatic organisms is 5 to 6 ppm. Levels less than 3 ppm are stressful to most aquatic organisms. DO levels below 2 ppm will not support fish.

The expected relationship between DO and water temperature is that as water temperature drops, DO increases. At three of the Carden sites, we have noticed that between early and mid-autumn DO decreases as water temperature decreases.

One explanation is that increased input of organic matter from fall plant die-off enters the stream and are broken down by microbes and macroinvertebrates as a food source. This process consumes dissolved oxygen, and could account for the lower concentrations of dissolved oxygen during a time when we would expect them to be increasing (Fey et al, 2015). Another explanation is that three of the sites are below lakes and that the drop in DO corresponds with the annual fall "inversion".

The most dramatic example is at WQ6: Talbot River South of Talbot Lake:

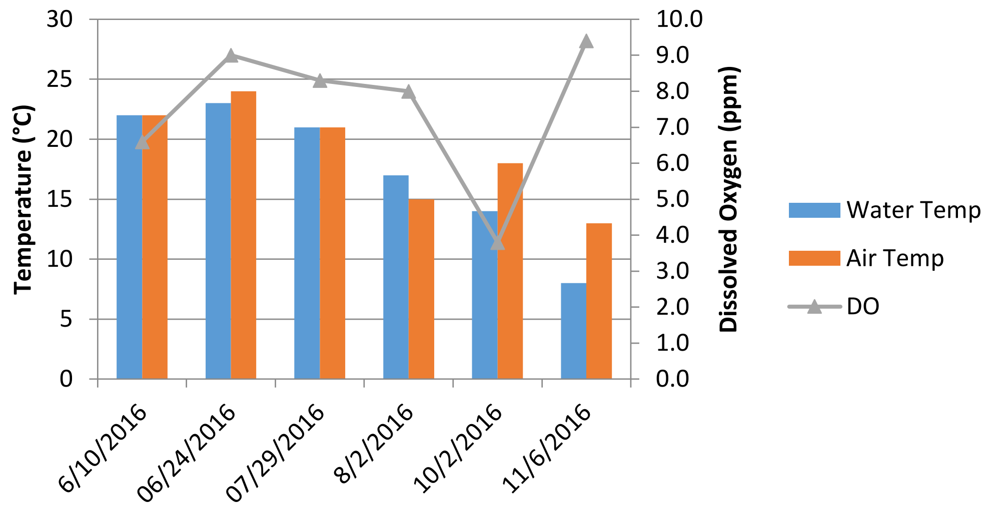


Figure 9: Water Temperature and Dissolved Oxygen

Site-Specific Results

Since Dissolved Oxygen and temperature are closely linked, they are displayed together for each monitoring site. Depth measurements are also included where they exist. Parameter readings that exceeded their limits for healthy ecosystems are also discussed in this section.

WQ1- McGee Creek at Sedge Wren Marsh (Carden Alvar)

The Sedge Wren Marsh site is a man-made (ditched) section of McGee Creek approximately half way between the head and tail of the Creek. McGee Creek eventually empties into Canal Lake. It is in a wetland and high levels of decaying organic matter are always a factor in results from this site.

While we had a regular team testing at this site in 2015, we only managed one monitoring visit on **May 6, 2016**:

Air T (degC)	Water T (degC)	Water Depth (cm)	pH	DO (ppm)	Phosphate (ppm)	Turbidity (JTU)	Alkalinity (ppm)	Nitrate (mg-N/L)
21.5	11.5	n/a	7.0	6.2	0	0	196	0

Based on our water temperature data from 2015 and 2016, we are tentatively classifying this section of McGee Creek as "Cool Water".

All the tests taken on May 6, 2016 are within a healthy range. We hope to assign a team to this site in 2017.

While it is beside a road, the road is not maintained in winter and testing for road salt is not an issue.

WQ3- Perch Creek at Doyle Road (Carden)

The Perch Creek at Doyle Road site is a natural stream, south of Perch Lake.

Dissolved Oxygen concentrations at this site consistently remained within the ideal range to support aquatic life. Unlike the Perch Creek Headwaters site upstream, this site never dried up completely.

It is close to a riffle area, which agitates the water surface, allowing more oxygen to mix into the water column. This acts to offset the effects of high air temperatures of dissolved oxygen concentrations.

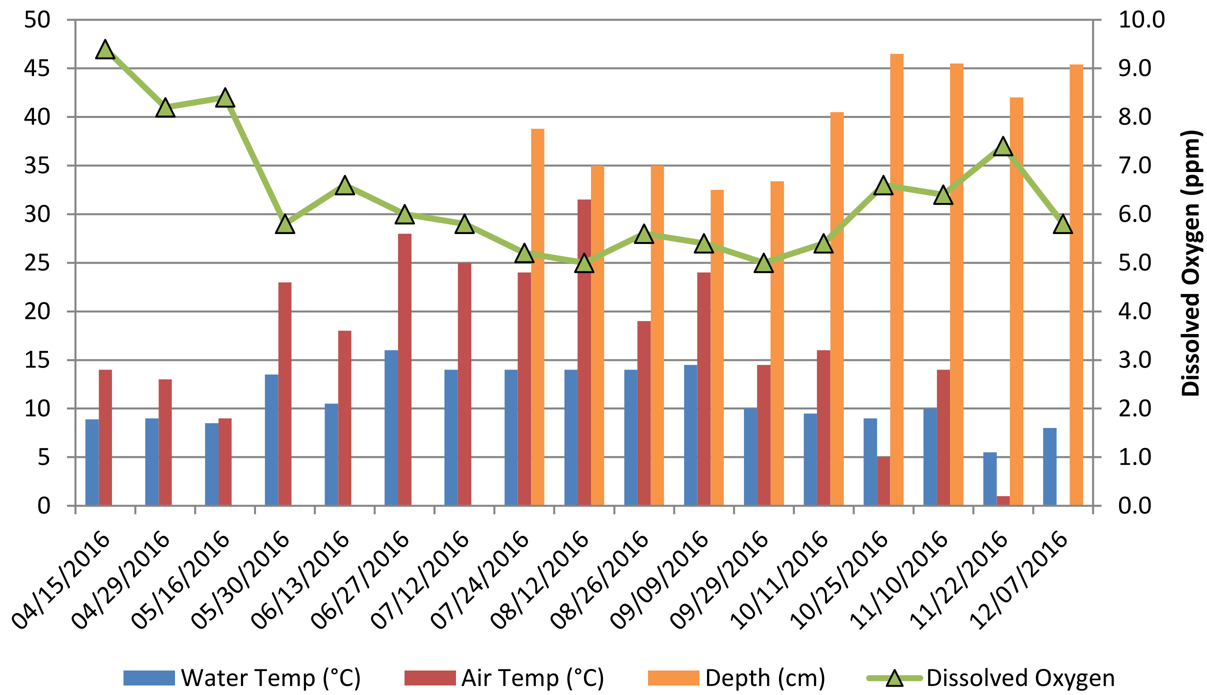


Figure 10: Dissolved Oxygen, Temperature and Depth at WQ3 during the 2016 monitoring season. Note that depth readings commenced July 24th.

Perch Creek at Doyle Road is the only site that maintained the same water temperature range throughout 2015 and 2016, never rising above 16 degrees Celsius.

It appears to be a very clean and healthy site which can support cold-water species. The only caveat is that it is road-side, and Chloride testing should be added to monitoring at this site in winter to study road salt.

WQ4- Talbot River at Doyle Road (Carden)

Talbot River at Doyle Road is just below Raven Lake, a shallow lake known for its Marl Lake bottom visible in satellite photos. Marl is a precipitate that forms on the bottom of the lake because of a reaction between groundwater and lake water. If not for a beaver dam at the south end of the lake, Raven Lake would likely be a bulrush marsh. The water is so shallow in this lake that it may be warming up with water before it heads downstream to our testing site at Doyle Road. By the time this water gets to our next site at Upton Bridge, it has merged with the cold waters of Perch Creek.

There are mussels visible in the water at this site, which we have yet to identify.

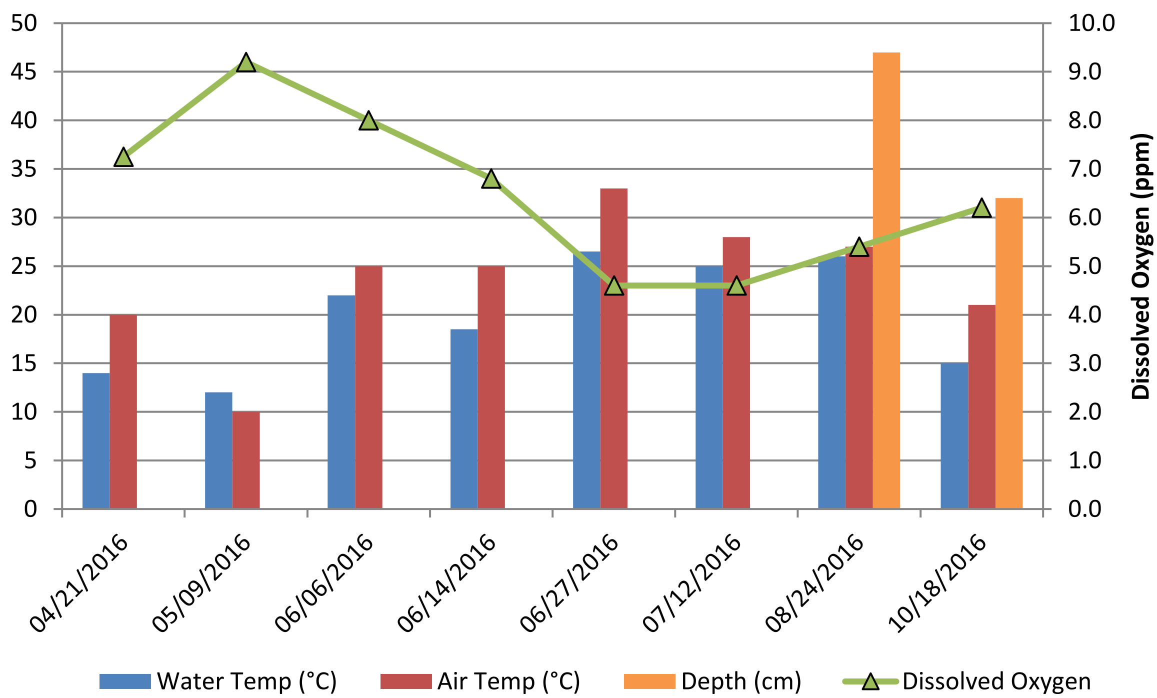


Figure 11: Dissolved Oxygen, Temperature and Depth at WQ4 during the 2016 monitoring season. Note that the first depth measurement was taken on August 24th.

The concentration of dissolved oxygen at WQ4 remains consistently within the range required to sustain aquatic life, with some drops into the stressful range during midsummer and is generally consistent with the known relationship between water temperature and dissolved oxygen.

Site	Date	Water Temp. (˚C)	pH	DO (ppm)	Phosphate (ppm)	Nitrate (mg-N/L)	Alkalinity (ppm)	Turbidity (JTU)	Comments/ Weather in Past 24 hrs
WQ4	04/21/2016	14	8.0	7.3	0	1	148	0	Sunny, no precipitation

We have had two Nitrate-Nitrogen readings of 1 in 2015, and one Nitrate-Nitrogen reading of 1 in 2016, with no correlation between time of year (April, July, September). The readings are, at this point, not a cause for concern and could be naturally occurring. As a road-side site, chloride testing should be added in 2017.

This is a natural watercourse.

WQ5- Talbot River at the Upton Bridge

Perch Creek and the Talbot River merge at Upton Bridge. The water at Upton Bridge is wide and shallow, allowing for atmospheric oxygen to diffuse into the water more readily, accounting for high DO concentrations at high temperatures.

The dissolved oxygen concentrations at the Upton Bridge site were consistently within the range required to support aquatic life.

The highest recorded summer temperature at this site was cooler in 2016 than in 2015.

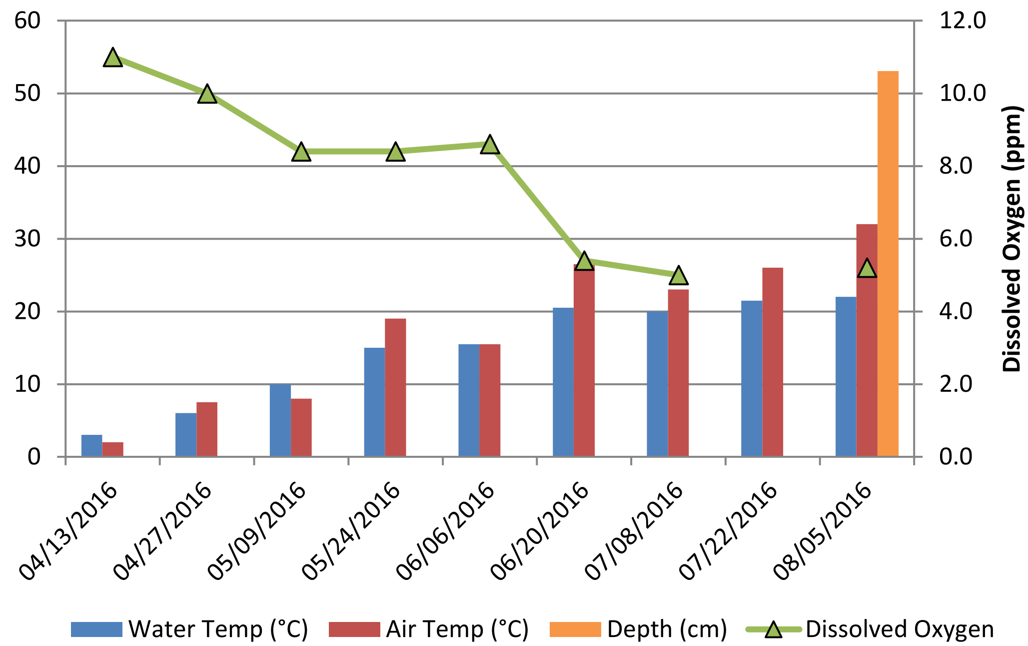


Figure 12: Dissolved Oxygen, Temperature and Depth at WQ5 during the 2016 monitoring season. Note that only one depth measurement was taken on August 5th.

Chloride testing should be added at this site in 2017.

WQ6- Talbot River South of Talbot Lake

This site is below Talbot Lake, a very shallow lake virtually empty of development and supporting Wild Rice.

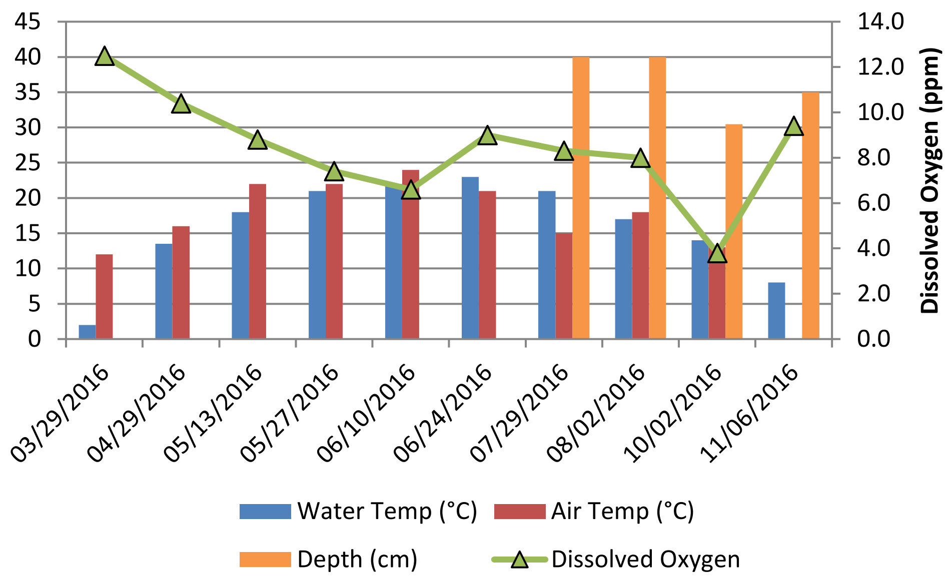


Figure 13: Dissolved Oxygen, Temperature and Depth at WQ6 during the 2016 monitoring season

The dissolved oxygen concentrations at WQ6 remain within the range required to support aquatic life, with one noticeable drop to a concentration that would be stressful to aquatic organisms occurring in October. This DO drop may be due to the fall lake inversion upstream, or to decaying plant material taking up oxygen.

In 2015, several instances of high phosphate and nitrate concentrations were observed at this site. This was not the case this year, as concentrations of these nutrients remained at 0 ppm. This could indicate an increase in overall water quality, though it is also possible that the drought conditions that persisted throughout 2016 prevented runoff from entering the stream. Further monitoring at this site is required to determine which scenario is more likely.

The highest recorded summer temperature at this site was cooler in 2016 than in 2015.

WQ7- Talbot Headwaters

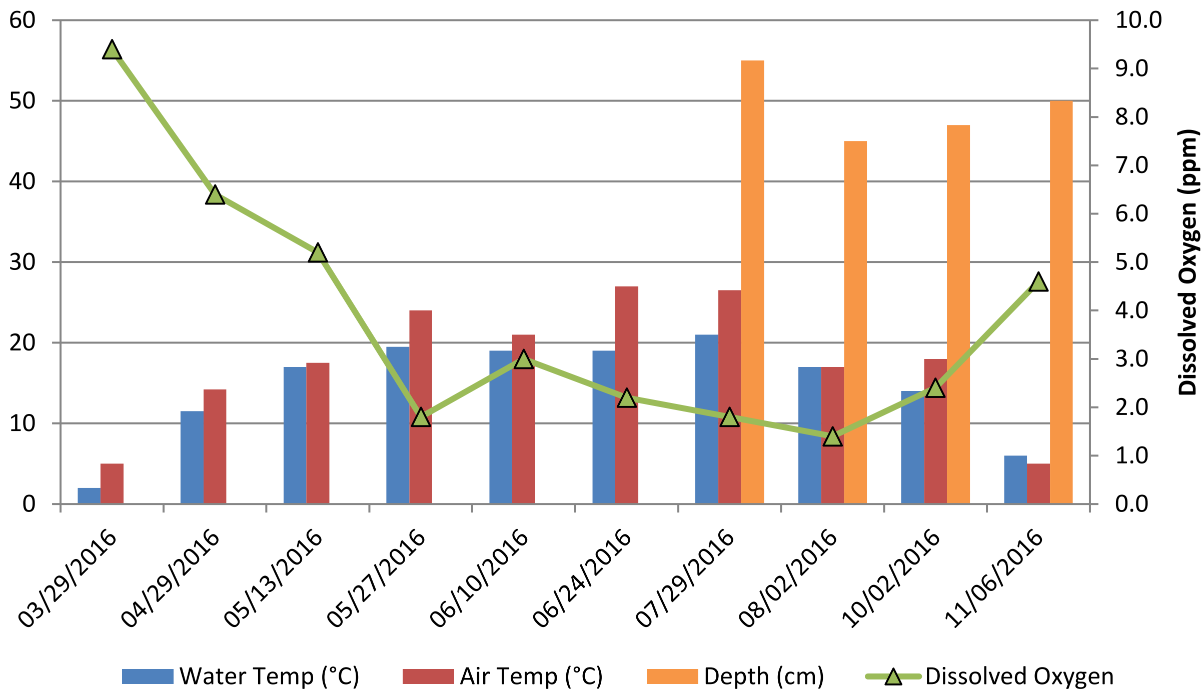


Figure 14: Dissolved Oxygen, Temperature and Depth at WQ7 during the 2016 monitoring season

The dissolved oxygen concentrations at the Talbot Headwaters remained consistently within the range that is stressful to aquatic organisms, rising only in the spring and late autumn. The low concentrations during summer and early through mid-autumn were also seen during the 2015 monitoring period.

Higher concentrations of nitrate and phosphate that were observed at this site in 2015 were not observed this year. In 2015, backhoe activity to remove a beaver dam and a beaver left the river bottom dredged down to gravel.

WQ8- Perch Creek Headwaters

Perch Creek is a cold water stream with an underground aquifer as its source. This gives the Perch Creek headwaters its clear, and usually, cold water for most of the year. This headwater site had numerous sightings of caddisfly larvae--their presence acting as an indicator of good water quality. Frogs, dragonflies, damselflies and various species of minnow are also commonly observed at this site. Though a shallow portion of the stream, the headwaters site usually maintained a consistent depth and flow of water during the drier portions of the summer. This was likely due to its ground water source making it less dependent on inputs from surface water. However, as the drought conditions over this summer persisted, the water table in the Carden area dropped. Many ground water sources that sat higher in the water table ran dry during mid to late summer, and the Perch Creek headwaters was among them.

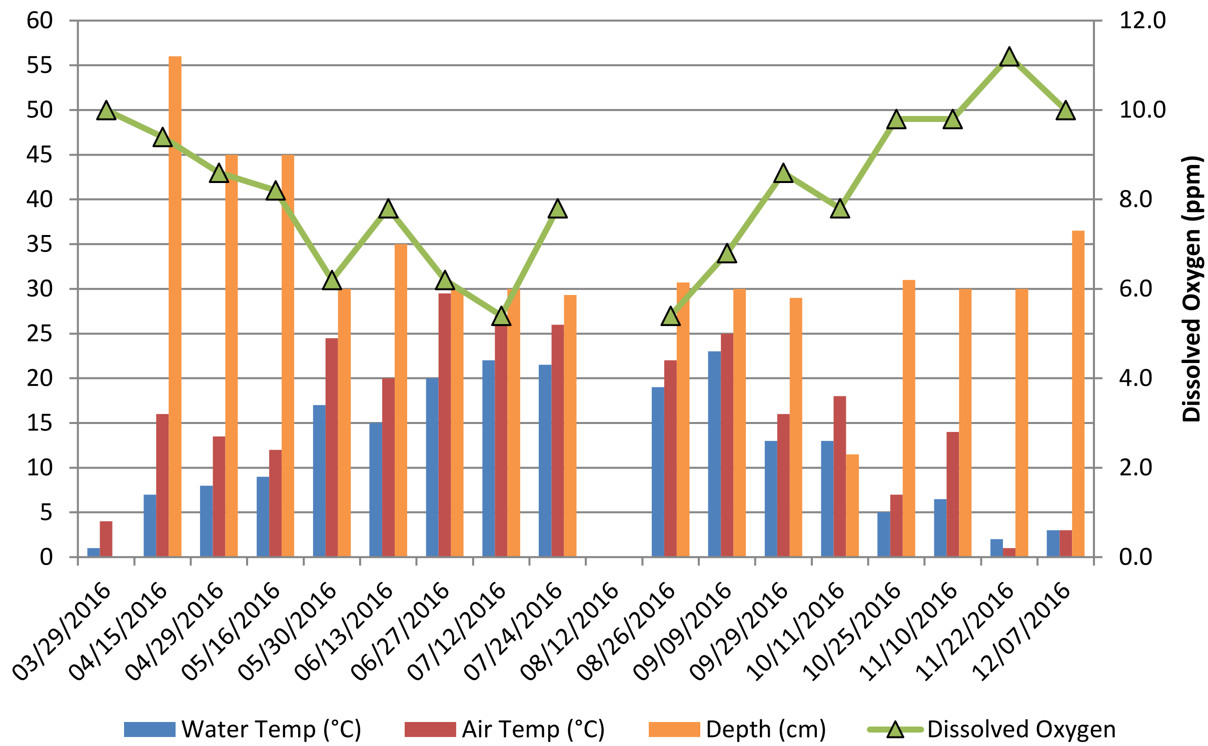


Figure 15: Dissolved Oxygen, Temperature and Depth at WQ8 during the 2016 monitoring season. Note that a depth measure is missing on March 29. This is due to the depth measure being completely submerged during this outing and accurate measurement of depth being impossible.

The dissolved oxygen concentrations at this site remain consistently within acceptable ranges throughout the year. There is a decrease observed on October 11th that is not in line with the known relationship between temperature and dissolved oxygen, possibly due to plant die-off.

WQ9- McGee Creek at Shrike Road

WQ9- McGee Creek at Shrike Road				
Phosphate (ppm)	Nitrate (mg-N/L)	Alkalinity (ppm)	pH	Turbidity (JTU)
0 - 0.2	0 - 0.5	164 - 262	7.0 - 8.0	0

McGee Creek at Shrike Road is as close to the headwaters of McGee Creek as we have been able to get without securing landowner permission. Unfortunately, above our testing site there is a ranch with cattle accessing the Creek for drinking water.

The first depth measurement was taken on July 29th at less than 2 centimetres, and did not recover until August 19th.

The values for pH, alkalinity and turbidity all fall within the healthy ranges for these parameters. One high concentration of phosphate occurred during the testing period, which was of great interest considering the presence of cattle in the stream. The high phosphate reading occurred following a period of warm and dry weather. It is also worth mentioning that the water level had decreased since the previous visit. Decreases in the water level result in higher concentrations of pollutants. Further monitoring at this site will help to determine whether high phosphate readings are part of a pattern.

The 0.5 ppm nitrate-nitrogen reading occurred following a period of heavy rainfall, indicating that runoff may have been a factor.

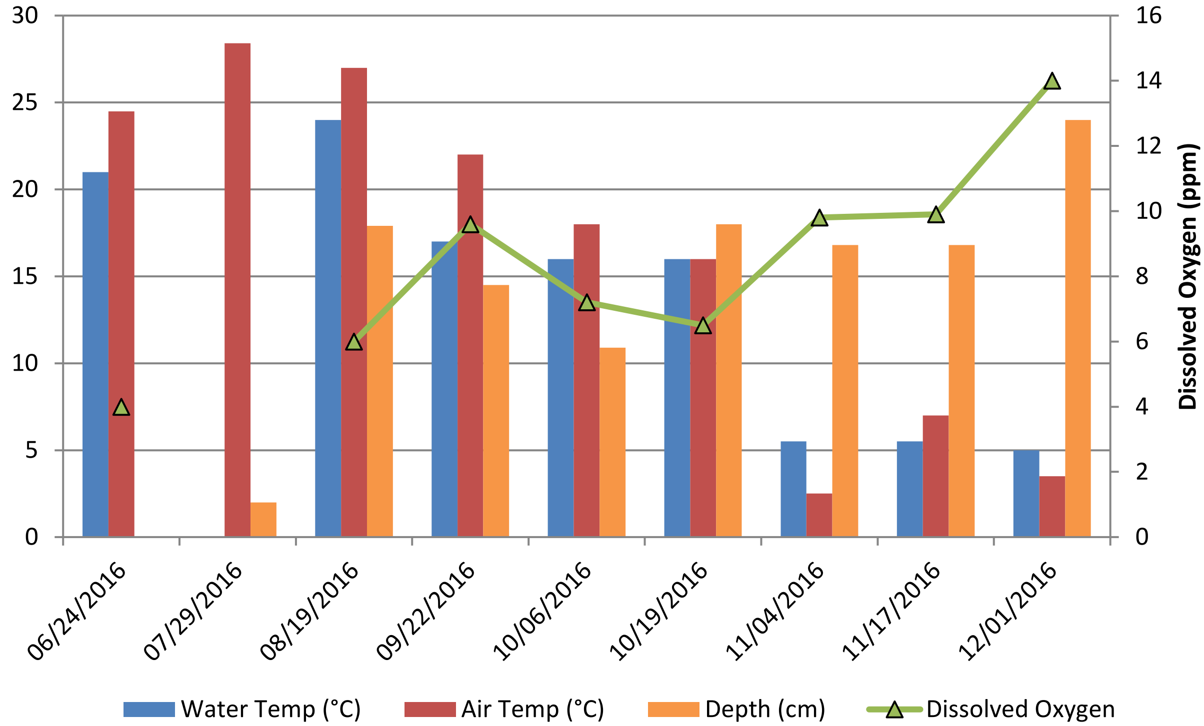


Figure 16: Dissolved Oxygen, Temperature and Depth at WQ9 during the 2016 monitoring season. Note the first depth measurement was not taken until July 29th.

Dissolved oxygen concentrations at this site are within healthy ranges. Note that this site also experiences a decrease in dissolved oxygen concentration during autumn. Further monitoring at this site will determine whether or not this is a trend.

In 2017 Chloride Testing should be added at this site, and if any phosphate readings above zero are noted, a water sample should be sent to the lab.

WQ61- Sundial Creek at Grant Wetland (aka Fittons Creek)

WQ61- Sundial Creek at Grant Wetland				
Phosphate (ppm)	Nitrate (mg-N/L)	Alkalinity (ppm)	pH	Turbidity (JTU)
0	0 - 4	200 - 316	7.5 - 8.5	0 - 40

The Couchiching Conservancy owns a 20-acre property within the City of Orillia bound by Fittons Road, Bay Street, and Maple Drive. Grant Wetland has two main waterways flowing through it: one named Sundial Creek and the other we have named “Bay Street Drainage”.

Sundial Creek has historic significance in Orillia as a source of water for hydroelectric generation, and as a cold-water creek sustaining cold-water fish species such as Brook Trout. It is sourced from underground springs originating further up Fittons Road that were known as the Fittons Springs in the 1800’s. The MNRF took efforts to naturalize the stream in the 1980’s by creating riffles and pools, to support a population of Brook Trout occurring naturally in the Creek.

While the Creek is in many respects healthy, it is also under a great deal of pressure from urban development.

Our first visit to monitor the water quality of Sundial Creek was on May 4th 2016:
We arrived to a clear cold stream, and videotaped minnows, including a rare sighting of a Trout-Perch (the evolutionary link between the Trout and Perch before they separated into two species). We conducted the standard water tests and all tests were in a very healthy range. Nitrate-Nitrogen was Zero. We walked away for a moment and turned around to find the Creek very quickly filling with silt. At the time, construction was taking place on Fittons Road. We undertook more tests, and our results indicated the increased Turbidity and lowered Dissolved Oxygen levels that would be expected due to siltation. The Nitrate-Nitrogen level increased to One.

We notified the City of Orillia recommending that the construction company working on Fittons Road be instructed to improve their silt barriers in case this was the problem.

We believe there are two main stress points on Sundial Creek: Siltation and high Nitrate-Nitrogen levels.

<u>Siltation:</u>

Siltation has been visible in Sundial Creek throughout 2016, and is of concern because it can:

- Suffocate fish eggs such as Brook Trout
- Introduce pollutants
- Alter the substrate of the streambed, which is visible in the photo below. The streambed should be a dark muck and instead now it is a sandy silt.

Sandy silt is clearly visible on June 2, 2016, one month after the event our water team witnessed on their first visit to the site May 4th.

High Nitrate-Nitrogen Levels:

Our first test at Sundial Creek had a Nitrate-Nitrogen reading of 0 ppm. After the siltation event, we re-tested and Nitrate-Nitrogen had increased to 1 ppm. The Nitrate-Nitrogen levels have remained high enough to consider the Creek polluted, but low enough that it is not considered a hazard to human health.

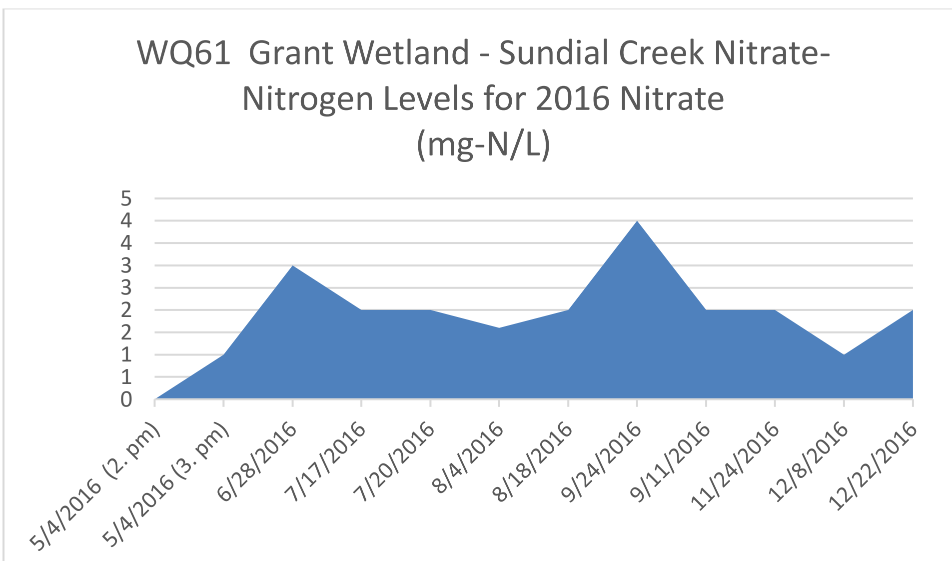


Figure 17: Nitrate-Nitrogen levels at Sundial Creek

Water samples have been collected and taken to the lab according to protocol and have been within our test kit results by 0.5 ppm.

Members of the Water Team presented to the City of Orillia's Environmental Advisory Committee on December 6, 2016, making a case for the EAC to investigate the issues of Siltation and high Nitrate-

Nitrogen levels. The presentation was well received and the EAC has opened an active investigation, and spoken to local media about the issue.

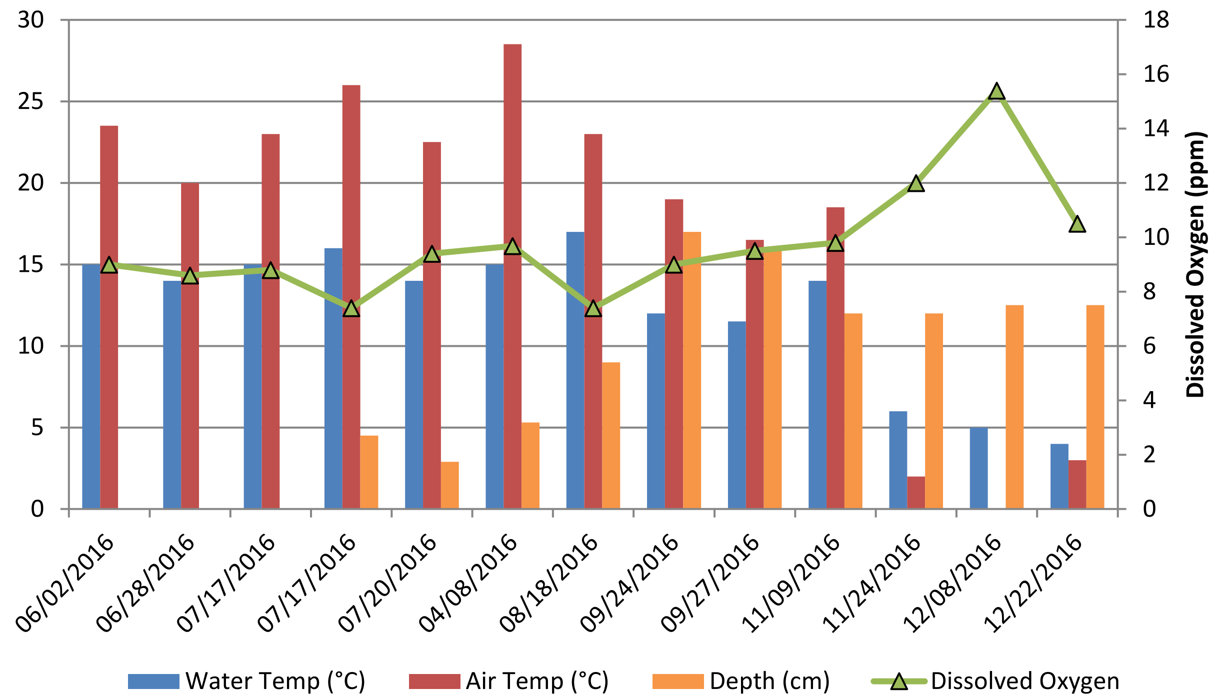


Figure 12: Dissolved Oxygen, Temperature and Depth at WQ61 during the 2016 monitoring season

Overall, dissolved oxygen concentrations at this site are high, and follow the expected relationship with water temperature.

Chloride testing should be added to this site in 2017.

WQ64- Mill Creek at Scout Valley

Phosphate (ppm)	Nitrate (mg-N/L)	Alkalinity (ppm)	pH	Turbidity (JTU)
0	0	14 - 340	7.5 - 8.2	5 - 50

The values at this site for phosphate, nitrate and pH consistently fall within healthy ranges for these parameters. The minimum value of alkalinity (14 ppm) was observed on November 15, 2016, and falls below the minimum concentration of alkalinity typically seen in freshwater streams. This value is preceded and followed by much higher values, and coincides with the lowest observed pH value, 7.5. While it is possible that this alkalinity reading was due to human error, it is also possible that this value reflects a spike in acidity in the water.

Turbidity values at this site fall within acceptable ranges, with a few observations above the upper 40 Jackson Turbidity Unit limit occurring. These observations tend to coincide with precipitation events, and are likely the result of soil from the surrounding area washing into the stream during and following these events.

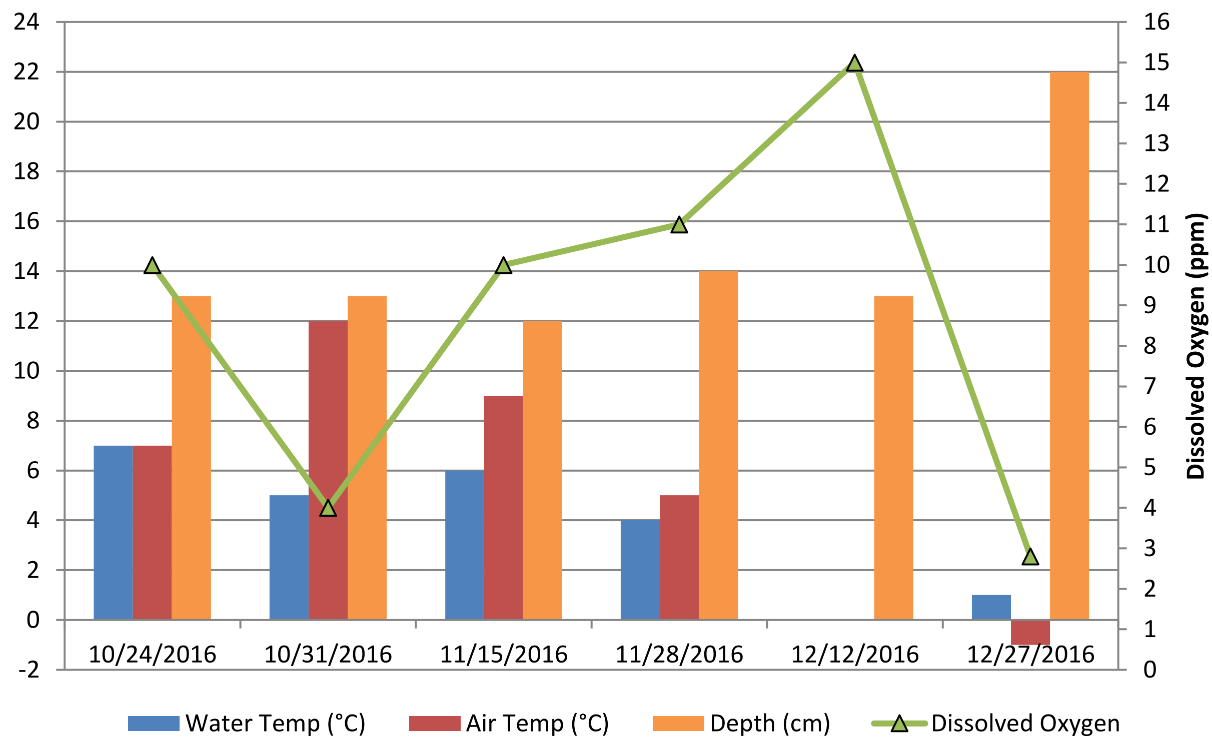


Figure 13: Dissolved Oxygen, Temperature and Depth at WQ64 during the 2016 monitoring season

This site also appears to exhibit the autumnal decrease in dissolved oxygen, as well as a significant dip during late winter. As monitoring at this site continues, we hope to gain a better understanding of the typical dissolved oxygen and temperature profiles at this section of the stream, so that we may draw conclusions more effectively.

This site should be monitored closely in 2017 due to nearby construction on the Old Barrie Road.

WQ65 – 67 Grant's Creeks (at the Grant's Woods Conservation Centre)

Grant's Woods is a 21-hectare parcel of mature upland forest owned by the Conservancy.

Two creeks meander through the property and merge, eventually joining the North River and flowing into Nottawasaga Bay on Lake Huron.

The source of the creeks is underground springs, which are also the source for Silver Creek, an important Coldwater stream in Severn Township.

In the late autumn of 2016, we began monthly monitoring of these creeks at three sites within Grant's Woods. Since the creeks frequently dry up completely in summer, testing parameters are limited to Depth, Water Temperature, and Air Temperature, with a spring test for all 8 parameters at the point where the two Creeks merge.

Our goal is to understand the water quality and aquatic species in this creek, and monitor any changes in depth and temperature over the long term. We believe this will help us understand the impact of climate change and/or the impact of development surrounding the property.

We started monitoring these Creeks October 6 and look forward to a full year of monitoring data in 2017:

WQ66 Grant's Woods East Creek Bridge G	**Air T (degC)**	**Water T (degC)**	**Water Depth (cm)**
Oct. 6 2016	16	15	13
Nov. 3 2016	11.5	11.5	13
Dec. 6 2016	4	6	7

WQ67 - Grant's Woods West Creek Bridge P	Air T (degC)	Water T (degC)	Water Depth (cm)
Oct. 6, 2016	N/A	N/A	0
Nov. 4, 2016	9	10.5	6.5
Dec. 7, 2016	2	4	11

Copeland Forest (Coldwater River, Sturgeon River & Matheson Creek)

The Copeland Forest is a 4,400 acre Resource Management Area owned and managed by the Ministry of Natural Resources and Forestry (MNRF). It contains high quality mature upland deciduous forest as it undulates and eventually drops 55 metres to a complex of wetlands containing the headwaters of three major watersheds that all drain into the Georgian Bay.

The Conservancy began a project with the MNRF in 2011 to engage users of the Copeland Forest in stewardship of the land, which resulted in the formation of the Copeland Forest Friends Association in 2015.

Twelve volunteers monitor seven sites in Copeland Forest, with the majority of testing sites in the most heavily used parts of the forest which contains the Coldwater River headwaters. Pressures on the headwaters include two ski resorts and a golf course, road run-off, and a sewage treatment facility.

Water testing for eight parameters took place in October, November, and December, and will resume at spring freshet in 2017. The following are summary results for the first three months:

WQ81 – Copeland Pump House

Air T (degC)	Water T (degC)	Water Depth (cm)	pH	DO (ppm)	Phosphate (ppm)	Turbidity (JTU)	Alkalinity (ppm)	Nitrate (mg-N/L)
8 - 10	5	13 - 25	7.0 - 8.0	7.8 - 15	0	0	164 - 180	0

WQ82 – Coldwater River at the Grand Allee

Air T (degC)	Water T (degC)	Water Depth (cm)	pH	DO (ppm)	Phosphate (ppm)	Turbidity (JTU)	Alkalinity (ppm)	Nitrate (mg-N/L)
2 - 16.5	4 - 12	13.5 - 22.5	8	9.6 - 12	0	0 - 20	216 - 246	0 - 1

WQ83 – Coldwater River at the 5th Line

Air T (degC)	Water T (degC)	Water Depth (cm)	pH	DO (ppm)	Phosphate (ppm)	Turbidity (JTU)	Alkalinity (ppm)	Nitrate (mg-N/L)
8 - 15	7 - 12.5	3 - 6	7 - 8	5.3 - 6.7	0	0 - 7.5	156 - 182	0

WQ84 – Copeland Parking Lot 2

Air T (degC)	Water T (degC)	Water Depth (cm)	pH	DO (ppm)	Phosphate (ppm)	Turbidity (JTU)	Alkalinity (ppm)	Nitrate (mg-N/L)
8 - 15	7.5 - 12	10 - 16	6.5 - 7.25	8 - 8.9	0	0	180 - 212	0

WQ85 – Copeland Coldwater River

Air T (degC)	Water T (degC)	Water Depth (cm)	pH	DO (ppm)	Phosphate (ppm)	Turbidity (JTU)	Alkalinity (ppm)	Nitrate (mg-N/L)
-1 - 17	2 - 14	14 - 20.5	6.5 - 7.5	7.4 - 11.3	0	0	128 - 224	0 - 2

WQ86 – Copeland Sturgeon River

Air T (degC)	Water T (degC)	Water Depth (cm)	pH	DO (ppm)	Phosphate (ppm)	Turbidity (JTU)	Alkalinity (ppm)	Nitrate (mg-N/L)
1 - 5	2 - 5	42 - 47	6.5 - 7	11.4 - 14	0 - 0.2	0 - 5	116 - 172	0

WQ87 – Copeland Matheson Creek

Air T (degC)	Water T (degC)	Water Depth (cm)	pH	DO (ppm)	Phosphate (ppm)	Turbidity (JTU)	Alkalinity (ppm)	Nitrate (mg-N/L)
3 - 20	1.5 - 12	24 - 44	7 - 7.5	7.8 - 15	0 - 0.2	0	120 - 184	0

Conclusions and Recommendations for 2017

The Second year of the Couchiching Conservancy Water Quality Monitoring Project was a period of expansion in both scope and knowledge. We added new sites throughout the region, forged new partnerships, and are beginning to see trends emerge such as the fall dips in Dissolved Oxygen.

We have a clearer understanding of which streams are cold, cool, and warm, and which steams are more robust during a drought. The two simplest test we perform, depth and temperature, proved their importance during the 2016 drought.

It is gratifying to see that the waters in and around our Conservation lands are generally of good quality. To date, our monitoring efforts reveal that the two issues that compromise water quality are urban and agricultural run-off. Urban run-off, such as the heavy siltation and elevated nitrate-nitrogen levels we are seeing at Grant Wetland, are more serious than anything we have seen yet compared to ranching on the Carden Alvar. Vegetation loss due to streamside grazing may be warming the water and may be compromising habitat for aquatic species, and going forward we will be placing a higher priority on benthic macroinvertebrates in order to test this out.

The following are our recommendations for 2017:

1. Implement Chloride testing at all roadside monitoring sites.
2. Add monthly monitoring of Sundial creek at two stations upstream to assist with efforts to find the source of excess nitrate-nitrogen.
3. Ensure all volunteers understand the lab testing protocol for Phosphates and Nitrate-Nitrogen.
4. Ensure all volunteers understand the importance of regular and systematic monitoring.
5. Place greater emphasis on the identification of aquatic species observed during site visits, and plan for a benthic macroinvertebrate identification day in September 2017.
6. Discontinue testing at the Talbot River South site, and continue to seek volunteers so that testing can resume at Sedge Wren Marsh and Upton Bridge.
7. Monitor Mill Creek Bridge closely during construction of Old Barrie Road.

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Appendix "A" - Definitions

pH is a measure of the acidity or alkalinity of water. A pH range between 6.5 and 8.2 is considered ideal for most aquatic life (Behar, 1997). Additionally, a pH value falling significantly above or below the aforementioned range will affect the availability of nutrients to aquatic plants (Murphy, 2007). Therefore, pH acts as a valuable indicator of ecosystem health.

Alkalinity is closely related to pH, as it refers to the buffering capacity of the water. That is, it determines how resistant to changes in pH the water is. Water with a high alkalinity value (between 100-200 ppm) is able to resist shifts in pH, and thus is more resilient in the face of outside inputs such as acid rain (Murphy, 2007).

Dissolved oxygen (**DO**) refers to the amount of oxygen dissolved in the water. This oxygen is vital to fish and other aquatic organisms for their survival. Oxygen from the atmosphere dissolves into water bodies most readily when the water is rough due to riffles or wind action, and when the water is cool (Murphy, 2007). As such, **temperature** is an important parameter. Not only does it act as an indicator of DO levels in a water body, but the health of aquatic organisms depends on the water maintaining an optimal temperature range.

The table below* describes the possible ranges of dissolved oxygen levels, and what they mean for aquatic life in that system.

Dissolved Oxygen (ppm)	Effect
0 - 2	Not enough oxygen to support life
2 - 4	Stressful to most aquatic organisms
5 - 6	Minimum requirements for surivival, growth and development of warmwater species
6.5-9.5	Minimum requirements for survival, growth and development of coldwater species

*taken from Canadian Council of Ministers of the Environment, 1999.

Nitrate is a source of nitrogen, an important element that provides nutrients to aquatic plants and algae, allowing for their growth and survival. Healthy water bodies tend to have a nitrate-nitrogen level below 1 ppm. Excess nitrogen leads to accelerated growth of aquatic plants, which is detrimental to ecosystem health. Additionally, nitrate concentrations of 3 ppm and above can have direct toxic effects on aquatic organisms over long periods of exposure (Canadian Council of Ministers of the Environment, 2012).

ppm: Parts per million

Similarly, **total phosphate** acts as a measurement of the total amount of phosphate, which is also an important nutrient for aquatic plants. However, as phosphate is naturally present in low amounts, even a small increase in its concentration can produce an adverse effect on ecosystem health through stimulating unnatural rates of plant growth. This occurs when phosphate levels exceed a concentration of 0.1 ppm (Behar, 1997). Elevated levels of nitrogen and phosphate are also indicators of agricultural runoff, as they are components of fertilizer and animal waste (Murphy, 2007).

Turbidity is a measure of the clarity of the water, and determines how far light can travel within the water column, and is increased by the presence of suspended solids such as clay, silt, plankton, and organic waste (Murphy, 2007). These solids block the transmission of light, thus limiting the ability of aquatic plants to photosynthesize. They also have the effect of absorbing heat and raising the water temperature, which is detrimental to the dissolved oxygen content (Behar, 1997). In addition to these chemical effects, high turbidity has physical effects on aquatic life, such as damaging fish gills, and smothering bottom-dwelling organisms (Behar, 1997). Turbidity can naturally increase due to rainfall and storm events, but can also be an indicator of excess runoff. A turbidity reading of 40 JTU or less is considered optimal for stream water (Rhode Island River Council, 2007).

The Couchiching Conservancy
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Please Return Data Sheets To:
Dorthea Hangaard dorthea@couchconservancy.ca
1485 Division Road West
(705) 326-1620 (w) (705) 331-0703 (m)

Site Name: __________Grant’s Wetland WQ61 Sundial Creek SE_________________________

Date: _______________________________________ Time: _______________________

Testing Team: ____

Weather in past 48 hours: ____

Air Temp. _________ **Water Temp**. __________**Water Depth** (cm): ______________

pH: ___________________ **Dissolved Oxygen** (parts per million): __________________

Low Range Phosphate (ppm): ______________ **Chlorides** (ppm): _________________

Turbidity (Jackson Turbidity Units JTU): _____________

Alkalinity (PPM): ______________ **Nitrate Nitrogen** (PPM): ______________________

Environmental Observations (plants, wildlife, pollutants, human activity). Note if you don’t know what something is, you can always take a photo or record a sound and submit it for i.d.

Interpreting Results/Healthy Range:

Water Temperature: Temperature preference among species vary widely. All species can tolerate slow seasonal changes rather than rapid changes. Thermal stress or shock occurs when temperatures change more than 1 to 2 degrees Celsius in 24 hours.

pH: A range of 6.5 – 8.2 is optimal for most organisms. Rapidly growing algae or Submerged Aquatic Vegetation (SAV) remove carbon dioxide from the water during photosynthesis. This can result in a significant increase in pH levels.

Dissolved Oxygen: DO levels below 3 ppm are stressful to most aquatic organisms. DO levels below 2 or 1 ppm will not support fish. Levels of 5 to 6 are usually required for growth an activity.

Low Range Phosphate: Total phosphate levels higher than 0.03 ppm contribute to increased plant growth (eutrophication). Total phosphate levels above 0.1 ppm may stimulate plant growth sufficiently to surpass natural eutrophication rates.

Turbidity: The ideal range for turbidity in stream water is generally considered to be between 0 and 40 JTU.

Alkalinity: High Alkalinity in a body of water means that it is more stable and resistant to changes in pH. A Total Alkalinity of 100 to 200 ppm will stabilize the pH in a stream. Levels between 20 and 200 ppm are typically found in fresh water.

Nitrate-Nitrogen: Unpolluted waters generally have a nitrate-nitrogen level below 1 ppm. Nitrate-nitrogen levels above 10 ppm are considered unsafe for drinking water.

<u>If something falls outside of the healthy range described above, please follow this protocol:</u>

1. Finish all of your tests.
2. Re-do the tests outside of the healthy range
3. If you get the same result a second time, and it is for anything but nitrates or phosphates, record the result and wrap up.
4. If it is nitrates or phosphates which are outside the normal range a second time, collect a water sample using the kit and instructions provided.
5. Either drop the water sample off at the Couchiching Conservancy office, or directly to:

Aquatic and Environmental Laboratory Inc.
3239 Penetanguishene Rd.
Barrie, On (Craighurst) (705) 722-5227
Hours: Mon – Thurs 9 am to 4:30 pm and Fri 9 am to 3 pm