2013 Overview of Pigeon Lake Water Quality, Sediment Quality, and Non-Fish Biota

May 2014

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EXECUTIVE SUMMARY

Pigeon Lake is a large recreational lake located southwest of Edmonton prone to occurrences of blue-green algae (cyanobacteria) blooms. As a result of these blooms and increased stakeholder initiatives to address them, a more intense sampling program was undertaken in 2013. The purpose of the 2013 program was to increase understanding of the water quality and ecology of Pigeon Lake, provide additional information for completion of a nutrient budget, and provide additional information for investigation of watershed and in-lake management options.

Data collected from Pigeon Lake in 2013 (not including fisheries information) consisted of:

- Weekly lake water quality;
- Weekly to bi-weekly stream water quality samples;
- Groundwater quality samples;
- Sediment quality samples; and
- Zooplankton and phytoplankton taxonomy (weekly), and cyanobacterial bloom quality samples.

Pigeon Lake did not exhibit significant vertical variation or stratification in profiles of temperature, dissolved oxygen, pH and conductivity but did show seasonal variability for these and several other water quality parameters. pH, alkalinity and water clarity declined during peak blooms of cyanobacteria while dissolved oxygen concentrations, especially at the lake surface, increased. Chlorophyll-*a* concentrations exhibited a strong positive relationship with total phosphorus but were inversely related to dissolved phosphorus concentrations, suggesting preferential uptake of dissolved fractions of phosphorus by the phytoplankton community.

Stream concentrations of many parameters tended to be highest during the spring runoff and after significant storm events when accumulated upland material was washed into the streams. Concentrations for most parameters at the inflowing streams were generally similar and reflected surrounding land-use while the outflow reflected lake conditions.

Seasonal patterns in stream discharge rates were similar for most inflowing streams, with maximum rates occurring during spring freshet and after significant rainfall events. The outflow had higher measurable flows on most sampling dates relative to inflowing streams and reflected the increasing and decreasing water levels of Pigeon Lake as opposed to runoff conditions. For most nutrient parameters, Zeiner had the lowest loading rates of all inflowing streams despite often higher relative nutrient concentrations due to lower discharge rates. Similarly, although nutrient concentrations in Tide Creek were close to concentrations observed at other inflows, loading rates were often highest at this location.

Groundwater samples had relatively low concentrations of nitrogen parameters relative to Pigeon Lake and the streams with the exception of ammonia which was much higher. Phosphorus concentrations were highest in streams, but lower in Pigeon Lake relative to groundwater. Finally, TDS concentration was higher in groundwater samples relative to the streams and lake, while organic content (measured as TOC and DOC) was lower. Differences observed amongst groundwater samples and relative to lake and stream samples likely reflected chemistry of surrounding geology and not well depth or well age.

Pigeon Lake sediment nutrient concentrations tended to be higher in sediments with higher silt and organic carbon content and tended to be higher in shallow sections of sediment cores (0-10cm) relative to deeper sections (>10cm). However, when normalized for moisture content, nutrient content was relatively similar amongst depths. Shallower samples closer to the shoreline tended to have higher amounts of sand as opposed to mid and deep samples which consisted of higher amounts of silt and clay.

The 2013 Pigeon Lake phytoplankton community shifted from true algal groups with a preference for cooler water temperatures such as Chrysophyceae, Cryptophyceae and diatoms early in the summer to cyanobacteria later in the summer. As cyanobacteria populations became more dominant, diversity of the phytoplankton community decreased. The cyanobacteria community was dominated by species not known to produce microcystin, hence levels of this algal toxin remained low throughout the summer.

Zooplankton density followed the true algae density, showing peaks in most species during the early and late summer. During the cyanobacterial bloom in August, zooplankton density declined likely reflecting issues of cyanobacteria palatability or size which can be difficult for zooplankton to graze. Despite the variation in zooplankton density, community diversity remained constant or increased through the summer likely reflecting a change in the zooplankton community from primarily juveniles to adult forms.

Detailed lake and watershed sampling contributed greatly to the existing data and knowledge base on Pigeon Lake. This supports the development of nutrient budget, understanding of the chemistry and biology of the lake as well as contributes to data requirements for the pursuit of in-lake and watershed methods for controlling nuisance algal blooms.

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ACKNOWLEDGEMENTS

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1.0 INTRODUCTION

Pigeon Lake is a large, shallow lake in central Alberta, highly valued for both its aquatic and recreational resources. It is located approximately 80 km southwest of Edmonton in the Counties of Wetaskiwin and Leduc. Recent severe cyanobacterial blooms have led to an increased concern about the lake's water quality. In order to improve water quality there is first a need to better understand the ecology and chemistry of Pigeon Lake and all the factors that may affect its water quality. To address these data needs, an enhanced lake and watershed monitoring program was initiated in 2012 and expanded in 2013. Data was collected to provide insight into potential causes of blooms, to develop a nutrient budget in order to partition phosphorus sources in the watershed and to objectively evaluate what management approaches may be most appropriate for improving the water quality in the lake. This report provides a synopsis of all 2013 data collected.

Each section of this report summarizes data collected in the open water seasons of 2013. Data collected included:

- Water quantity (levels) and quality data for the lake;
- Water quantity (discharge) and quality data for the major inflowing and outflowing streams;
- Groundwater quality;
- Sediment quality; and
- Phytoplankton and zooplankton data.

Individual sections detail relevant methods, analysis and conclusions and provide insight into why the data is relevant and what the data is indicating about the state of the lake. Although watershed characteristics and potential sources of measured nutrients are included here, a detailed nutrient budget for Pigeon Lake is documented in a separate report.

1.1 History and Settlement

The lake name is a translation from the Cree *Mehmew Sâkâhikan*, which means 'Dove Lake', but by 1858 the name Pigeon Lake was in use (Aubrey 2006). It has been suggested that the name Pigeon Lake refers to the huge flocks of Passenger Pigeons that once ranged in the area. The lake was also previously known as Woodpecker Lake, and the Stoney name is recorded as *Kegemni-wap-ta*.

Pigeon Lake was a gathering place for First Nations peoples and is part of the traditional lands of the Maskwacis people, a part of the Plains Cree Nation, and was described in maps produced by the Palliser Expedition from 1857 to 1860. In 1847, Reverend Robert Rundle received permission to establish a mission on Pigeon Lake from the Hudson's Bay Co. and the Wesleyan Missionary Society. A Hudson's Bay Company post was established on the west shore in 1868. In 1896 the Pigeon Lake Indian Reserve was established on the southeast shore. European settlement began in earnest by the 1900s and logging, commercial fishing, and farming were important livelihoods of early residents. In 1924 the summer village of Ma-Me-O was developed at the south end of the lake on land leased from the Indian Reserve. In 1965, Rundle's Mission was dedicated as a National Historic Monument. Rundle's Mission is now held by the Government of Alberta and managed by the non-profit Rundle Mission Society (Mitchell and Prepas 1990).

Pigeon Lake has become a very popular recreational lake within easy driving distance of more than one million people in the cities of Edmonton, Leduc, and Wetaskiwin. The population of the watershed is estimated at 2500 people (Alberta Municipal Affairs 2014) but increases in the summer because of tourists and summer-only residents. Pigeon Lake has extensive recreational development along its shorelines with ten summer villages, two provincial parks (with campgrounds), and cottage or resort developments along the shorelines in the counties of both Leduc and Wetaskiwin. The watershed also has extensive agriculture, oil and gas, as well as recreational development throughout it.

1.2 Watershed Characteristics

The lake's drainage basin is small (187 km^2) with the lake itself (96.7 km^2) occupying 52% of the watershed area (Table 1-1). The lake is shallow, with a maximum depth of 9.1m and a mean depth of 6.2m (Figure 1-1). Water flows into the lake through a number of intermittent streams draining the west and northwest portions of the watershed (Figure 1-2). The sole outlet, Pigeon Lake Creek, at the southeast margin of the lake, drains toward the Battle River.

Table 1-1 Physical characteristics of Pigeon Lake (from Mitchell and Prepas 1990)

Variable	Value
Elevation (m) [a]	849.48
Surface Area (km^2) [a]	96.7
Volume (m^3) [a]	603 x 106
Maximum depth (m) [a]	9.1
Mean depth (m) [a]	6.2
Shoreline length (km)	46
Mean annual lake evaporation (mm)	664
Mean annual precipitation (mm)	534
Mean annual inflow (m^3) [b]	17.0 x 106
Mean residence time (yr) [b]	>100
Sill elevation (m)	849.8
Watershed Area (km^2)	187
Watershed to lake area ratio	2 to 1

[a] On date of sounding (1961)
[b] excluding groundwater inflow

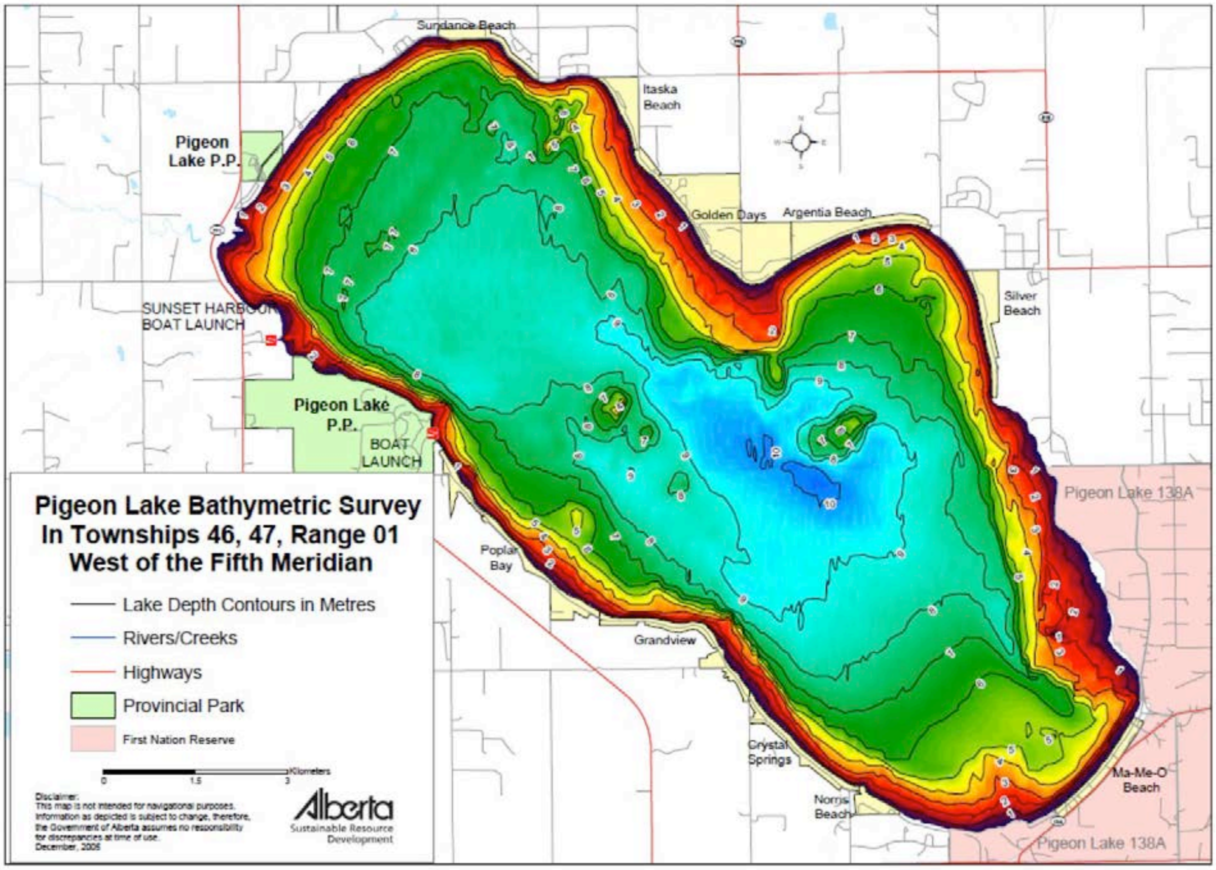

Figure 1-1 Bathymetric Map of Pigeon Lake

Soils throughout the watershed are dominated by moderately well-drained, Orthic and Dark Gray Luvisols that developed from glacial bedrock underlying the area. Most of the soils are classified as III and IV, with low fertility (low in nitrogen, phosphorus, sulfur and organic matter), and are considered to have limited agricultural use. Some areas in the watershed have Class VI soils, which are limited for forage crops and are not feasible for improvement practices (Aquality 2008). Wetlands in the watershed have Gleysols and Organic soils.

The terrain can be level to gently rolling, ranging from 0 to 9% slope (Natural Regions Committee 2006). The lake's watershed consists of 15 subwatersheds (Figure 1-3, Table 1-2). These lie primarily in the Dry Mixedwood Natural Subregion of the Boreal Forest Natural Region. A much smaller portion of these subwatersheds lie within the Central Mixedwood and Central Parkland Natural Subregions. Vegetation in the subwatersheds are typical of their natural subregions; dominated by trembling aspen, white spruce and balsam poplar on upland sites and shrub dominated wetlands or sedge dominated fens and marshes (Natural Regions Committee 2006).

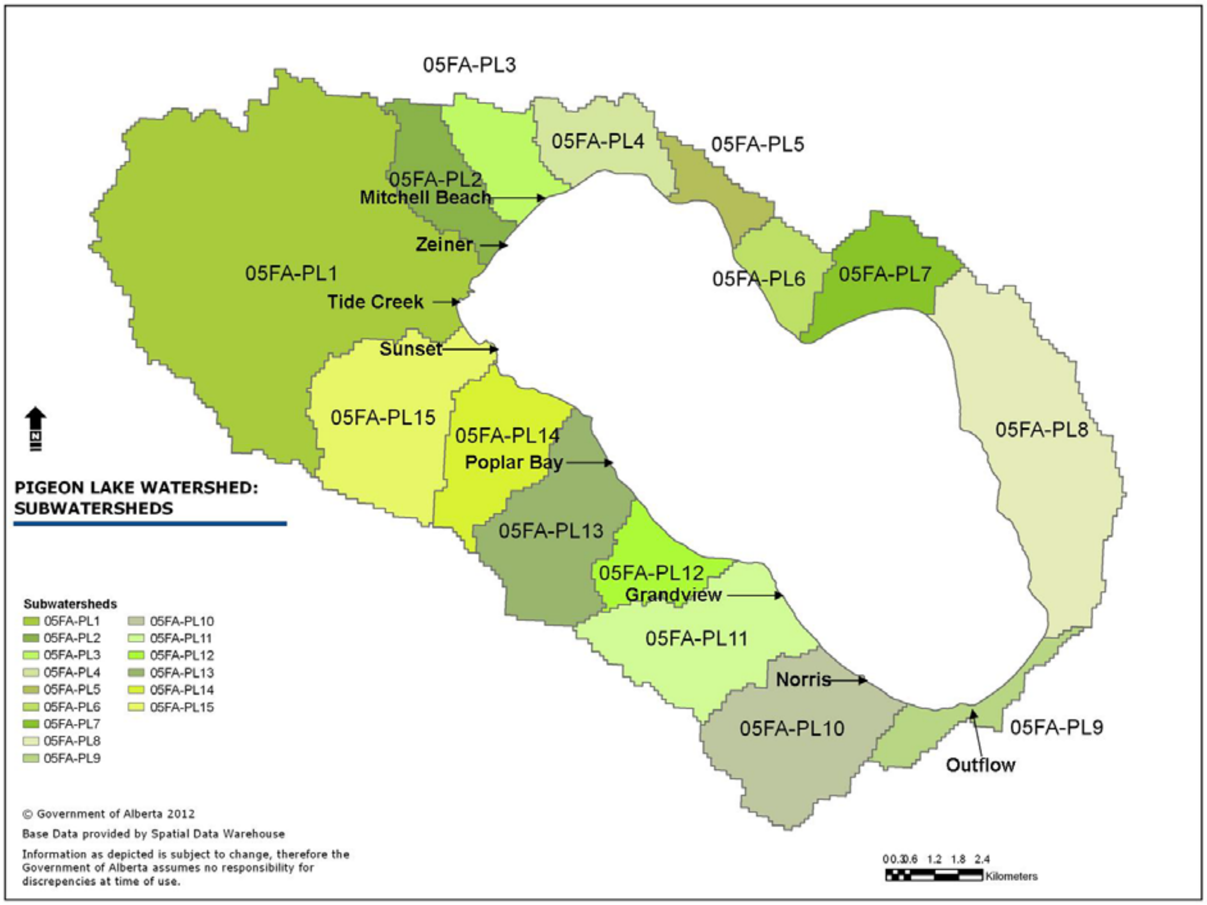

Figure 1-2 Pigeon Lake Sub-Watershed Boundaries and Stream Locations

Over 60% of the watershed has been cultivated or converted to human uses, including urban development (2% of total area), pasture/perennial crops (48%), and annual crops (10%) (Table 1-2, Figure 1-3). A remaining 40% of the landcover is considered undeveloped and include water (1%), such as in tributaries and ponds, wetlands (1%), shrub lands (1%), and forests (35%) dominated by either deciduous or coniferous trees.

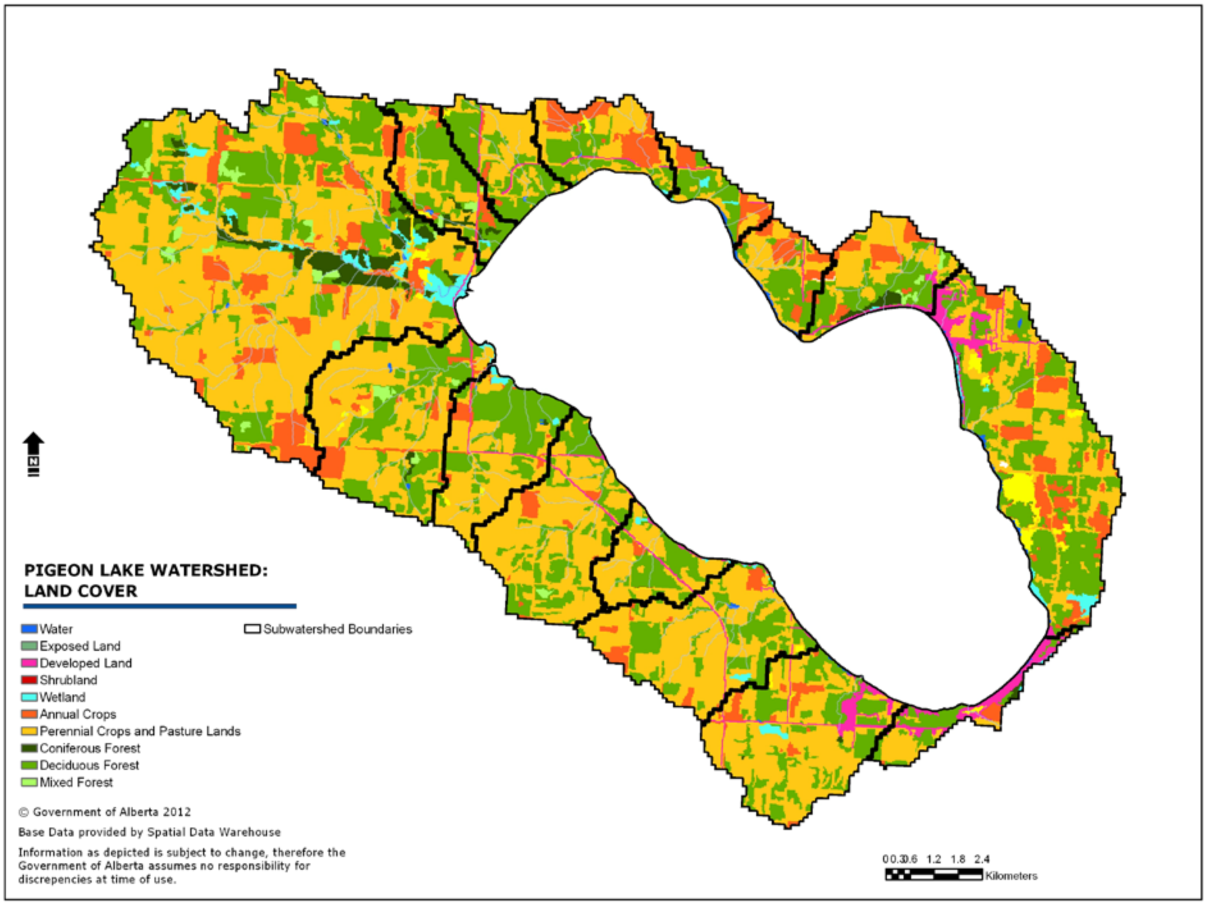

Figure 1-3 Distribution of Landcover Types in the Pigeon Lake Watershed

Table 1-2 Pigeon Lake Watershed Landcover Types [1]

	05FA-PL1	05FA-PL2	05FA-PL3	05FA-PL4	05FA-PL5	05FA-PL6	05FA-PL7	05FA-PL8
LANDCOVER TYPE[1]								
Water	33.2	4.0	5.6	10.1	14.8	23.3	7.8	51.9
Exposed Land	0	0	0	0	0	0.8	1.17	2.25
Developed	7.74	5.4	10.8	8.1	5.9	5.1	28.5	107.6
Shrubland	29.25	4.95	3.51	6.48	0	0	0	111.9
Wetland	142.5	3.51	0	2.07	8.6	0	3.3	41.22
Annual Crops	610.9	76.95	17.37	162	70.01	94.5	82.2	302.9
Perennial Crops/Pasture	3022.1	177.4	214.0	234.2	87.66	147.1	279.4	673.7
Coniferous	294.6	29.43	0.45	0	0	0	28.8	1.62
Deciduous	1297	309.9	273.9	172.6	119.9	140.5	234	906.6
Mixed Forest	90.63	12.87	0.81	0	0	0	16.56	0
Ecological lands	1887.2	364.7	284.2	191.2	143.3	163.8	290.5	1113.2
Built-Up/Urban lands	3641	259.7	242.2	404.3	163.6	247.5	391.2	1087
Total Area	**5528.0**	**624.4**	**526.4**	**595.5**	**306.8**	**411.3**	**681.7**	**2199.8**

	05FA-PL9	05FA-PL10	05FA-PL11	05FA-PL12	05FA-PL13	05FA-PL14	05FA-PL15
LANDCOVER TYPE[1]							
Water	7.0	10.3	7.1	9.9	5.0	17.1	9.6
Exposed Land	0	0	0	0.9	0	0	0.54
Developed	80.28	25.47	19.98	12.6	19.71	101.5	4.32
Shrubland	6.48	3.96	5.4	4.86	0	4.68	8.55
Wetland	13.41	12.33	5.67	14.58	1.62	5.31	7.29
Annual Crops	72.45	71.73	7.65	39.42	46.44	24.64	107
Perennial Crops/Pasture	751.4	769.1	176.7	413.2	751.7	91.32	816.4
Coniferous	2.79	0	0	1.71	0	9.45	8.19
Deciduous	410.7	361.4	180.4	385	364.5	117.9	467.9
Mixed Forest	0	0	0	0	5.94	0	21.96
Ecological lands	440.4	388.0	198.5	416.1	377.0	154.4	523.5
Built-Up/Urban lands	904.1	866.3	204.3	466.2	817.9	217.5	928.3
Total Area	**1344.5**	**1254.2**	**402.8**	**882.2**	**1194.9**	**371.9**	**1451.8**

1. All areas in hectares. Un-developed lands are the combined areas of water, shrub land, wetland, coniferous, deciduous, and mixed forest. Developed lands are the combination of developed, annual crops, perennial crops and pasture.

2.0 LAKE WATER QUALITY

In 2013, Pigeon Lake was sampled 15 times from June through September (Table 2-1). Water quality sampling was conducted at profile and composite sites. The profile site refers to the deepest location in the lake (approximately N53° 01'52.9, W114° 02'02.2) and sampling involved lowering a multi-meter probe from the surface to the sediments, taking measurements every 0.50 m. Secchi disk measurement was also taken at the profile site to determine the depth of the euphotic zone. The composite sample locations consisted of ten predetermined locations around the lake (including the profile site). Composite samples were collected from the euphotic zone using euphotic tubing with a one-way foot valve and pooled into a 10-L jug. This pooling of samples provides a snapshot of lake water quality as opposed to localized conditions at a single site which may not be representative of the entire lake. Results for all composite lake water quality samples collected are included in Appendix 2-1 while profile data is included in Appendix 2-2. Further discussions on individual parameters are presented in the following sections.

Table 2-1 2013 Pigeon Lake Sample Dates

Month	Dates Sampled
June	5, 16, 18, 26
July	4, 10, 17, 24, 29
August	8, 14, 22, 28
September	5, 19

2.1 Physical Parameters

2.1.1 Water Levels

Water levels in Pigeon Lake tend to fluctuate within a one-meter interval typical of many central Alberta lakes (Figure 2-1). Fluctuations in water levels are influenced primarily by rainfall and evaporation and to a lesser extent by groundwater and surface water inflows and outflows (Terry Chamaluk, Hydrologist, ESRD *pers. comm*.). A weir at the mouth of the outlet was initially installed in 1983 by ESRD with approval from the Pigeon Lake Municipalities and permitted for a full supply level (FSL) of 849.935 meters above sea level (masl). In 2008, monitoring revealed that the weir had risen 0.15 m due to frost heaving. Over the next four years, ESRD monitored the structure to ensure further shifting would not occur before taking restorative action. In March of 2013, the weir height was adjusted by ESRD to bring the structure back to the initially permitted FSL of 849.935 masl. This proactive approach was intended to restore the original design and height of the weir to ensure proper function.

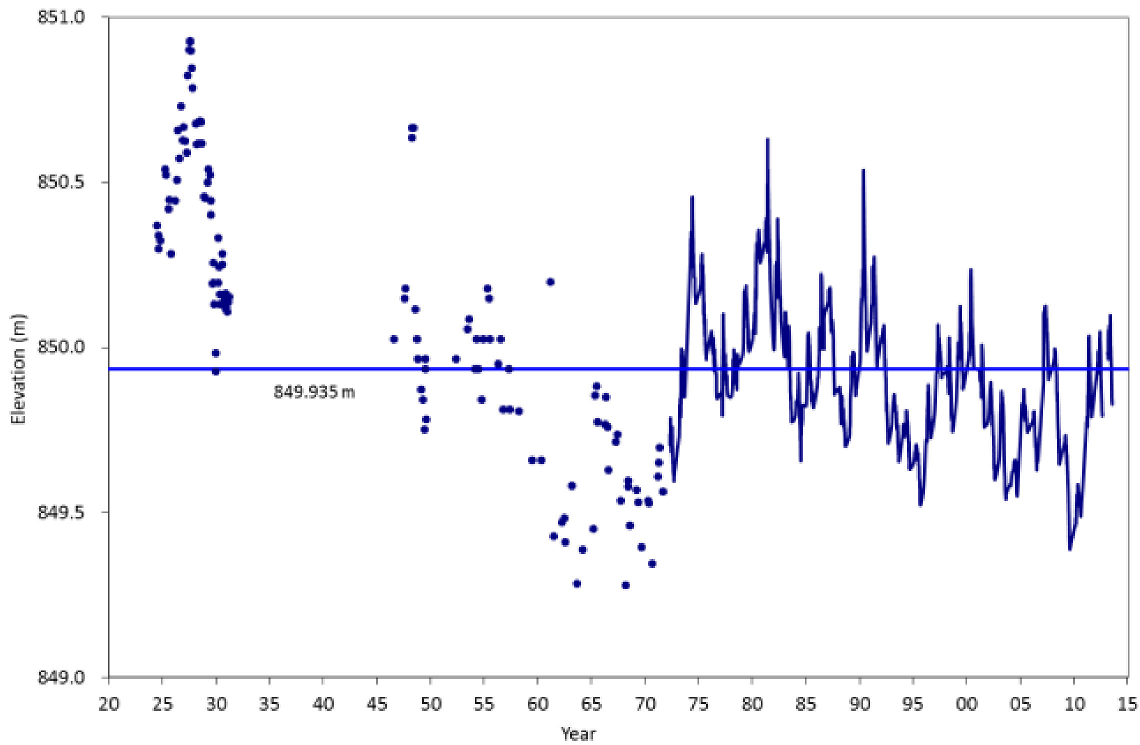

Figure 2-1 Historical Pigeon Lake Water Levels

2.1.2 Water Temperature and Dissolved Oxygen

Given that Pigeon Lake is shallow and has a large fetch, the water column is frequently mixed by wind energy. Temporary weak thermal stratification events may occur on hot, calm days. Temperature and dissolved oxygen concentrations play an important role in the ecology of Pigeon Lake, affecting both fish and non-fish biota as well as influencing severity of nuisance blue-green algae blooms. Temperature and dissolved oxygen were measured on each sampling trip at the profile site with data recorded every 0.50 m.

In 2013, water temperatures were relatively uniform throughout the water column, with weak and deep thermal stratification observed on June 5th, June 26th, and July 4th (Figure 2-2). The absence of strong stratification is not unexpected, as temperatures in 2013 were relatively cool, and wind mixes the water column completely. On June 5th water temperature measured a seasonal minimum of 14.1 °C at the surface and 11.0 °C at the lakebed. By July 24th, temperatures had increased to a seasonal high of 20.1 °C at the surface and 19.4 °C at the lakebed. In mid-August, water temperatures had declined slightly to 19.69 °C at the surface and 18.3°C at the lakebed. Finally, by September 19th, water temperatures measured 17.1 °C at the surface and 16.9 °C at the lakebed.

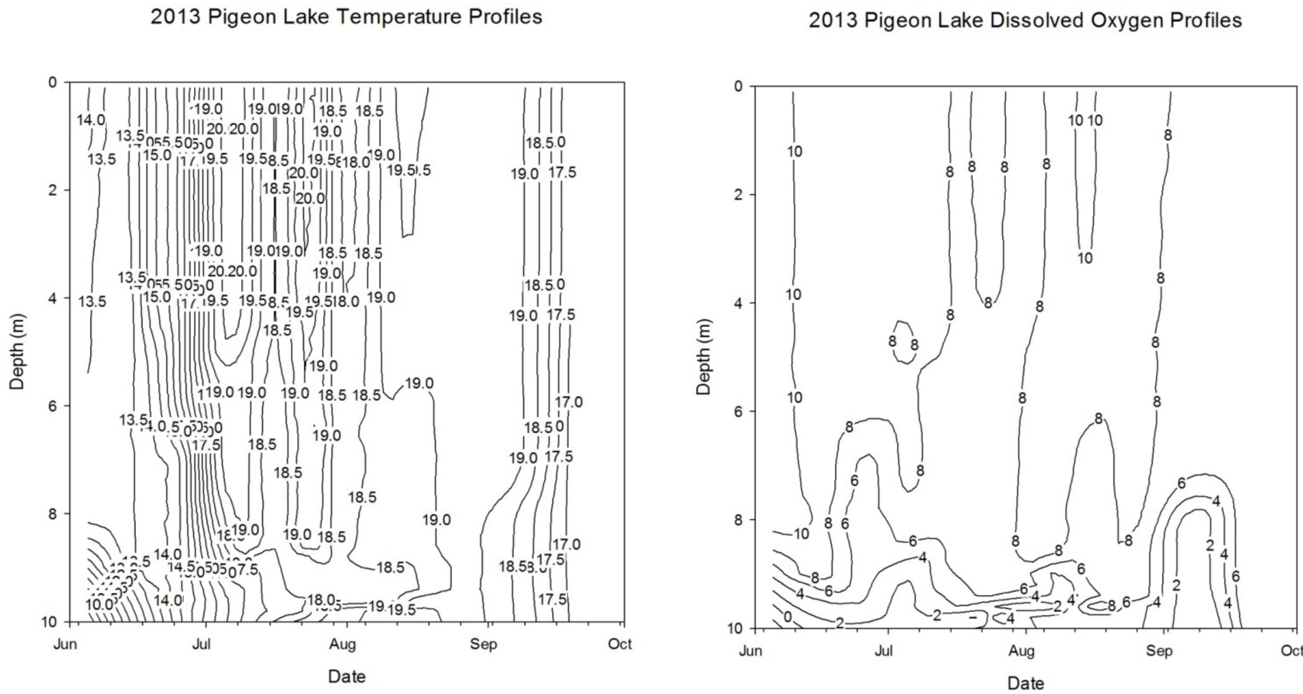

Figure 2-2 2013 Pigeon Lake Temperature and Dissolved Oxygen Profiles

In 2013, dissolved oxygen concentrations measured well above the Alberta and Canadian Council for Ministers of the Environment (CCME) guidelines of 5.0 mg/L for the Protection of Aquatic Life (PAL acute guideline; Figure 2-2). Surface concentrations ranged between a maximum of 11.41 mg/L on June 5th to a minimum of 7.50 mg/L on September 5th. On August 14th there was a notable increase in dissolved oxygen concentration, measuring 10.33 mg/L at the surface. This coincided with the occurrence of a large cyanobacteria bloom and may be the result of photosynthetic oxygen production. This bloom may also help explain the low dissolved oxygen concentrations observed in September, as decomposition of the dying bloom likely consumed large amounts of dissolved oxygen. Ultimately, due to a lack of strong thermal stratification, dissolved oxygen concentrations remained relatively uniform throughout the water column. Anoxia was not observed near the sediments in 2013 - a state which can contribute to the release of nutrients, such as phosphorus, from the sediments.

Pigeon Lake has experienced large fish kills, particularly in 2010, possibly due to high temperatures stressing fish and forcing them into deeper water with little oxygen. In response, fisheries staff from ESRD have begun deploying datasondes which collect temperature and dissolved oxygen data on a much more frequent basis (typically every 15 minutes) at a depth of 1 m in Pigeon Lake. Results from the datasonde deployed in 2013 are presented in Figure 2-3. Temperature rose in the lake from approximately 14 ^{o}C in June to over 20 ^{o}C by early July, remaining at this temperature for the rest of the summer. Dissolved oxygen declined slightly over much of the summer, increasing in mid-August, similar to what was observed during weekly readings.

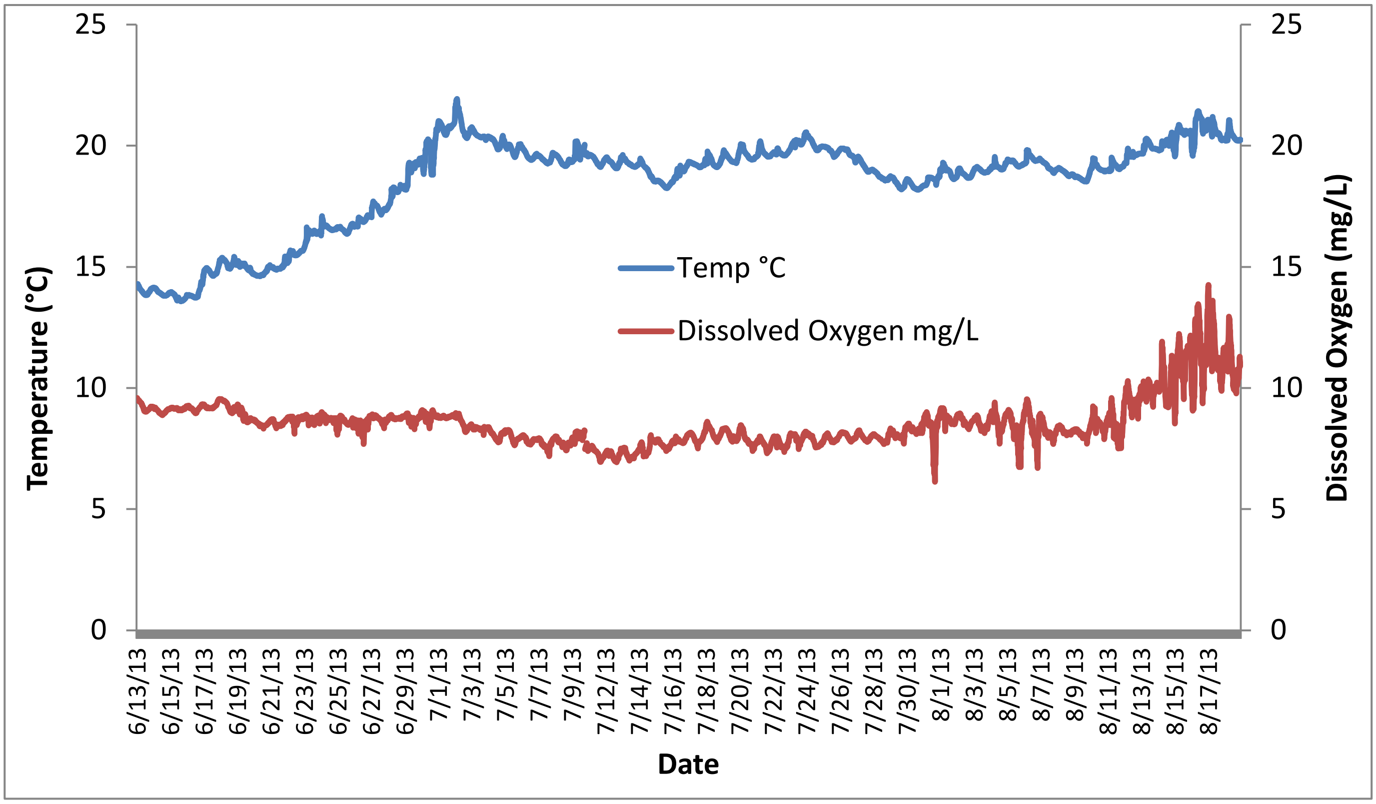

Figure 2-3 2013 Pigeon Lake Datasonde Results

2.1.3 Secchi Disk Depth

Secchi disk depth, a measure of water clarity, can be a useful tool for tracking changes in lake such as changes in colour, suspended sediments, and algae or cyanobacteria densities. An inverse relationship between chlorophyll-*a* concentrations (a measure of algal biomass) and Secchi depth was observed. As algal biomass increased water clarity decreased (Figure 2-4), suggesting phytoplankton, primarily cyanobacteria, is the primary factor affecting water clarity in Pigeon Lake. Recorded at the profile site on each trip, 2013 Secchi disk depths fluctuated from a maximum of 5.70 m on July 10th (coinciding with some of the lowest chlorophyll-*a* concentrations of the season) to a seasonal minimum of 1.50 m on August 28th (coinciding with the highest chlorophyll-*a* concentration of the season; Figure 2-4). By the last sample on September 19th, Secchi disk depth had recovered slightly after the collapse of the cyanobacteria bloom, measuring 2.50 m.

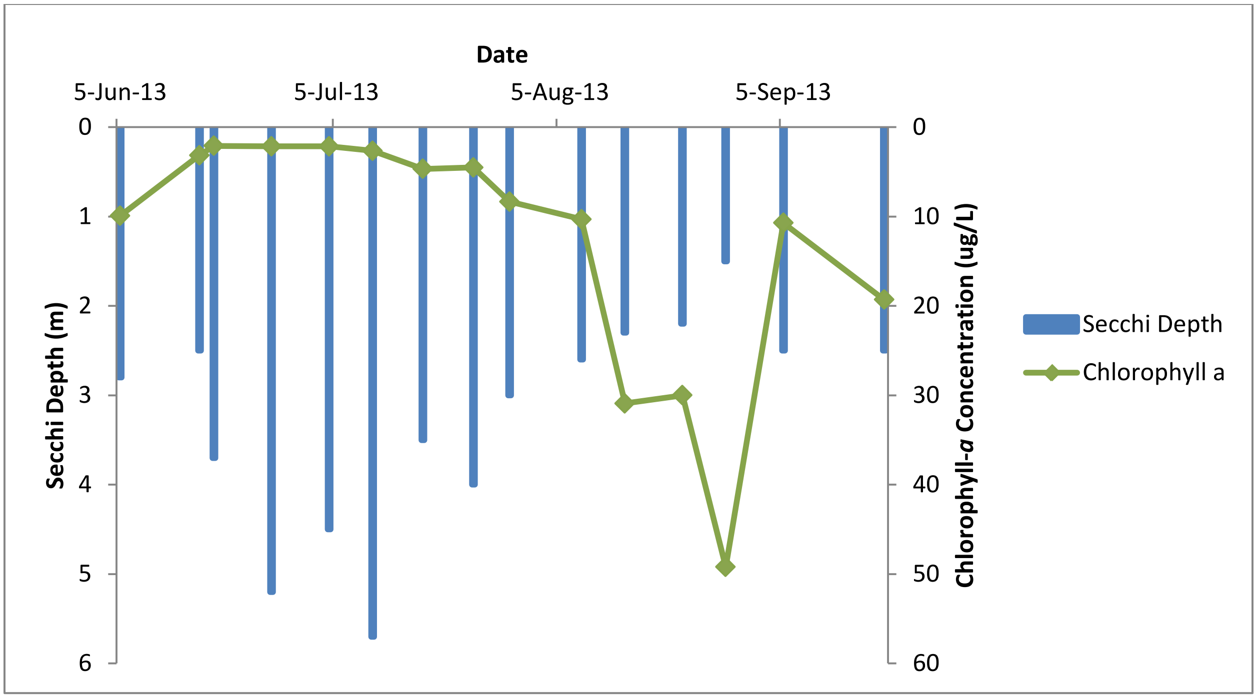

Figure 2-4 2013 Pigeon Lake Secchi Depths

2.1.4 pH and Alkalinity

Measured pH profiles in Pigeon Lake are shown in Figure 2-5. pH was typically higher near the surface while slightly lower at deeper depths. This may reflect both sediment/water chemistry interactions as well as biological processes (*e.g*. photosynthesis), both of which can alter pH. Typically, pH remained above 8.0 throughout most of the water column over the course of the sampling season.

Pigeon Lake alkalinity and pH from composite samples are shown in Figure 2-6. Both parameters showed seasonality, potentially in response to changing primary producer (algae and macrophytes) biomass and corresponding photosynthetic rates. The removal of CO_2 due to photosynthesis increases pH and alkalinity by reducing concentrations of carbonic acid. pH and alkalinity reached a seasonal minimum in mid-July (7.93 and 158 mg/L $CaCO_3$ respectively), though recovered quickly.

The high alkalinity (average = 163.9 mg/L $CaCO_3$) and bicarbonate concentration (average = 194.5 mg/L) in Pigeon Lake help buffer the water from changes in pH. However, a combination of high pH and high bicarbonate concentration may provide a competitive advantage to cyanobacteria over other phytoplankton species as cyanobacteria are able to assimilate bicarbonate as a carbon source (Badger & Price, 2002).

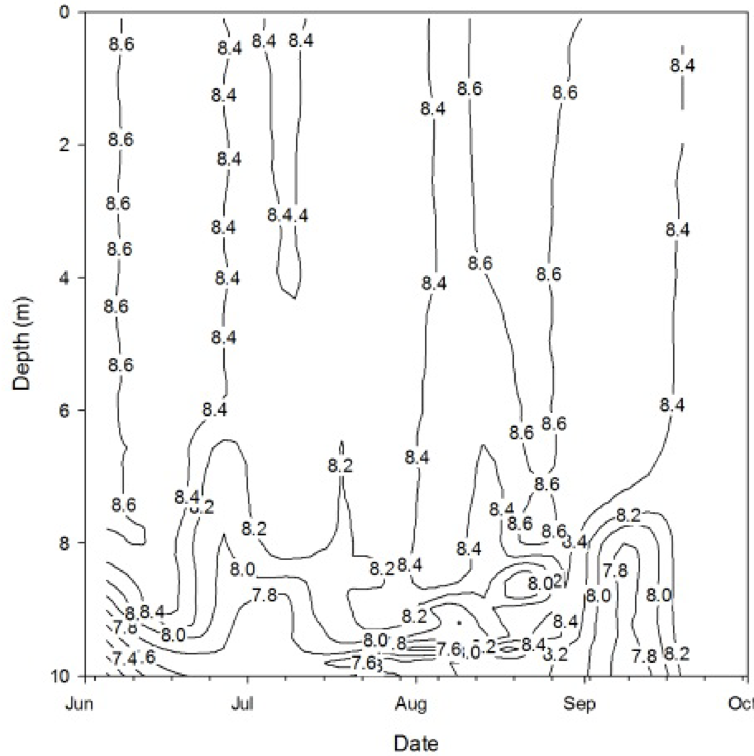

Figure 2-5 2013 Pigeon Lake pH profiles

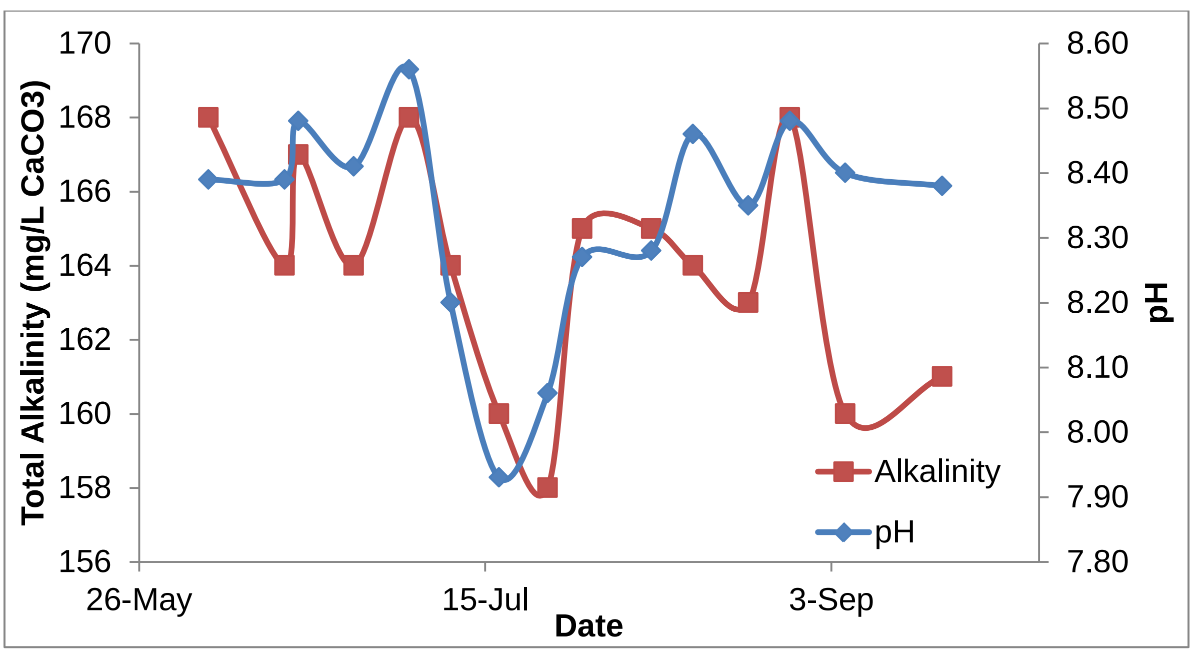

Figure 2-6 2013 Pigeon Lake Total Alkalinity and pH

2.2 Lake Chemistry

2.2.1 Major Ions

Conductivity, an indicator of salinity, may influence the amounts and types of algae and cyanobacteria in a lake. Conductivity of a lake may be influenced by inputs of dissolved solids from runoff or groundwater, and may be altered by climate as precipitation and evaporation will dilute or concentrate salts. In 2013, dominant ions included bicarbonate (194.5 mg/L), calcium (27.62 mg/L), and sodium (20.57 mg/L). Table 2-2 lists the concentrations of major ions in Pigeon Lake. While changes to concentrations of individual ions may be small, cumulative changes across major ions may be observed through changed in conductivity or total dissolved solids (TDS). In 2013, average conductivity measured 320 µS/cm and average TDS measured 176 mg/L. Profile data indicated very little variation in conductivity throughout the open water season in 2013 (Figure 2-7).

Average water hardness for Pigeon Lake was 122 mg/L $CaCO_3$ in 2013. This indicates that Pigeon Lake has hard water, and may be observed as a build-up of $CaCO_3$ in water lines.

Table 2-2 2013 Pigeon Lake Major Ions, Conductivity, Hardness, and TDS

Parameter	2013
Bicarbonate mg/L	194.53
Calcium mg/L	27.62
Carbonate mg/L	3.27
Chloride mg/L	3.19
Magnesium mg/L	12.84
Potassium mg/L	6.59
Sodium mg/L	20.57
Sulphate mg/L	6.38
Hardness (mg/L CaCO3)	122
Conductivity µS/cm	164
TDS (mg/L)	176

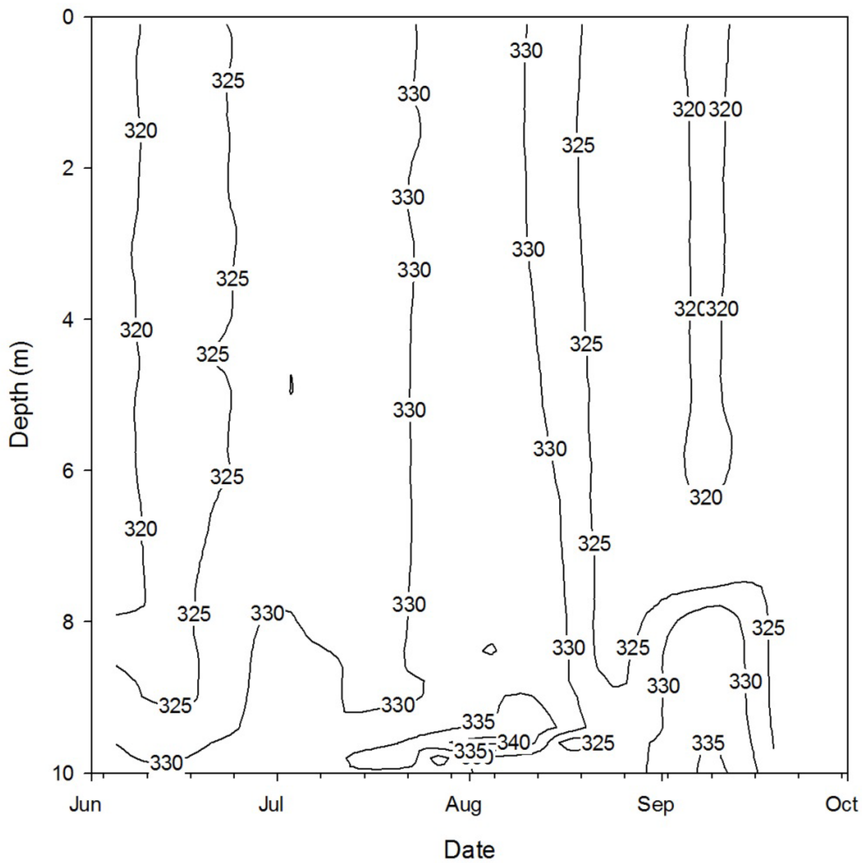

Figure 2-7 2013 Pigeon Lake Conductivity Profiles

2.2.2 Nutrients

Phosphorus and nitrogen are important nutrients which can contribute to the growth of algae and cyanobacteria in Alberta's lakes. While agricultural plants are usually nitrogen limited, phosphorus is usually in shortest supply in aquatic ecosystems and even a slight increase of phosphorus can promote cyanobacterial blooms.

Throughout the summer, total phosphorus (TP) concentrations ranged from a minimum of 16 µg/L on June 5th to a maximum of 56 µg/L on September 19th with a mean of 26.7 µg/L (Figure 2-8). Increasing TP concentrations throughout the summer is commonly observed in well-mixed lakes. Phosphorus released from sediments, entering the lake through runoff or through direct precipitation is constantly mixed into the water column and incorporated into biomass.

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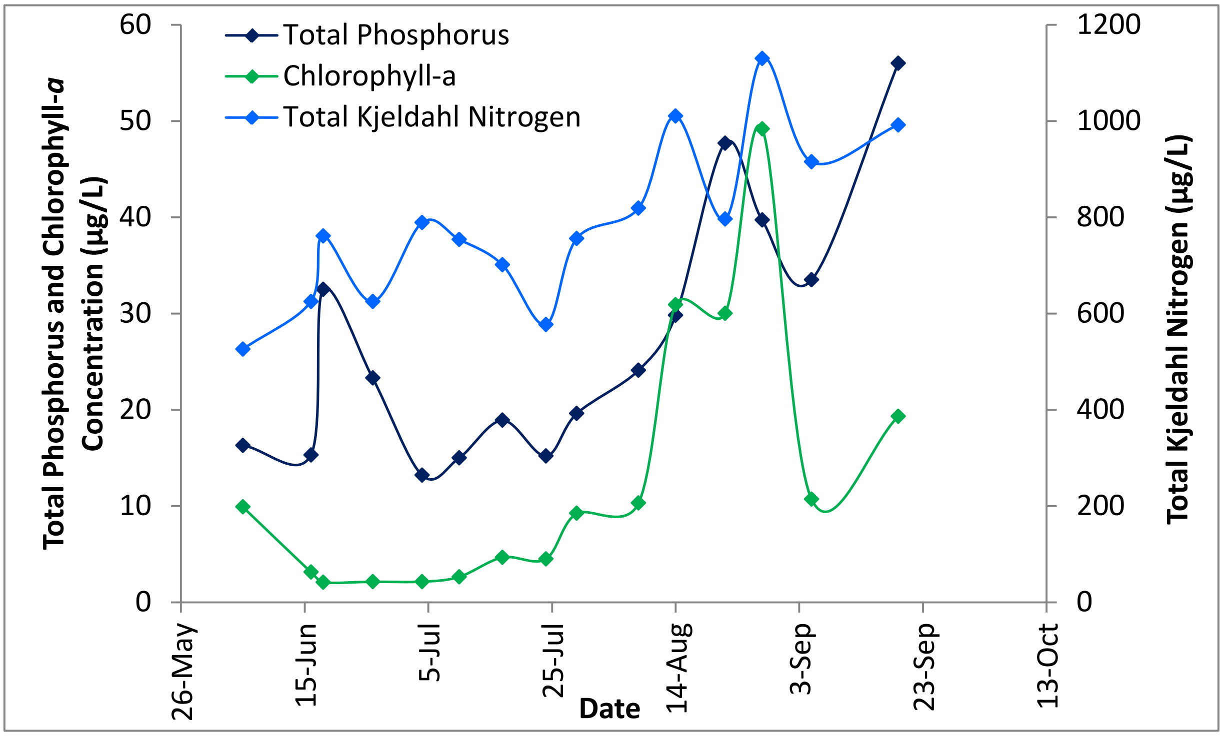


Figure 2-8 2013 Pigeon Lake Nutrient Concentrations

In addition to total phosphorus, both dissolved phosphorus and dissolved ortho-phosphate were collected on all dates from Pigeon Lake. Results from these analyses are shown in Figure 2-9. Of interest is the decline in both fractions corresponding to an increase in algal biomass (as measured by chlorophyll *a* concentrations). This decrease suggests that the algae are preferentially taking up dissolved fractions of phosphorus, specifically ortho-phosphate for growth. Through uptake of dissolved phosphorus fractions and converting into algal biomass, this would effectively shift the form of phosphorus into the total pool which measures both bound (associated with sediment and algae) and unbound phosphorus in a water sample.

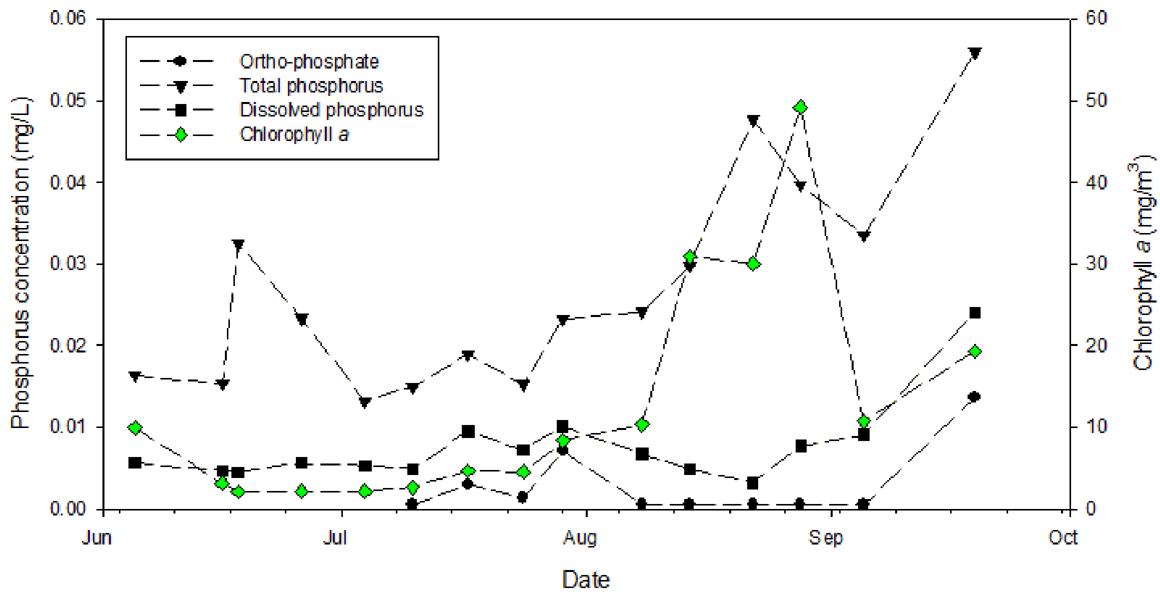


Figure 2-9 2013 Pigeon Lake Phosphorus and Chlorophyll-*a* Concentrations

Total Kjeldahl Nitrogen (TKN) concentration ranged from a minimum of 526 µg/L on June 5th to a maximum of 1130 µg/L on August 28th with an average value of 785 µg/L in 2013 (Figure 2-8). Similar to total phosphorus, TKN concentrations increased over the course of the open water season. The average ratio of Total Nitrogen (TN of which TKN comprises the majority of) to TP was on average 30:1 for 2013. In a system in which no nutrient is limiting, the TN:TP ratio is typically 16:1 (Redfield, 1934). Hence, the TN:TP ratio in Pigeon Lake indicates a strong phosphorus limitation.

In addition to composite samples phosphorus and nitrogen were also measured from 1m below the surface and 1m above the sediment at the profile site on four occasions (Appendix 2-1). Phosphorus bound to the sediments may be released in a dissolved form back into the water column under anoxic conditions. Thus, the sediment can act as an important source of nutrients and these nutrients may accumulate in deeper waters under stratified conditions. 2013 data showed little difference in phosphorus or nitrogen concentrations at either depths.

2.2.3 Metals

While most metals are naturally present in aquatic environments due to the weathering of rocks, elevated levels may be indicators of human pollution. In 2013, composite samples from the euphotic zone were analyzed twice for metals (Appendix 2-1). All concentrations fell within their respective CCME guidelines for protection of aquatic life.

2.3 Lake Water Quality Summary

Profiles of temperature, dissolved oxygen, pH and conductivity showed little variation with depth throughout the year in Pigeon Lake indicating little to no stratification. Conditions in Pigeon Lake such as high alkalinity, pH, and conductivity both reflect natural geology in the area, but also create favourable conditions for the growth of blue-green algae.

Variability over the season for several parameters likely reflected algal growth, photosynthesis and respiration. This included changes observes in pH, alkalinity, dissolved oxygen, water clarity and nutrient concentrations. While chlorophyll-*a* concentrations exhibited a strong positive relationship with total phosphorus as would be expected given that total phosphorus is the limiting nutrient for algal growth in Pigeon Lake, dissolved phosphorus was inversely related to chlorophyll-*a* concentrations. This suggests that during growth, algae and cyanobacteria may preferentially utilize dissolved fractions of phosphorus, converting it into total phosphorus through incorporation into algal biomass.

3.0 STREAM WATER QUALITY

Stream water quality samples were collected from a total of seven inflowing streams and the single outflow (Pigeon Lake Creek). Locations of the streams sampled are shown in Figure 3-1. Sample dates for each stream is presented in Table 3-1. All stream water quality data is provided in Appendix 3-1.

Streams sampling was conducted on a flow weighted basis. That is, more frequent (weekly) samples were collected earlier in the season when flows were higher, decreasing to bi-weekly sampling during the summer and early fall. In addition to routine sampling, streams were also sampled shortly after significant rainfall events on May 27 and July 16. As many parameters increase or decrease with changes in flow, it is important to conduct flow biased sampling in an attempt to capture the highest periods of variability in water quality.

In addition to water quality samples, physical parameters were also collected. These included measurements of dissolved oxygen, temperature, pH and conductivity. Instantaneous stream flow measurements were converted into discharge measurements to allow for calculation of loadings from streams. If there was no measureable flow in a given stream, water quality samples were not collected. Thus in some streams such as Grandview, Norris, Poplar Bay and Tide Creek, relatively few samples were collected due to zero measurable flow. While from a visual perspective, Tide Creek appears as though it would contribute a significant input into Pigeon Lake, it was found in 2012 and 2013 that there was relatively little to no flow throughout the season.

Streams represent a point source input of water quantity and quality into Pigeon Lake. Current water balances for Pigeon Lake suggest that these input sources are relatively small compared to diffuse non-point surface sources. However, sampling non-point sources is difficult, relying mostly on use of runoff coefficients developed through more extensive sampling programs and water quality models. Stream sampling by comparison is cost and time effective and provides a good broad overview of potential issues in the watershed which may manifest themselves in the receiving environment of the streams and lake.

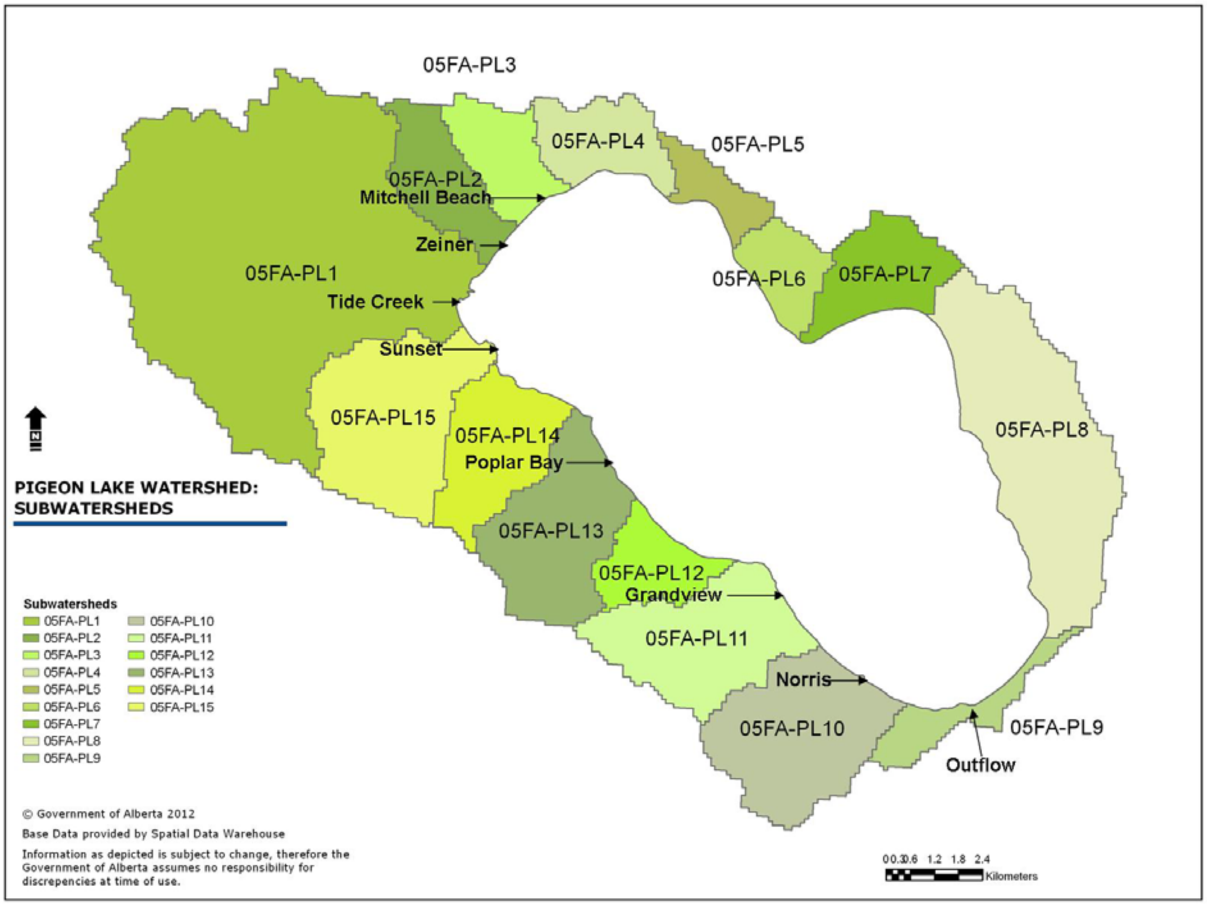


Figure 3-1 2013 Pigeon Lake Stream Water Quality Sample Locations

Table 3-1 2013 Pigeon Lake Stream Sample Dates

Location	Date ('X' indicates sample was collected)															
	4/25	4/26	4/30	5/2	5/6	5/13	5/27	6/10	6/24	7/8	7/16	7/22	8/6	8/20	9/3	9/17
Grandview		X														
Mitchell	X			X	X	X	X	X	X	X	X	X				
Norris		X		X												
Outflow				X	X	X	X	X	X	X	X	X	X	X	X	X
Poplar Bay	X			X	X		X				X					
Sunset	X			X	X	X	X	X	X	X	X	X		X		
Tide			X								X					
Zeiner		X		X	X	X	X	X	X	X	X	X				

Note: Highlighted cells correspond to samples collected after significant rainfall events.

3.1 Stream Chemistry

For all stream parameters measured, figures of measured values for each stream on each date sampled are presented in the following sections. In addition, summary statistics were also generated for all inflow streams combined, the outflow stream, and all streams combined (inflows and outflows). Summary statistics are presented to show the general range of concentrations observed at Pigeon Lake streams. One summary statistic unique to streams is flow weighted mean concentrations (FWMC).

FWMC is the average concentration of a substance in the water corrected for volume of water between samples. Thus, samples collected during higher flows and/or more with more time to a subsequent sample are given greater weight than those collected under low flows and/or collected close to the next sample. The FWMC is calculated as:

$$\text{FWMC} = \frac{\sum_{1}^{n}(c_i * t_i * q_i)}{\sum_{1}^{n}(c_i * t_i)}$$

where c_i = concentration in the i^{th} sample

t_i = time window for the i^{th} sample

q_i = flow in the i^{th} sample

3.1.1 Physical Parameters

Table 3-2 provides summary statistics for Pigeon Lake stream physical parameters (dissolved oxygen, pH, conductivity and water temperature). Figures 3-2 to 3-3 present individual measures for Pigeon Lake stream physical parameters.

Table 3-2 2013 Pigeon Lake Stream Physical Parameters Summary Statistics

Streams	Statistic	Dissolved Oxygen	pH	Conductivity	Water Temperature
Inflows	FWMC	7.31	7.38	265.7	7.92
	Mean	7.23	7.33	410.7	9.61
	Median	6.88	7.36	416.7	10.22
	Min	1.35	6.68	169.0	0.36
	Max	11.58	7.91	666.7	18.15
	5th percentile	3.93	6.82	197.5	0.68
	10th percentile	4.16	6.95	213.4	2.11
	90th percentile	10.74	7.62	567.7	15.30
	95th percentile	11.28	7.68	589.0	17.21
Outflow	FWMC	8.70	8.50	317.8	17.32
	Mean	10.37	8.48	291.4	16.17
	Median	9.88	8.57	317.0	19.22
	Min	8.77	7.74	144.0	3.10
	Max	13.78	8.84	328.8	22.51
	5th percentile	8.80	7.98	179.6	6.92
	10th percentile	8.87	8.18	216.2	9.47
	90th percentile	13.40	8.71	325.0	20.88
	95th percentile	13.72	8.77	326.5	21.53
Combined	FWMC	8.28	8.17	302.2	14.50
	Mean	7.94	7.61	382.0	11.19
	Median	8.29	7.52	383.8	11.22
	Min	1.35	6.68	144.0	0.36
	Max	13.78	8.84	666.7	22.51
	5th percentile	4.03	6.83	196.9	0.86
	10th percentile	4.29	7.03	212.6	3.11
	90th percentile	10.95	8.57	542.1	19.33
	95th percentile	11.53	8.62	579.9	20.69

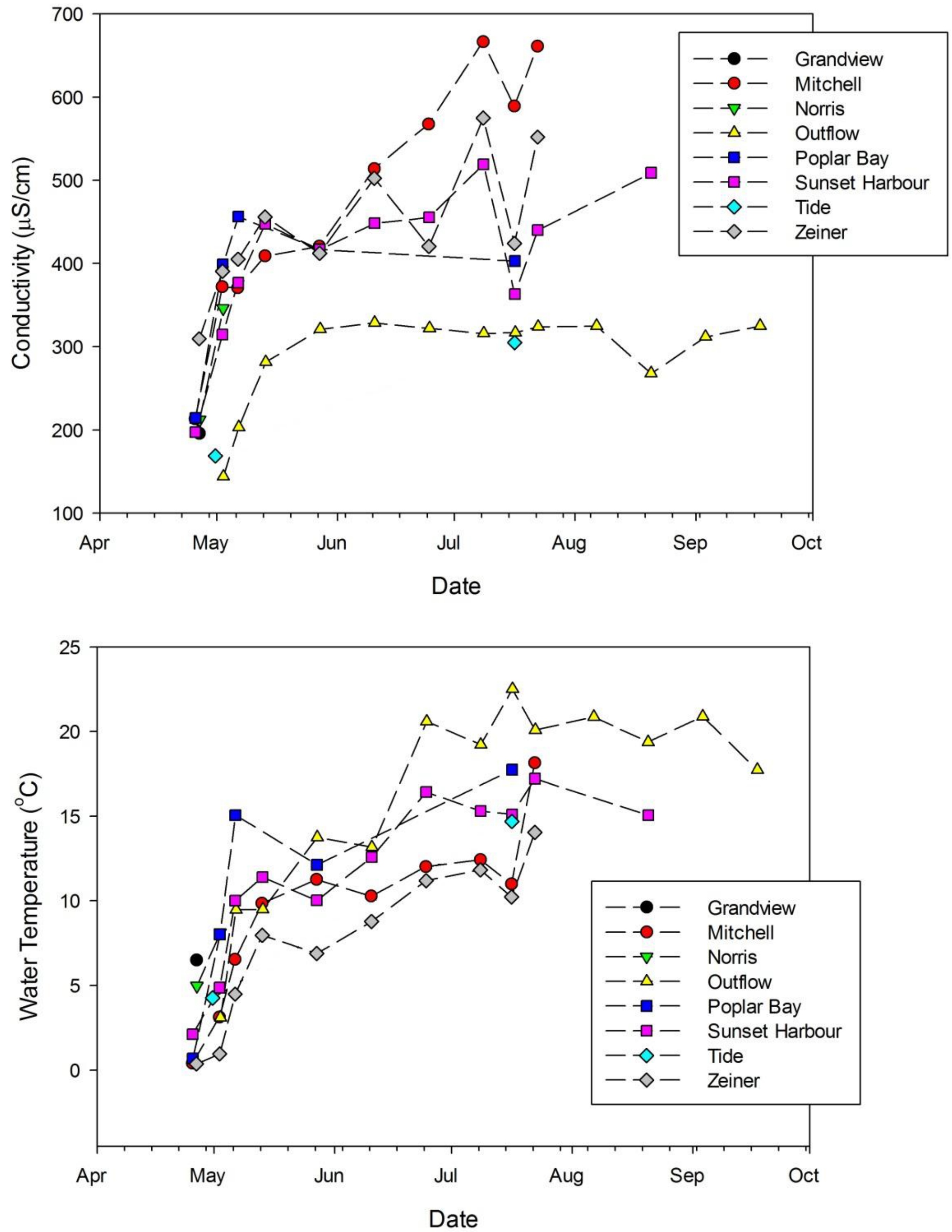


Figure 3-2 2013 Pigeon Lake Stream Conductivity and Water Temperature

Conductivity was lowest during the spring, increasing over the course of the summer. This reflects early spring melt which tends to be low in dissolved ions. The lower conductivity of the outflow is likely due to the influence of lake water which comprises the majority of the outflow water.

Water temperature increased at all streams over the course of the open water season. Outflow temperatures were higher than all inflowing streams beginning in July, again reflecting the influence of the lake which is subject to less temperature fluctuations as opposed to the smaller inflowing streams.

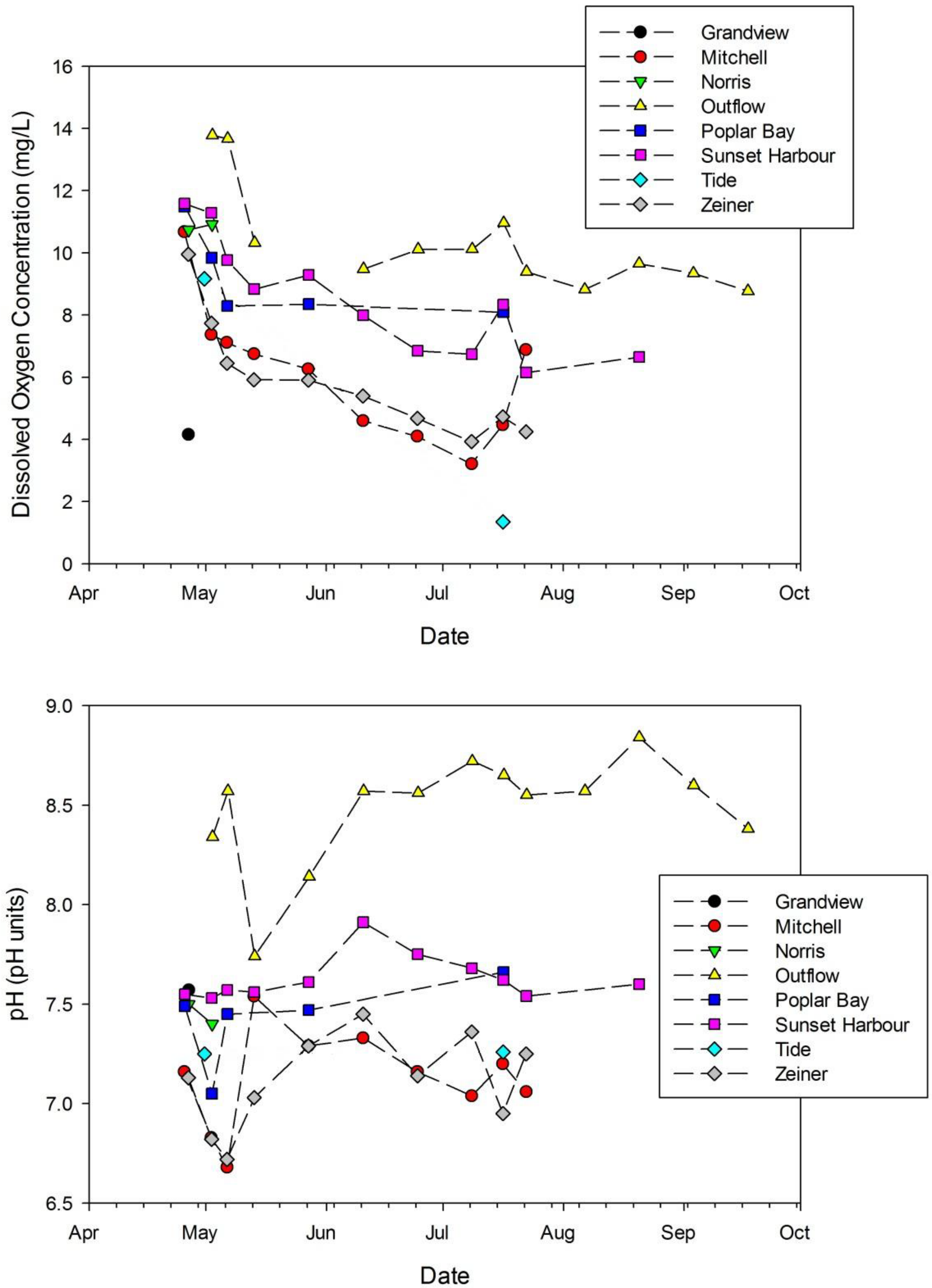


Figure 3-3 2013 Pigeon Lake Stream Dissolved Oxygen and pH

Dissolved oxygen concentrations decreased through the open water season at all locations. Warmer water holds less dissolved oxygen relative to colder water and the pattern observed in water temperature suggests that dissolved oxygen concentration in streams primarily reflects temperature. The outflow did have slightly higher dissolved oxygen concentrations throughout the year, despite having warmer water relative to the inflowing streams. This may be in part due to high primary productivity in the outflow (growth of algae and plants were observed throughout the season) or the influence of Pigeon Lake where primary productivity contributes to elevated daytime dissolved oxygen levels. Tide Creek dissolved oxygen concentrations in mid-July were near anoxic levels (1.35 mg/L). This sample was collected after a recent storm event which resulted in an increase in dissolved oxygen levels at most other streams. Thus prior to this date, the water was likely stagnant and dissolved oxygen levels may have been lower due to chemical and biological processes.

Stream pH stayed relatively consistent throughout the open water period, showing small declines potentially in response to storm events. For the inflowing streams, pH was near neutral (FWMC=7.38) while the outflow had a more alkaline pH (FWMC=8.50), again reflecting influence of Pigeon Lake as well as higher productivity which can lead to elevated pH readings.

3.1.2 Nutrients

Nitrogen Parameters

Measured nitrogen parameters included ammonia (NH_3), nitrate (NO_3), nitrite (NO_2), nitrate+nitrite (NO_3+NO_2) and total Kjeldahl nitrogen (TKN). Total nitrogen was calculated as the sum of organic and inorganic nitrogen parameters. Summary statistics for nitrogen parameters are presented in Table 3-3. Figures 3-4 to 3-6 present individual stream measurements for the various nitrogen parameters. Due to contamination issues, all nitrogen values from July 16 for Poplar Bay Creek and Pigeon Lake Creek (outflow) were removed from the dataset.

Table 3-3 2013 Pigeon Lake Stream Nitrogen Parameters Summary Statistics

Streams	Statistic	Ammonia	Total Kjeldahl Nitrogen	Nitrate	Nitrite	Nitrate + Nitrite	Total Nitrogen
Inflows	FWMC	0.0809	1.173	0.2272	0.0084	0.2355	1.408
	Mean	0.0815	1.151	0.1576	0.0071	0.1646	1.315
	Median	0.0683	1.140	0.0599	0.0063	0.0679	1.210
	Min	0.0122	0.641	0.0030	0.0010	0.0030	0.705
	Max	0.3720	1.890	0.8130	0.0368	0.8330	2.060
	5th percentile	0.0180	0.768	0.0033	0.0010	0.0061	0.860
	10th percentile	0.0238	0.863	0.0091	0.0010	0.0126	0.904
	90th percentile	0.1287	1.504	0.4973	0.0115	0.5045	1.881
	95th percentile	0.1566	1.650	0.6123	0.0137	0.6255	1.903
Outflow	FWMC	0.0261	0.968	0.0145	0.0014	0.0151	1.005
	Mean	0.0666	1.025	0.0992	0.0024	0.1010	1.171
	Median	0.0302	0.841	0.0030	0.0010	0.0030	0.934
	Min	0.0103	0.612	0.0030	0.0010	0.0030	0.612
	Max	0.2850	2.027	0.9840	0.0074	0.9880	2.040
	5th percentile	0.0107	0.615	0.0030	0.0010	0.0030	0.666
	10th percentile	0.0115	0.627	0.0030	0.0010	0.0030	0.710
	90th percentile	0.1535	1.768	0.0831	0.0048	0.0902	1.861
	95th percentile	0.2141	1.902	0.4901	0.0060	0.4960	1.947
Combined	FWMC	0.0425	1.029	0.0783	0.0035	0.0812	1.126
	Mean	0.0781	1.122	0.1441	0.0060	0.1499	1.282
	Median	0.0639	1.065	0.0453	0.0046	0.0529	1.200
	Min	0.0103	0.612	0.0030	0.0010	0.0030	0.612
	Max	0.3720	2.027	0.9840	0.0368	0.9880	2.060
	5th percentile	0.0143	0.660	0.0030	0.0010	0.0030	0.711
	10th percentile	0.0184	0.719	0.0030	0.0010	0.0030	0.836
	90th percentile	0.1427	1.616	0.4940	0.0113	0.5003	1.879
	95th percentile	0.1700	1.814	0.6303	0.0126	0.6535	1.923

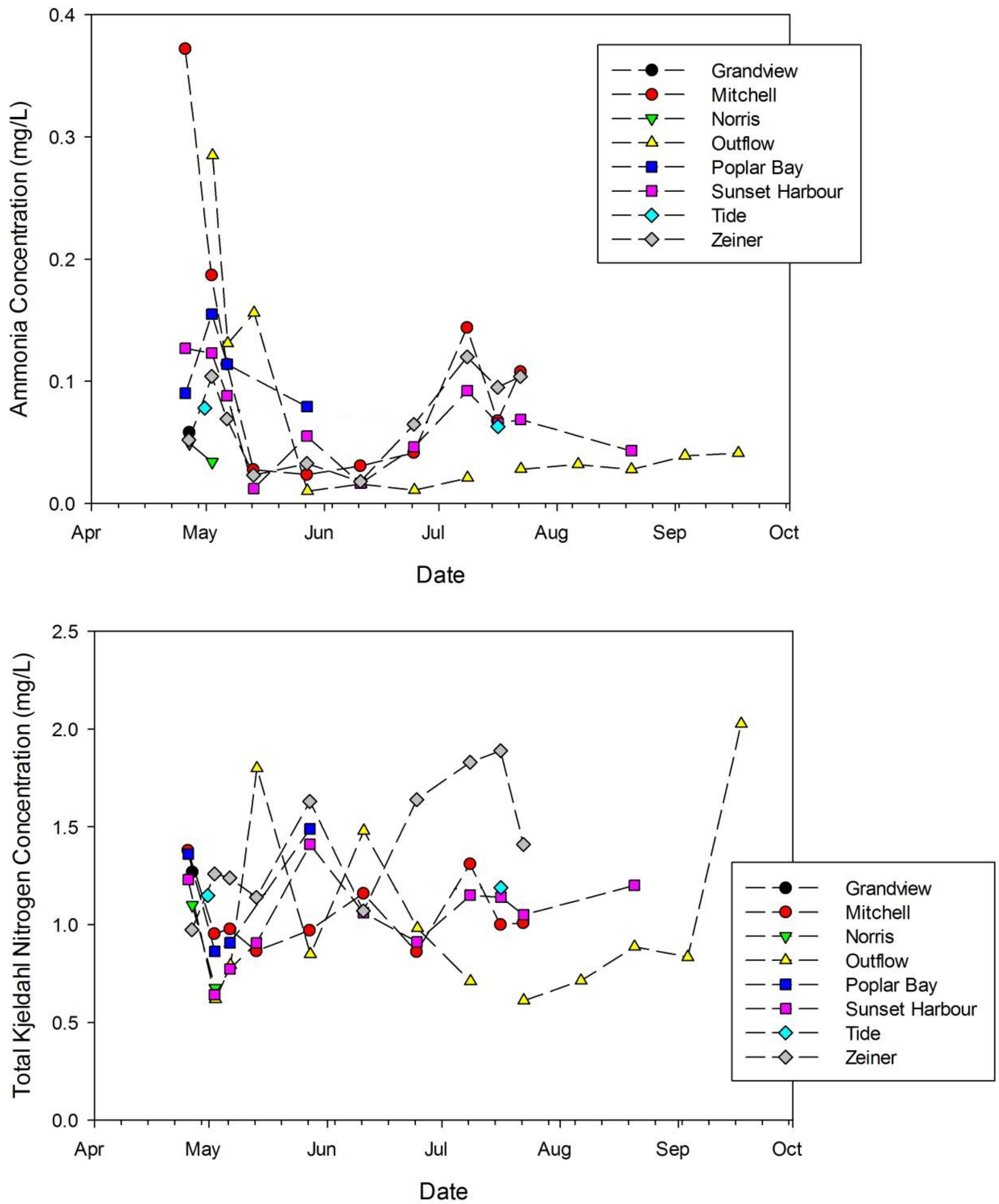


Figure 3-4 2013 Pigeon Lake Stream Ammonia and Total Kjeldahl Nitrogen Concentrations

Ammonia concentrations were slightly elevated early in the open water season, but quickly declined at all streams by mid-May. A small increase was observed at most streams sampled on July 8, but generally declined again on subsequent sampling dates. Ammonia concentrations at the outflow were slightly lower than the inflowing streams most of the season. Relative to lake concentrations, all streams had much higher ammonia content.

Total Kjeldahl nitrogen, a measure of organic nitrogen, ammonia and ammonium (NH_4^+), varied between 0.5 and 2.0 mg/L throughout most of the open water period. TKN concentrations did not show any strong pattern related to flow or time of year. TKN was slightly lower at the outflow during the latter part of the year (with the exception of the final sample collected in September), but was indiscernible from other streams during the early part of the year. TKN concentrations were higher at Zeiner Creek for the latter part of the year.

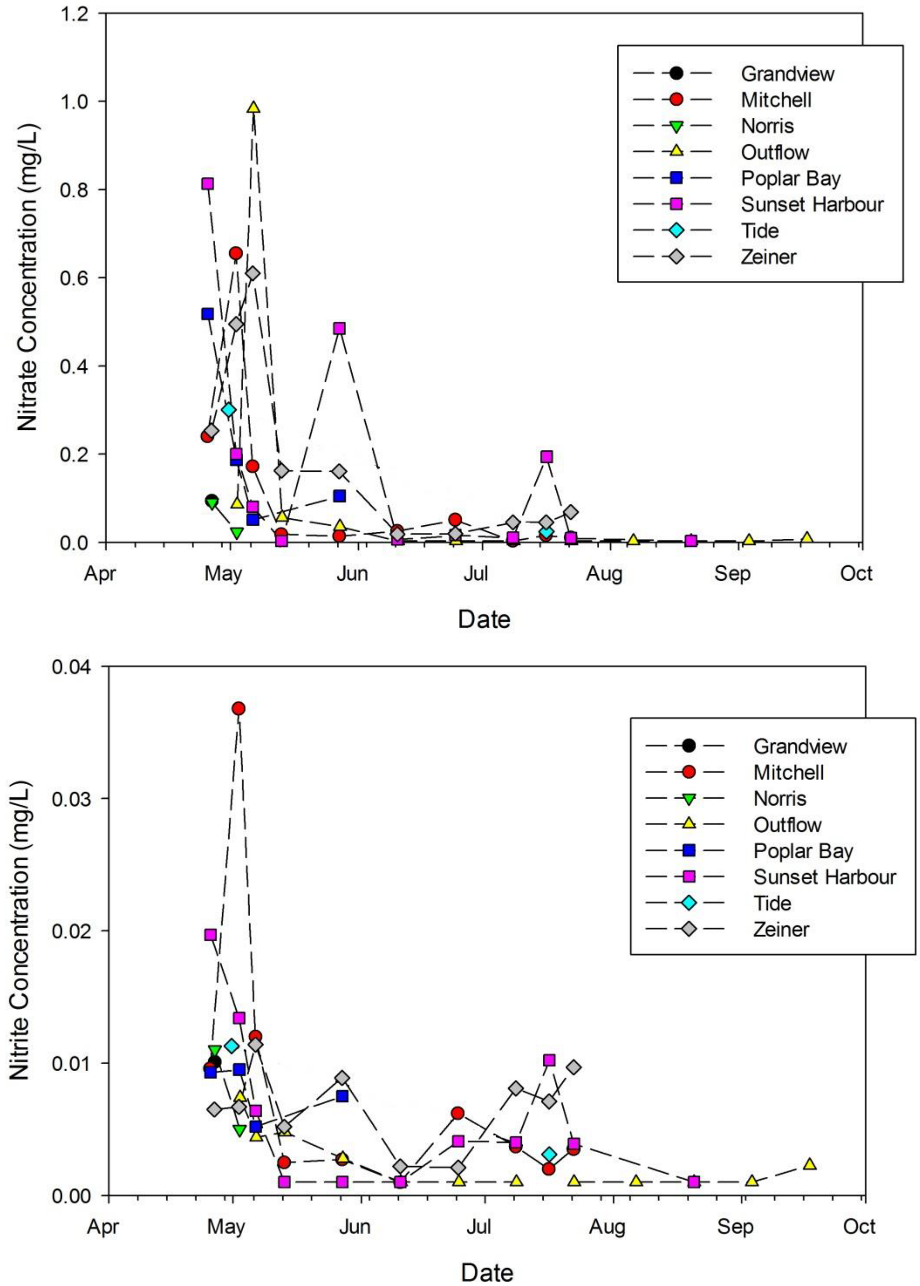


Figure 3-5 2013 Pigeon Lake Stream Nitrate and Nitrite Concentrations

Both nitrate and nitrite concentrations showed similar patterns at streams throughout the year as would be expected. Concentrations were highest early in the open water season and declined through the rest of the year. Peaks were observed shortly after major rainfall events (May 27 and July 16) likely as a result of flushing of surrounding soils. Outflow concentrations for both parameters were low, but within the range of the other inflows.

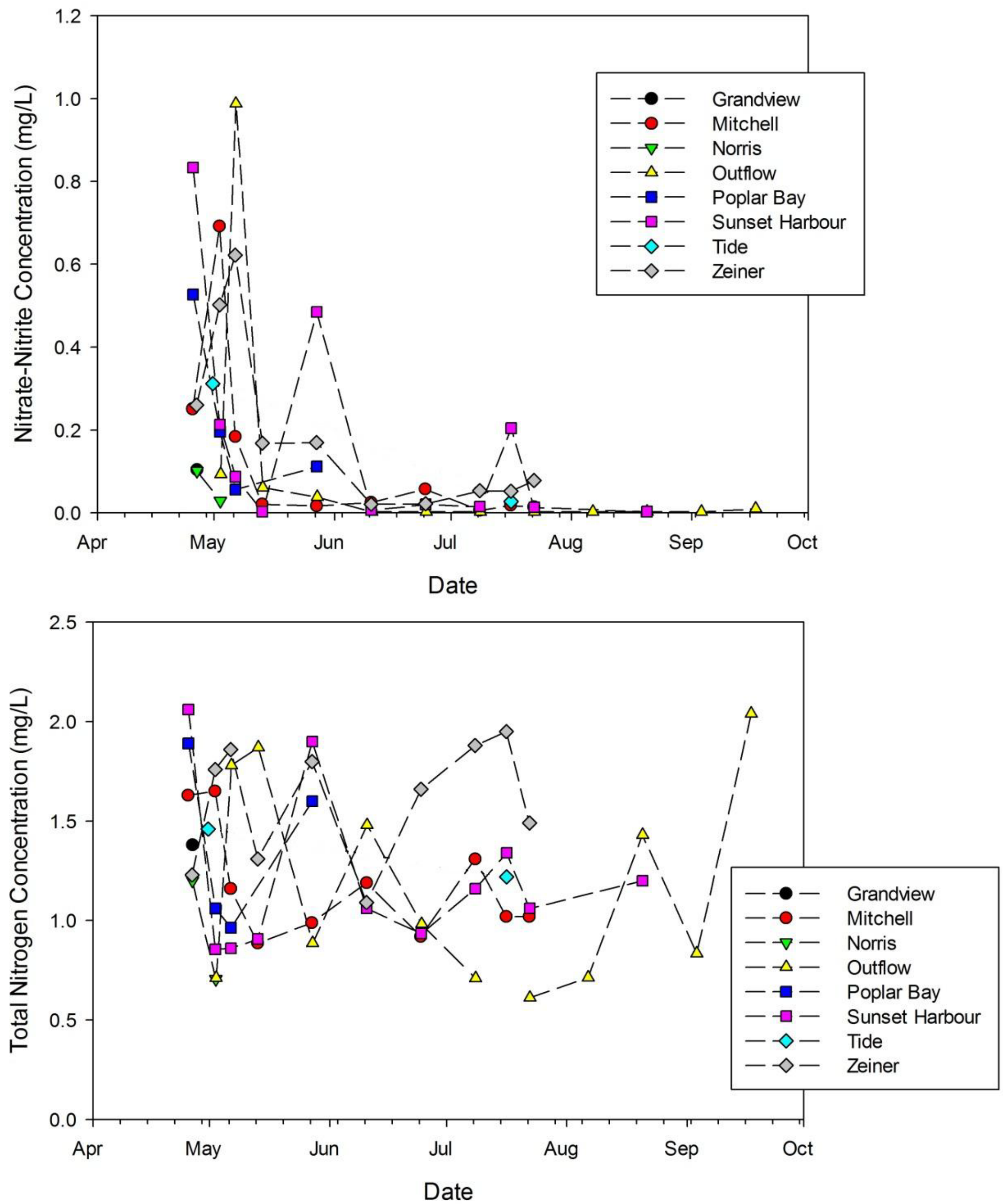


Figure 3-6 2013 Pigeon Lake Stream Nitrate+Nitrite and Total Nitrogen Concentrations

The combined variable of nitrate+nitrite showed very similar patterns to nitrate in Pigeon Lake streams. As nitrate is present in much higher concentrations relative to nitrite, this is to be expected. Similarly, total nitrogen, a measure of all inorganic and organic nitrogen, showed similar patterns to TKN which comprises the majority of nitrogen in Pigeon Lake streams. Concentrations of total nitrogen were typical of what is observed at other small streams flowing into lakes in Alberta (C. Teichreb, unpub. data) and were higher than concentrations observed in Pigeon Lake (see Figure 5-2 in Groundwater Quality section).

Phosphorus Parameters

Phosphorus parameters measured in 2013 included total phosphorus, total dissolved phosphorus and dissolved ortho-phosphate. Table 3-4 presents summary statistics for the three phosphorus parameters measured while Figures 3-7 to 3-8 presents individual measurements for each stream sampled. Due to contamination, all phosphorus results from July 16 for Pigeon Lake Creek (outflow) were removed from the dataset.

Table 3-4 2013 Pigeon Lake Stream Phosphorus Parameters Summary Statistics

Streams	Statistic	Total Phosphorus	Total Dissolved Phosphorus	Dissolved Ortho-Phosphate
Inflows	FWMC	0.1612	0.0958	0.0604
	Mean	0.1554	0.0954	0.0643
	Median	0.1370	0.0677	0.0390
	Min	0.0598	0.0279	0.0102
	Max	0.4000	0.3330	0.2890
	5th percentile	0.0678	0.0353	0.0141
	10th percentile	0.0736	0.0371	0.0185
	90th percentile	0.2790	0.1940	0.1480
	95th percentile	0.3030	0.2950	0.1930
Outflow	FWMC	0.0862	0.0064	0.0010
	Mean	0.0701	0.0077	0.0014
	Median	0.0286	0.0076	0.0005
	Min	0.0179	0.0053	0.0005
	Max	0.2600	0.0115	0.0061
	5th percentile	0.0189	0.0056	0.0005
	10th percentile	0.0198	0.0059	0.0005
	90th percentile	0.1770	0.0096	0.0035
	95th percentile	0.2156	0.0105	0.0048
Combined	FWMC	0.1087	0.0332	0.0188
	Mean	0.1361	0.0755	0.0501
	Median	0.1270	0.0526	0.0296
	Min	0.0179	0.0053	0.0005
	Max	0.4000	0.3330	0.2890
	5th percentile	0.0228	0.0068	0.0005
	10th percentile	0.0271	0.0075	0.0005
	90th percentile	0.2624	0.1636	0.1106
	95th percentile	0.2916	0.2740	0.1924

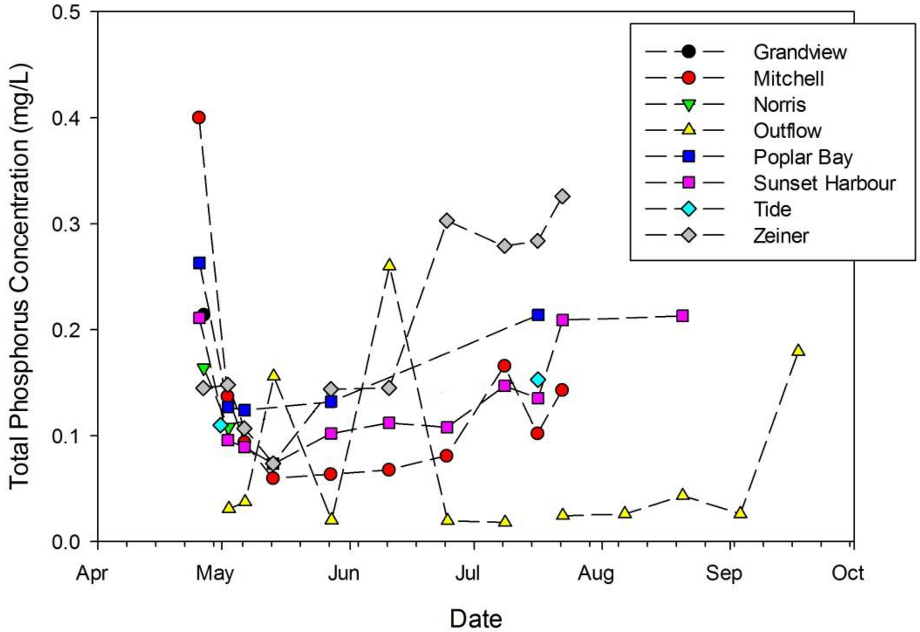


Figure 3-7 2013 Pigeon Lake Stream Total Phosphorus Concentrations

Total Phosphorus Concentrations in Pigeon Lake streams were similar to nitrogen parameters, starting at elevated concentrations during the spring runoff and decreasing shortly afterwards in late May. However, most streams showed a gradual increase in concentration from late May onwards, especially at Zeiner. This may reflect an increased flushing of phosphorus off of surrounding soils into the receiving streams. Storm events did not appear to play a significant role in influencing short-term phosphorus concentrations.

Outflow total phosphorus concentrations were typically lower than the inflow streams (FWMCs of 0.0862 and 0.1612 for outflow and inflowing streams respectively). However, peaks in phosphorus concentration above inflowing stream measurements were also observed through the season. Concentrations of total phosphorus were much higher in streams relative to Pigeon Lake (see Figure 5-3 in Groundwater Quality section).

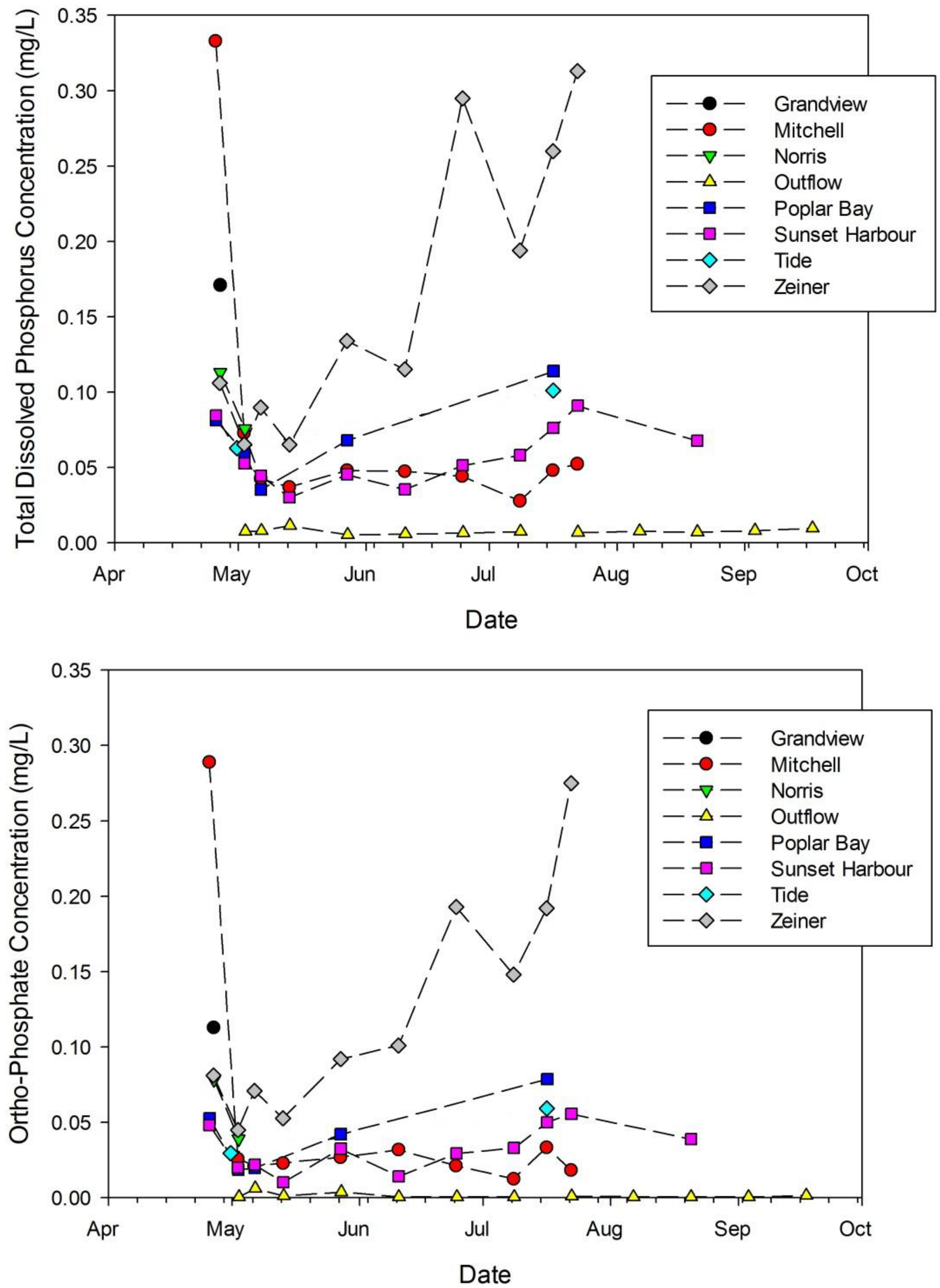


Figure 3-8 2013 Pigeon Lake Stream Total Dissolved Phosphorus and Ortho-Phosphate Concentrations

Total dissolved phosphorus and dissolved ortho-phosphate are constituents of total phosphorus and therefore showed similar patterns to total phosphorus with elevated concentrations at the beginning of the year, declining rapidly, and then increasing through the rest of the season at most sites. Zeiner Creek concentrations were generally much higher relative to all other streams. The outflow concentrations were lower than the other streams and did not show the same peaks as total phosphorus, indicating that the peaks may have been associated with suspended sediments observed on those dates (see Figure 3-10 in the following section). Overall, concentrations of dissolved phosphorus and ortho-phosphate in the outflow were similar to Pigeon Lake, while the inflowing streams had higher concentrations of these two parameters relative to the outflow and lake.

3.1.3 Organic Carbon, Total Dissolved Solids and Total Suspended Solids

Table 3-5 presents summary statistics for total and dissolved organic carbon (TOC and DOC), total dissolved solids (TDS) and total suspended solids (TSS). Figures 3-9 to 3-10 present individual dates and stream data for these parameters.

Table 3-5 2013 Pigeon Lake Stream Summary Statistics for Organic Carbon, Total Dissolved Solids and Total Suspended Solids

Streams	Statistic	Total Organic Carbon	Dissolved Organic Carbon	Total Dissolved Solids	Total Suspended Solids
Inflows	FWMC	17.9	17.6	19.6	195
	Mean	19.9	19.8	12.8	275
	Median	18.0	17.8	7.0	272
	Min	12.4	11.5	1.5	114
	Max	40.7	40.3	112.0	436
	5th percentile	13.5	13.5	1.5	157
	10th percentile	13.8	13.7	1.5	162
	90th percentile	29.7	29.7	21.0	380
	95th percentile	36.8	37.5	66.0	403
Outflow	FWMC	8.5	8.1	58.5	196
	Mean	8.5	7.9	45.0	180
	Median	7.2	6.9	4.0	190
	Min	5.0	5.1	1.5	97
	Max	24.1	21.9	182.0	211
	5th percentile	5.2	5.2	1.5	110
	10th percentile	5.4	5.4	1.5	128
	90th percentile	9.1	7.9	145.4	204
	95th percentile	15.2	13.5	165.2	207
Combined	FWMC	11.3	10.9	46.8	196
	Mean	17.2	16.8	20.6	252
	Median	16.3	15.9	6.0	244
	Min	5.0	5.1	1.5	97
	Max	40.7	40.3	182.0	436
	5th percentile	6.3	6.3	1.5	137
	10th percentile	7.1	6.9	1.5	159
	90th percentile	27.3	28.2	77.2	370
	95th percentile	33.4	34.1	111.4	394

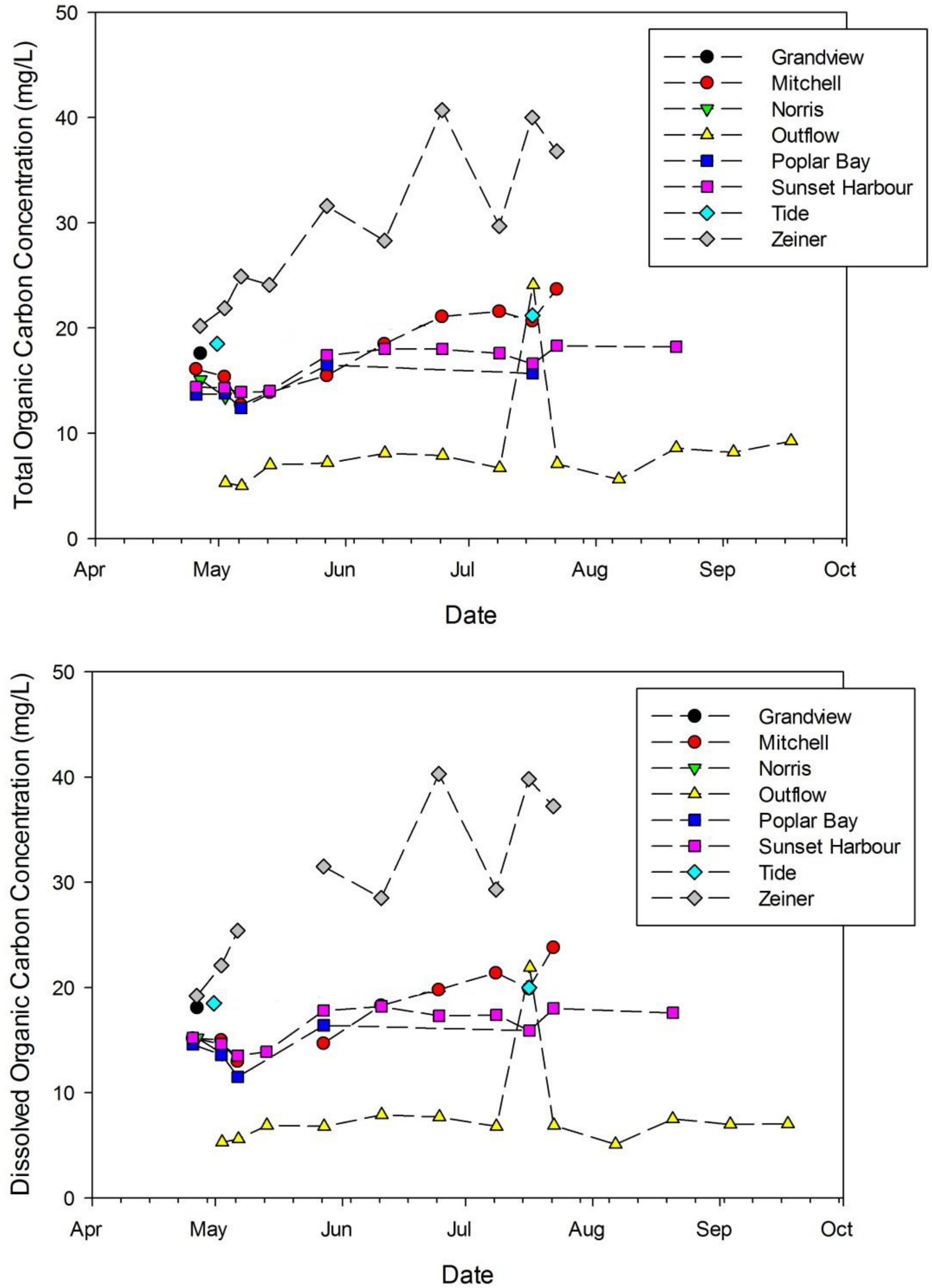


Figure 3-9 2013 Pigeon Lake Stream Total and Dissolved Organic Carbon Concentrations

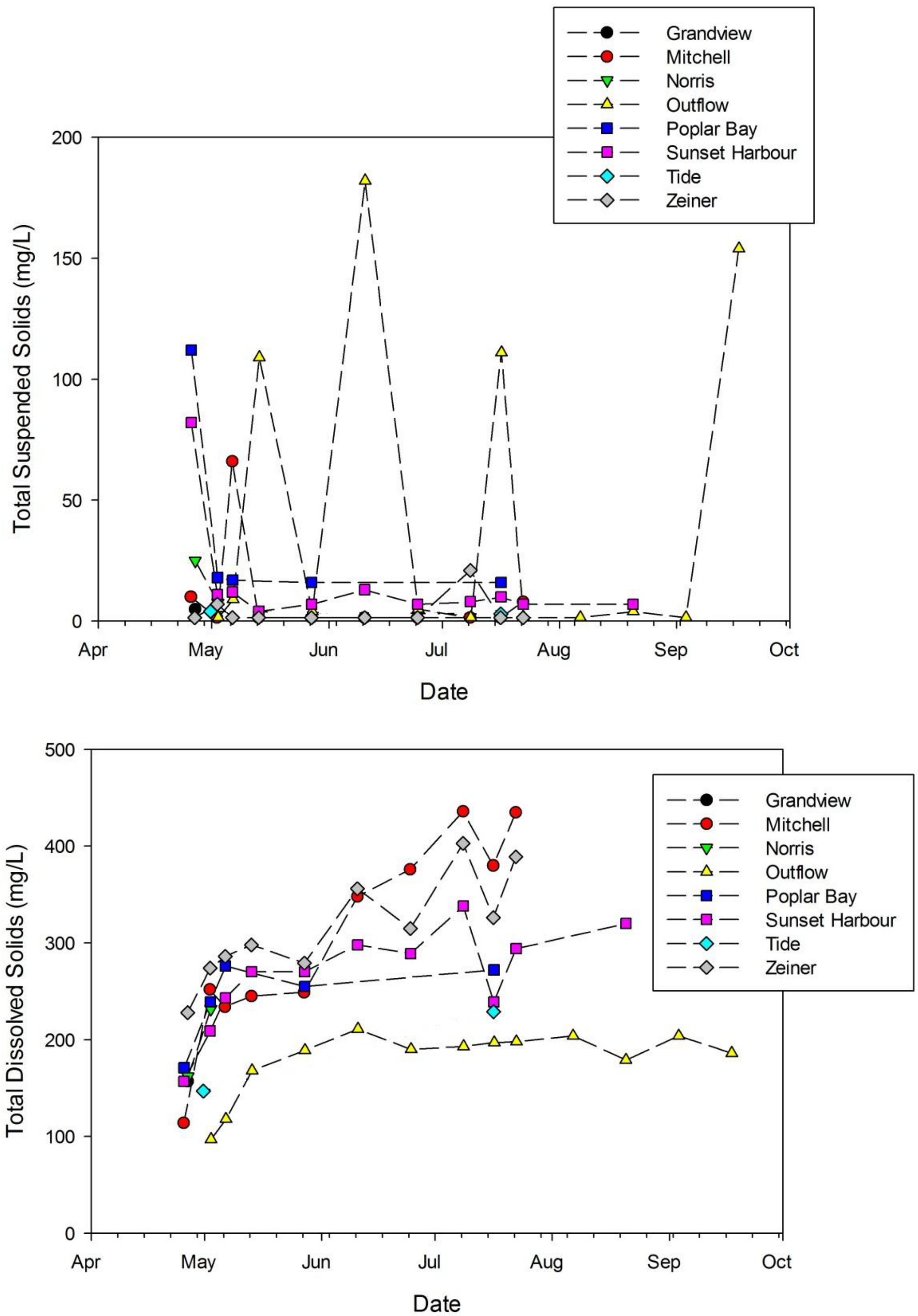


Figure 3-10 2013 Pigeon Lake Stream Total Suspended Solids and Total Dissolved Solids Concentrations

Both total and dissolved organic carbon showed similar patterns in Pigeon Lake streams throughout the year. Concentrations were typically between 10 and 20 mg/L at all streams with the exception of the outflow and Zeiner Creek. While Zeiner Creek initially had similar concentrations as the other inflows, both TOC and DOC steadily rose throughout the rest of the year indicating a much higher organic carbon loading source to this stream relative to others. The outflow had much lower concentrations of both parameters relative to the inflows throughout the year with the exception of a storm related peak in concentration on July 16. While TOC and DOC were not measured in Pigeon Lake, it is likely safe to assume the concentrations observed in the outflow reflect lake chemistry as a similar pattern was observed for many other measured parameters.

Total dissolved solids, a measure of dissolved organic and inorganic constituents in water, was lowest during the spring runoff when primarily dilute melt waters would be entering the streams. Concentrations increased through the year, showing slight declines corresponding to rainfall events (May 27 and July 16). Similar to other parameters, the outflow had lower TDS concentrations reflecting lower TDS concentrations of Pigeon Lake. It is likely that low TDS water entering via precipitation may have resulted in lower TDS concentrations in the lake and subsequently the outflow.

Total suspended solids were relatively low at all streams throughout the year with the exception of initial samples collected during runoff. TSS did show significant peaks at the outflow. The peaks on May 27 and July 16 corresponded to recent rainfall events. The June 10th peak appears to be the result of a windstorm event on Pigeon Lake which resulted in resuspension of sediment. The September 17th peak likely corresponded to the cyanobacterial bloom occurring at that time, as algae contribute to measures of TSS.

3.2 Stream Bacteriological Parameters

Both fecal coliform bacteria and *E.coli* bacteria samples were collected from all Pigeon Lake streams sampled. Table 3-6 presents summary statistics for the two bacteria parameters, and Figure 3-11 presents individual results by stream and date.

Both bacteria parameters were typically low in all streams, often being present below detection limit (<10 colony forming units per 100 mL). However, samples collected after recent rainfall events (May 27 and July 16) had elevated to extremely high numbers in several streams. As these bacteria originate from the digestive tracts of warm blooded animals, these peaks likely reflect a flushing of the bacteria from surrounding soils into the streams. High peaks followed by rapid declines are not unusual for small streams located in agricultural areas. From a contact recreation standpoint, it would be advisable to avoid contact with streams after recent storm events for health and safety reasons.

Table 3-6 2013 Pigeon Lake Stream Bacteria Numbers

Streams	Statistic	Fecal Coliforms	*E. coli*
Inflows	FWMC	630	477
	Mean	458	384
	Median	50	20
	Min	5	5
	Max	8800	8800
	5th percentile	5	5
	10th percentile	5	5
	90th percentile	470	340
	95th percentile	2600	2100
Outflow	FWMC	35	29
	Mean	84	64
	Median	18	5
	Min	5	5
	Max	780	600
	5th percentile	5	5
	10th percentile	5	5
	90th percentile	96	82
	95th percentile	372	289
Combined	FWMC	213	164
	Mean	368	307
	Median	30	10
	Min	5	5
	Max	8800	8800
	5th percentile	5	5
	10th percentile	5	5
	90th percentile	449	334
	95th percentile	1417	1125

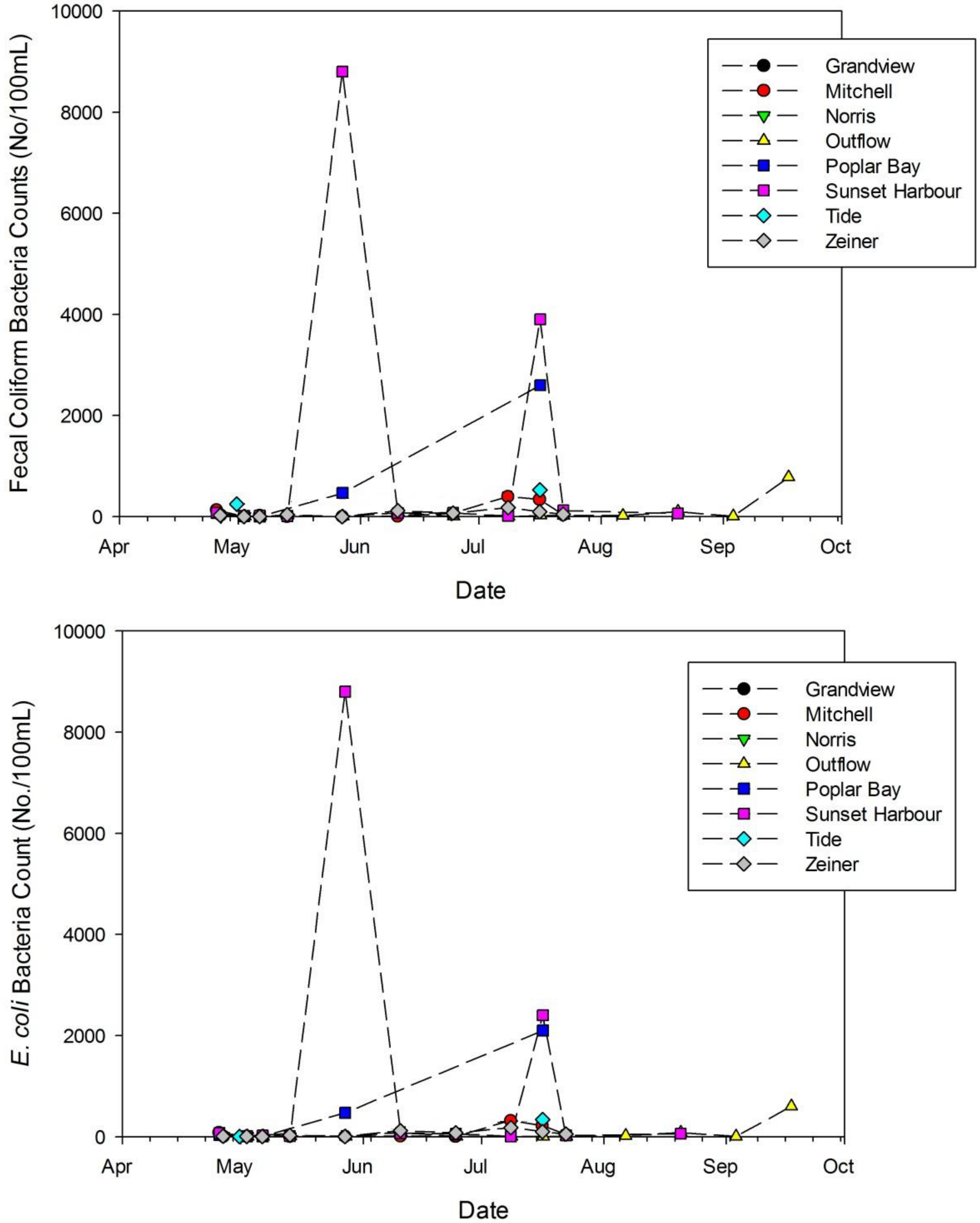


Figure 3-11 2013 Pigeon Lake Stream Fecal Coliform and *E.coli* Bacteria Counts

3.3 Stream Water Quality Summary

Concentrations of many parameters tended to be highest during spring runoff which tends to wash accumulated material from the winter into the streams. Similarly, concentrations of several parameters peaked shortly after significant storm events. These post-storm event peaks were especially evident in the bacterial parameters.

While concentrations for most parameters at the inflowing streams was generally similar, the outflow was quite different. Outflow dissolved oxygen, pH and TSS tended to be higher relative to inflows while conductivity, TDP, ammonia, TKN, total nitrogen, total phosphorus, total dissolved phosphorus, ortho-phosphate, TOC and DOC were lower. The occasional high TSS peaks in the outflow contributed to high peaks in total phosphorus, despite being lower than most streams on all other dates. Concentrations observed in the outflow strongly reflected those of Pigeon Lake, while concentrations in the inflow likely reflected surrounding land-use activities.

4.0 STREAM NUTRIENT LOADINGS

While stream chemistry is useful in delineating differences amongst streams that may be the result of differences in land-use or formation, it is also useful to know how much of a given substance is entering a lake from a given stream (or leaving the lake in the case of the outflow). Loadings can be estimated using instantaneous discharge measurements. By quantifying discharge (measured in cubic meters per second) and knowing the concentration of a given parameter (typically in milligrams per liter), an instantaneous loading rate expressed as kilograms per day can be calculated. Instantaneous loading rates therefore account for differences in stream flow and provide an estimate of how much of a substance is entering the lake. While a stream may have high concentrations of a given parameter, it may not contribute a large load to the lake if there is minimal flow and vice versa.

From a watershed management perspective, it is important to know which streams contribute high loads of phosphorus, as these can be seen as potentially contributing more to the growth of algae in the lake. However, this must be weighed carefully with concentration measurements. Reducing phosphorus levels in a stream with low concentrations but high overall loads due to high flows may prove more difficult than reducing concentrations in a smaller stream with problematically high phosphorus concentrations.

For this report, loadings were calculated for nutrient parameters only, as nuisance algal blooms are currently the primary water quality concern of the majority of lake users at Pigeon Lake. Loads were calculated on an instantaneous basis using the method described above. For cumulative (*i.e.* annual) loads, the period between sampling dates was calculated. Daily loads were assumed to be constant from a given sampling date to the next sampling date. For example, if loading rates were calculated to be 1 kg/day for a given parameter on July 5, and the subsequent sampling date was July 10, the rate was assumed to be 1kg/day for July 5, 6, 7, 8 and 9. Cumulative loads were calculated as the sum of all daily loads over the course of the sample period (late April to late September).

On July 16, samples for nitrogen parameters at Poplar Bay and Pigeon Lake (outflow) Creeks and phosphorus parameters for Pigeon Lake Creek were found to be contaminated and subsequently removed from the dataset. To estimate loads for this date, concentrations from the previous sample trip (July 8 for the outflow, May 27 for Poplar Bay) were assumed and discharges from July 16 were used. Results for both instantaneous and cumulative loads for all streams are presented in Appendix 4-1. Discussion of individual parameters follows below.

4.1 Stream Discharge

Figures 4-1 and 4-2 show instantaneous and cumulative stream discharge respectively for all streams sampled in 2013. For all streams except the outflow and Tide Creek, discharge was highest during the initial spring runoff, decreasing to low levels soon afterwards. Increases in discharge rates were observed after major rainfall events on May 27 and July 16 at several streams. Several of the streams decreased to zero measurable flow by early summer reflecting their ephemeral nature.

Tide Creek had measurable flows on two dates only (May 30 and July 16). Discharge rates were similar on both dates and much higher than the relatively smaller streams. Discharge rate for the outflow of Pigeon Lake reflected lake levels. As lake levels increased through the initial part of summer, so did this discharge rates. The July 16 storm sampling event saw a peak occur at the outflow which was maintained to July 22 before gradually declining. This is in contrast to the sharper decline observed at the smaller inflows. As the lake rose in level during this period, it would create a buffering volume along discharge out the outflow to continue for a longer period of time.

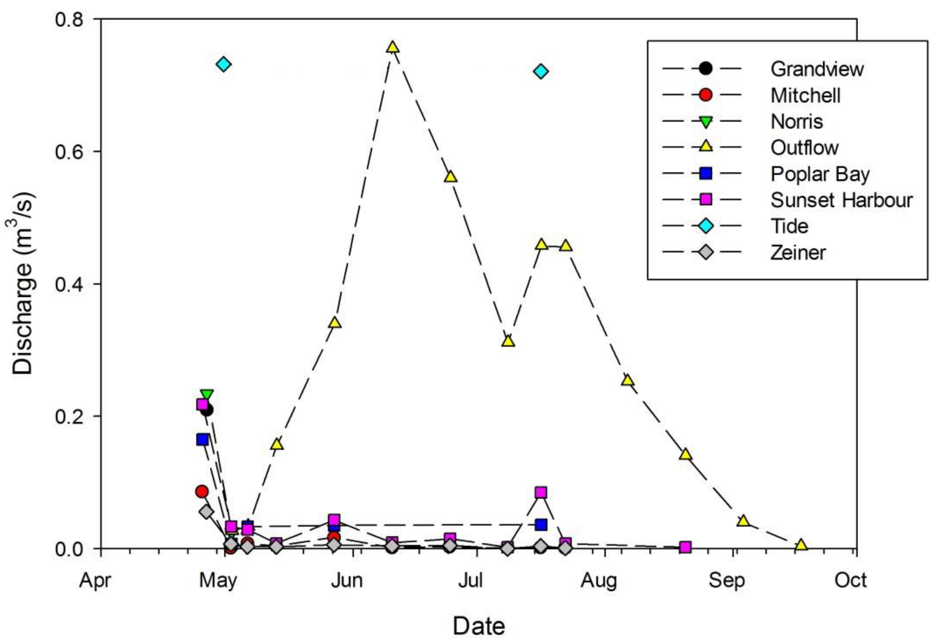


Figure 4-1 2013 Pigeon Lake Stream Discharge

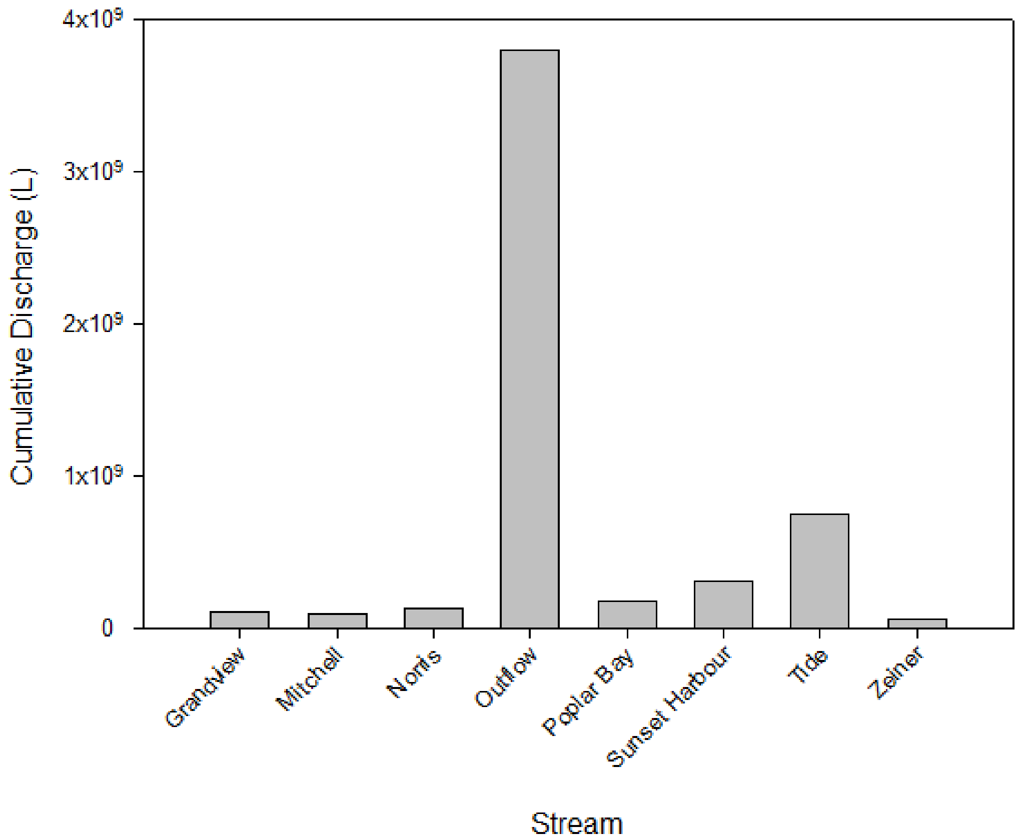
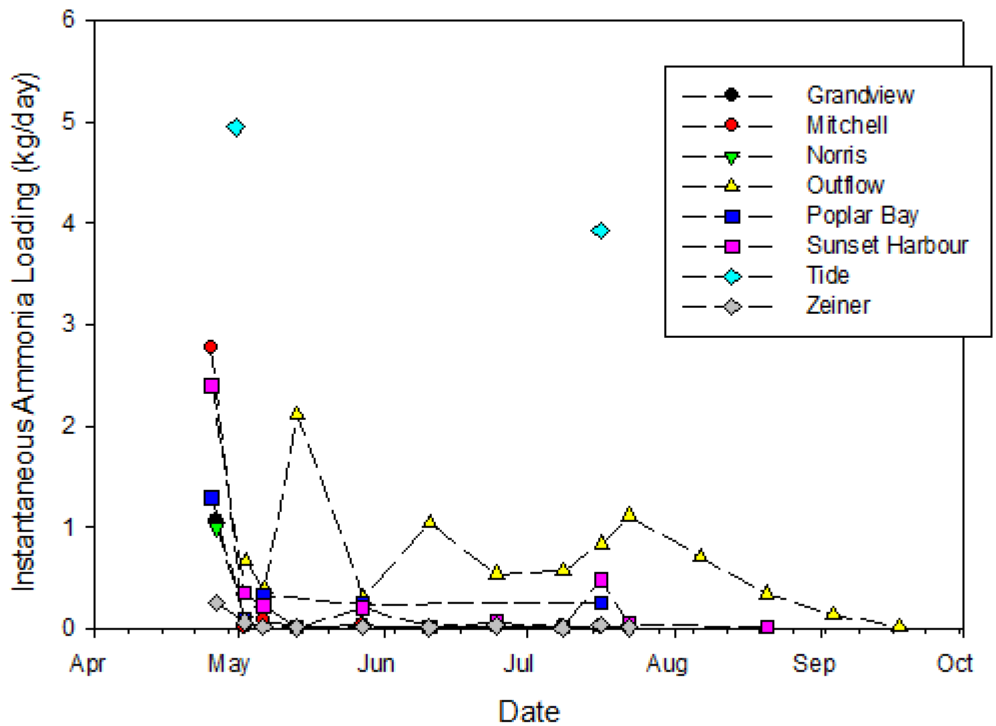


Figure 4-2 2013 Pigeon Lake Stream Cumulative Discharge

Cumulative discharge was similar for most inflows, ranging from 58,270,560 L (Zeiner) to 307,405,800 L (Sunset Harbour). Of the inflowing streams, Tide Creek had the highest cumulative discharge (747,718,800 L). The outflow had had a higher cumulative discharge than all sampled inflowing streams combined at 3,796,531,500 L. This was due to a combination of continued flow throughout the year with discharge rates much higher than the inflows on most dates. Interestingly, the outflow does not discharge on a continuous basis from year to year. During 2013, the weir at the outflow of Pigeon Lake was lowered as previous frost heaving had raised the level. As a result, discharge from the lake occurred sooner and on a more consistent basis relative to previous years.

4.2 Nitrogen Loadings

Instantaneous loadings for ammonia and total Kjeldahl nitrogen are presented in Figure 4-3. Figure 4-4 shows cumulative loadings for these two nitrogen parameters.



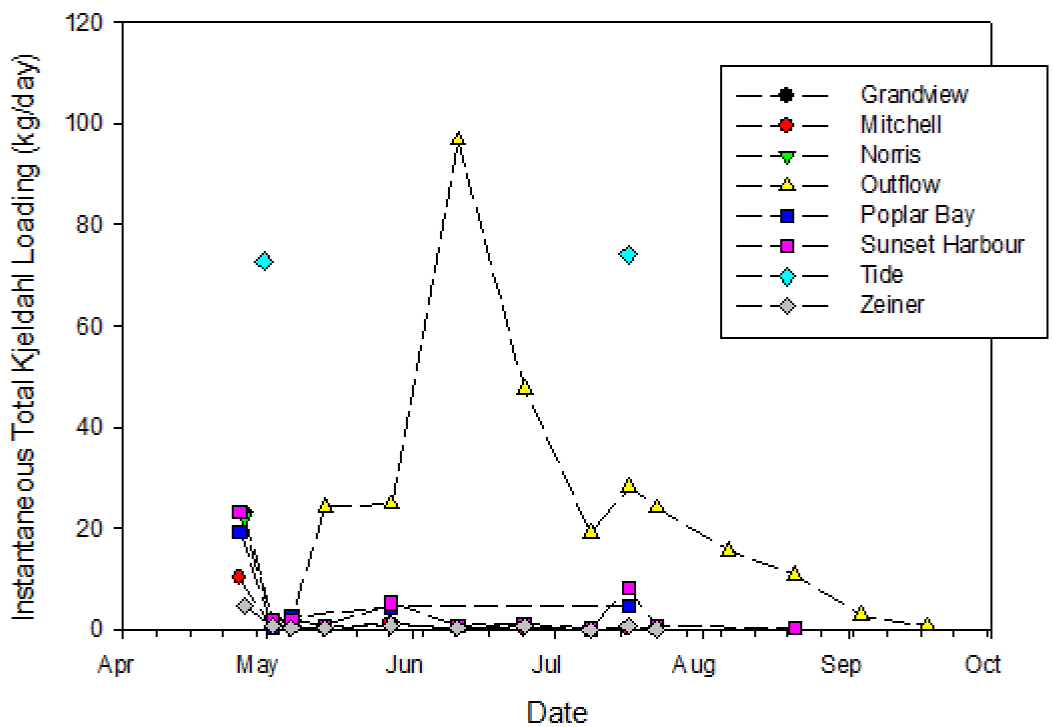


Figure 4-3 2013 Pigeon Lake Stream Instantaneous Ammonia and Total Kjeldahl Nitrogen Loads

Instantaneous ammonia loadings showed the influence of discharge measurements, loading rates being highest in spring and declining later in the season. Tide Creek, which had relatively higher discharge measurements but similar ammonia concentrations had higher ammonia loading rates relative to the other inflow streams. Despite having much higher discharge rates than the inflows, the outflow ammonia loading rate was only slightly higher than inflow rates. This is due to the low ammonia concentrations detected on most dates at the outflow (Figure 3-4).

Instantaneous TKN loading rates were similar to the ammonia loading rates for all streams. The exception was the outflow, where loading rates were much higher on most dates than the inflowing streams. TKN concentration was similar in the outflow relative to the inflows, so this higher loading rate reflects higher discharge rates observed at the outflow.

Cumulatively, ammonia loads were lowest in Zeiner Creek (3 kg) and highest in Tide Creek (53 kg) for the inflowing streams. The outflow discharged 104 kg of ammonia over the 2013 sampling period. For TKN, cumulative loads were lowest in Zeiner Creek (70 kg) and highest in Tide Creek (875 kg) for inflowing streams while the outflow TKN cumulative load was 3838 kg.

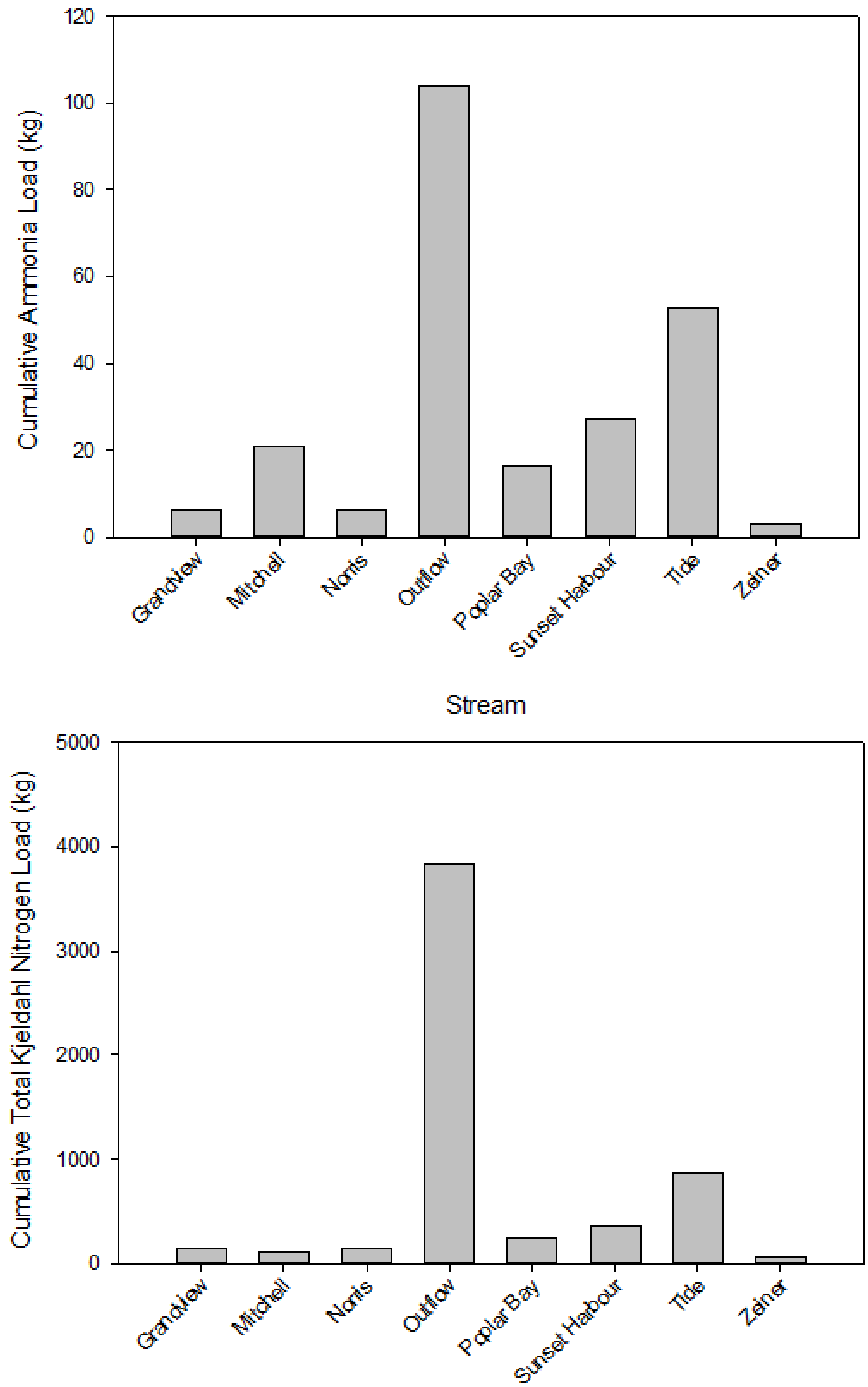


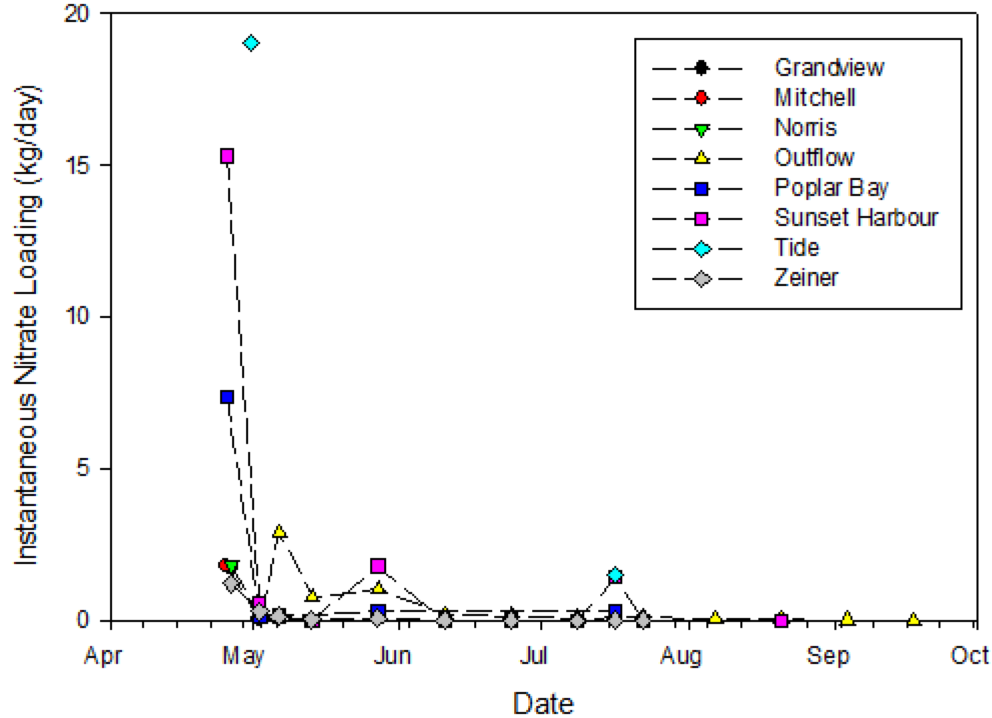
Figure 4-4 2013 Pigeon Lake Stream Cumulative Ammonia and Total Kjeldahl Nitrogen Loads

Figure 4-5 shows instantaneous loading rates for nitrate and nitrite in Pigeon Lake streams, while Figure 4-6 shows cumulative loading rates for these two parameters. Both parameters had higher loading rates during initial spring runoff, with subsequent small peaks after the May 27 and July 16 storm event. Nitrate loading rates for the outflow were very similar to the inflowing streams, as nitrate concentration was much lower in the outflow relative to the inflowing streams. While Tide Creek initially had the highest nitrate loading rate during spring runoff, this rate would have dropped off significantly afterwards when no flow was detected. By the July 16 storm event, loading rates were similar to other streams at Tide Creek.

Instantaneous nitrite loading rates were highest at Tide Creek on the two dates sampled. Loading rates at the outflow were slightly elevated compared to the inflows although the low nitrite concentration in the outflow resulted in lower loading rates than might have been expected with the higher discharge rates observed at the outflow.

On a cumulative basis, for inflowing streams nitrate load was lowest at Grandview (10 kg) and highest at Sunset Harbour (143 kg). Instantaneous rates may appear to suggest loads would be highest at Tide Creek. However, the more consistent flows observed at Sunset Harbour meant a more consistent supply of nitrate to the lake at lower levels. Cumulative nitrate load at the outflow was 55 kg, lower than several of the inflows.

Nitrite cumulative loads were lowest at Zeiner (0.4 kg) and highest at Tide (5.4 kg) for the inflowing streams. Cumulative loads at the outflow were very similar to Tide Creek at 5.4 kg.



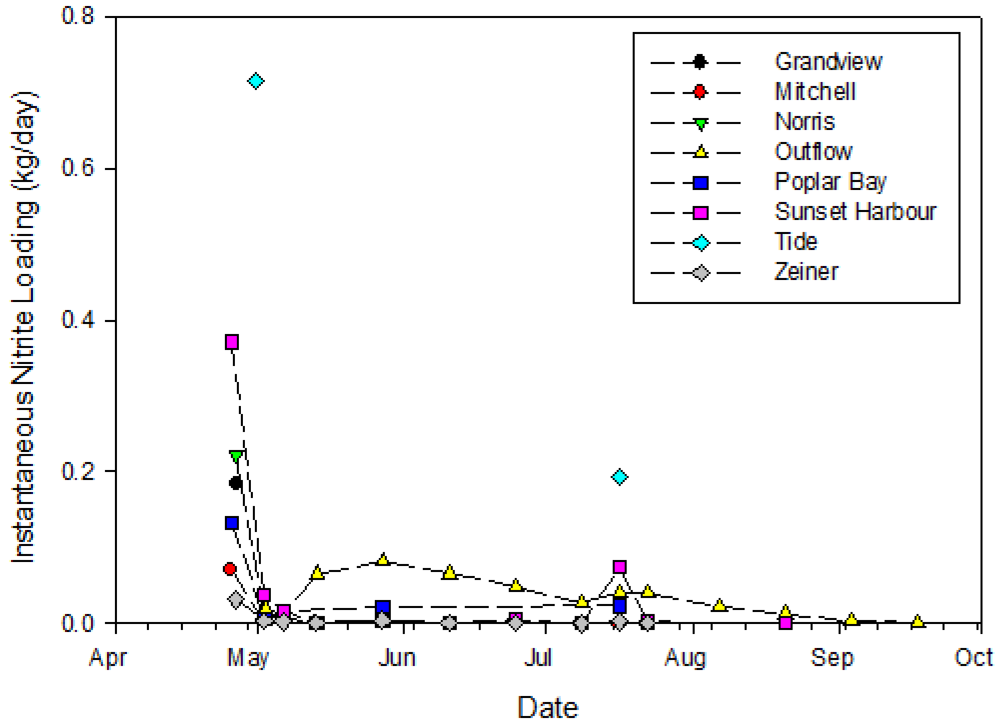


Figure 4-5 2013 Pigeon Lake Stream Instantaneous Nitrate and Nitrite Loads

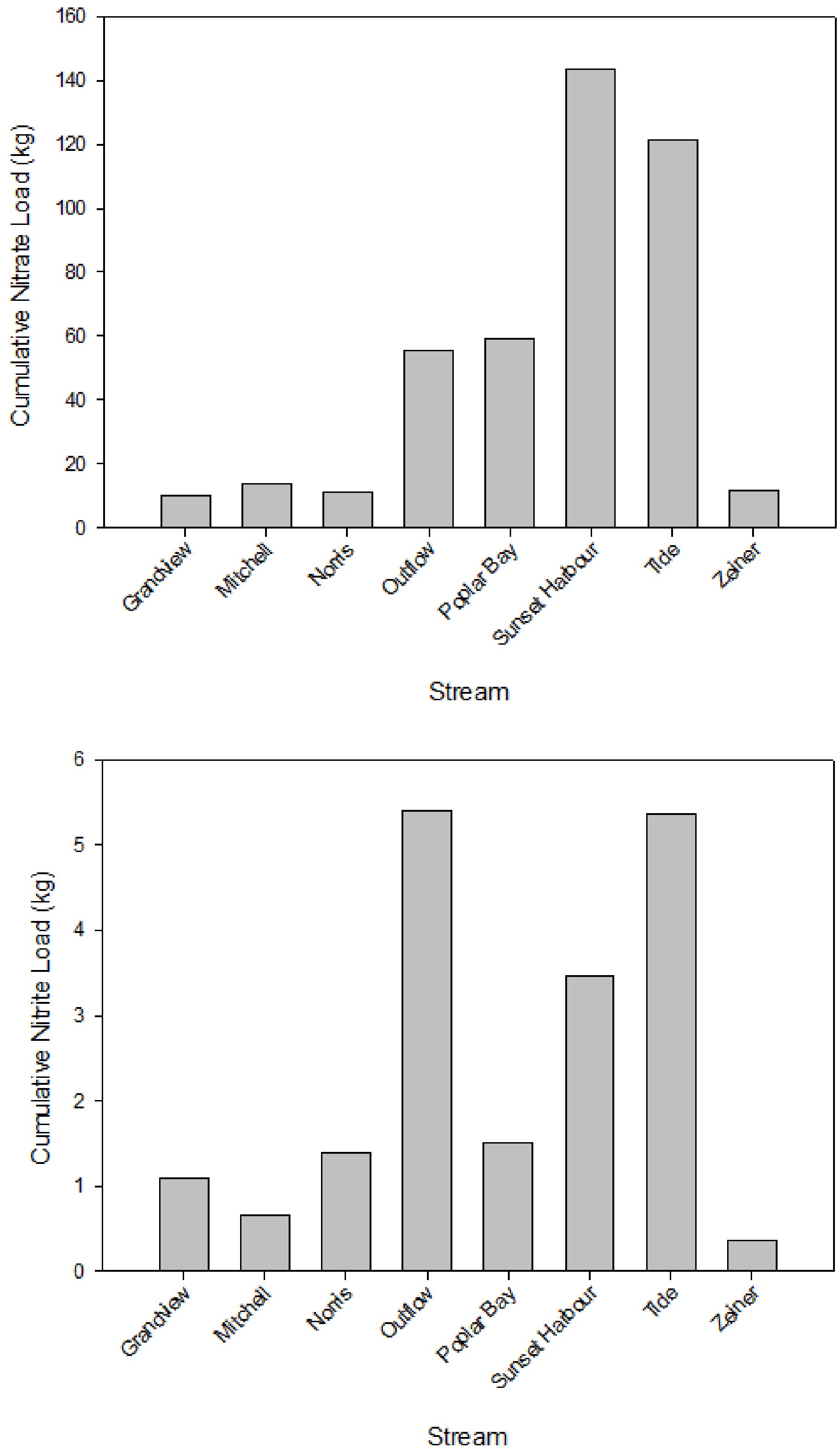


Figure 4-6 2013 Pigeon Lake Stream Cumulative Nitrate and Nitrite Loads

Figure 4-7 shows instantaneous loading rates for nitrate+nitrite and total nitrogen. Cumulative loads for both parameters are shown in Figure 4-8.

Instantaneous loading rates for nitrate+nitrite were very similar to nitrate loading rates. Rates for inflowing streams were highest during spring runoff and declined to low levels afterwards. Increases were observed after significant rainfall events. For total nitrogen, loading rates reflected discharge rates much more closely. Loading rates were highest in Tide Creek for the inflowing stream and were generally higher on most dates for the outflow.

Over the course of the sampling season, Zeiner had the lowest nitrate+nitrite load (12 kg) and Tide Creek had the highest (126 kg). Outflow cumulative nitrate+nitrite load was only 58 kg. For total nitrogen, Zeiner had the lowest load (82 kg), and Tide the highest (1001 kg). The outflow had significantly more total nitrogen load at 3896 kg.

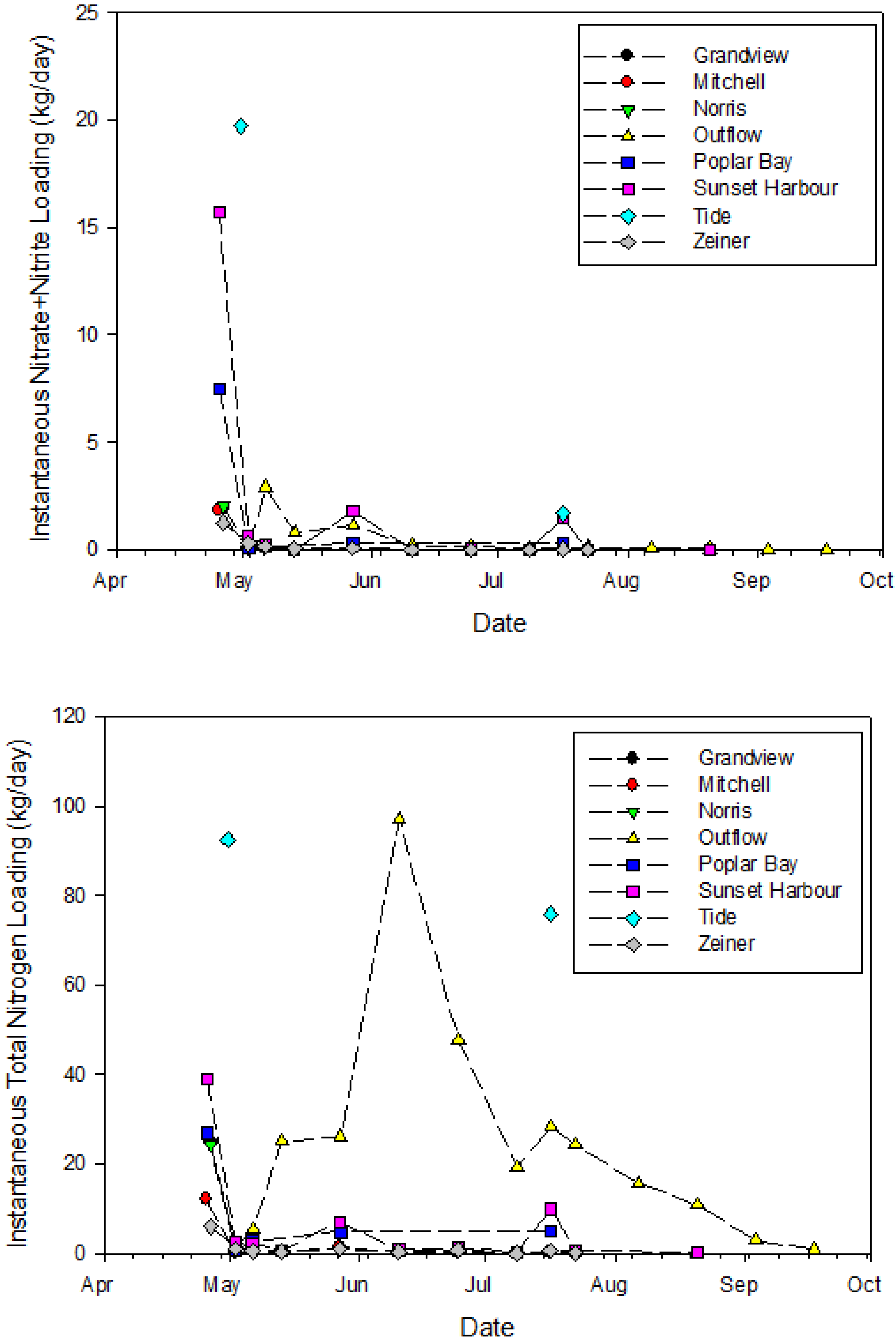


Figure 4-7 2013 Pigeon Lake Stream Instantaneous Nitrate+Nitrite and Total Nitrogen Loads

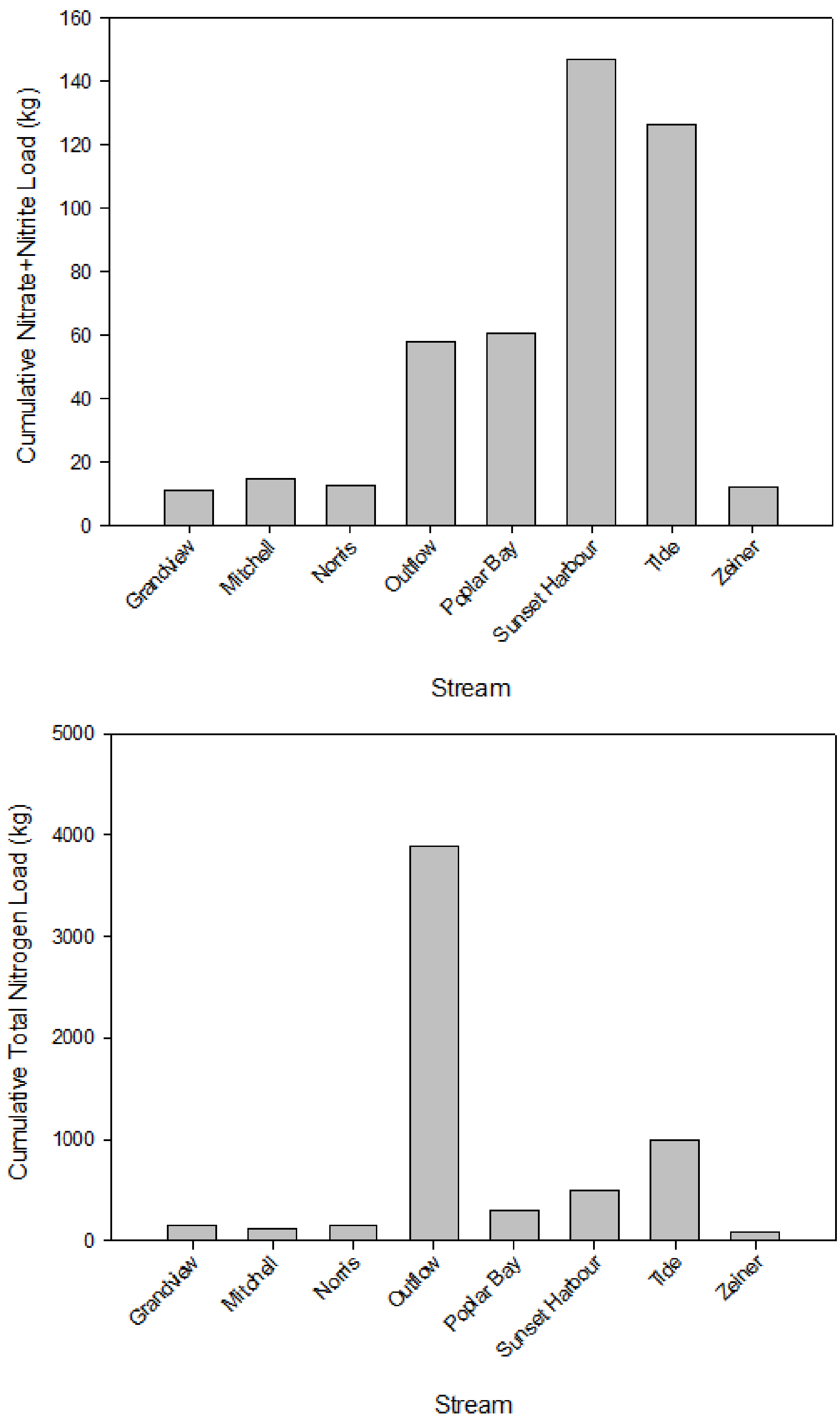


Figure 4-8 2013 Pigeon Lake Stream Cumulative Nitrate+Nitrite and Total Nitrogen Loads

4.3 Phosphorus Loadings

Instantaneous total phosphorus loading rate for Pigeon Lake streams is shown in Figure 4-9 while Figure 4-10 shows cumulative total phosphorus loads. Phosphorus loading rates were highest in the spring runoff with a small peak occurring for some streams on July 16 after the rainfall event. Tide Creek had the highest phosphorus loading rates relative to all streams on both dates when flow was detected. The inflow phosphorus loading rate was similar to slightly elevated compared to most inflow streams with the exception of June 10 (17 kg/day). Higher discharge rate along with higher total phosphorus concentration on that date contributed to the higher loading rate.

Cumulative total phosphorus loads were lowest at Zeiner (10 kg) and highest at Tide (98 kg) for the inflowing streams. The outflow total phosphorus loads were much higher than the inflows at 331 kg over the course of the sampling season.

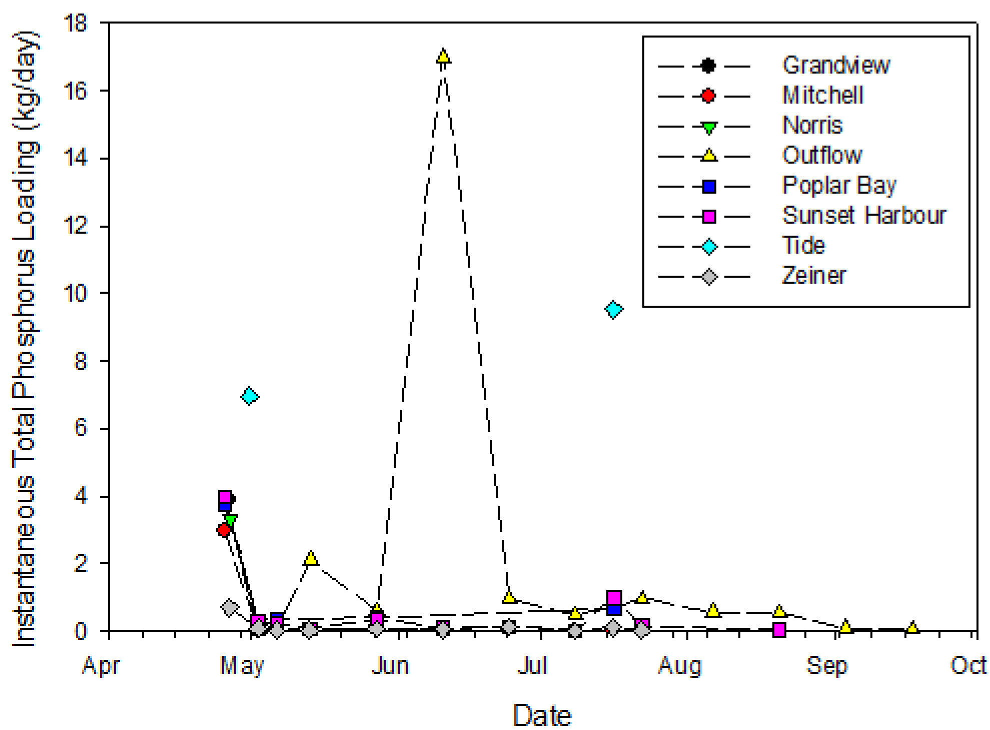


Figure 4-9 2013 Pigeon Lake Instantaneous Total Phosphorus Loads

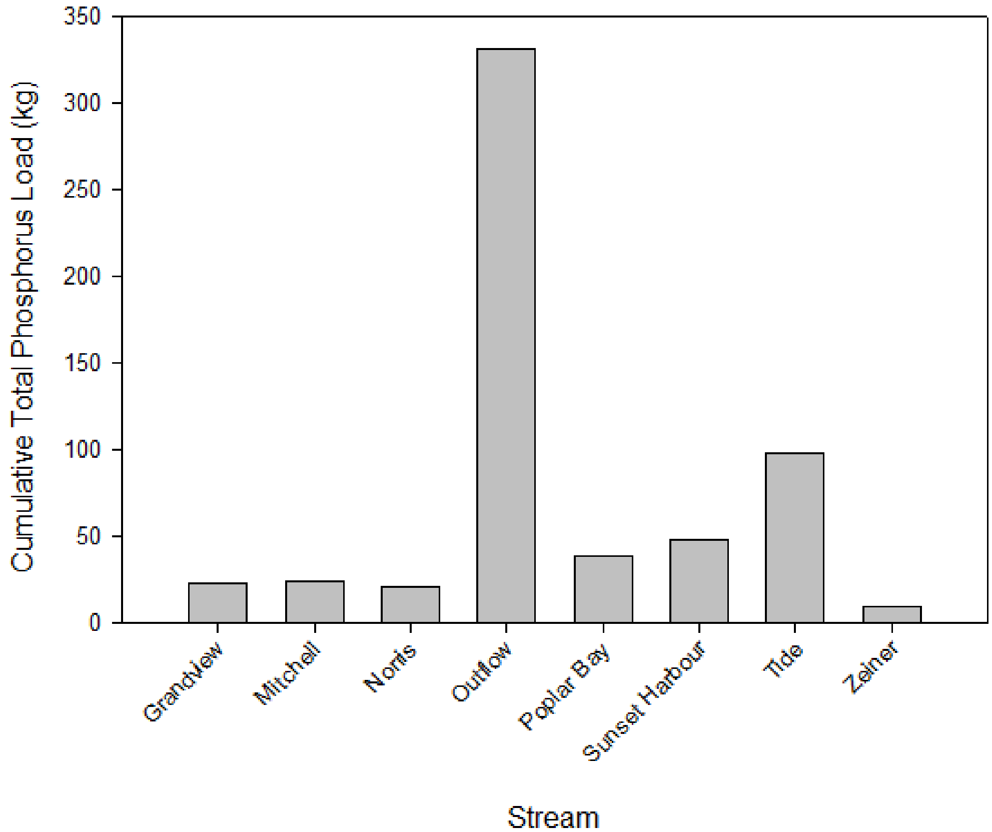


Figure 4-10 2013 Pigeon Lake Stream Cumulative Phosphorus Loads

Figures 4-11 and 4-12 show instantaneous loading rates and cumulative loads respectively for total dissolved phosphorus and dissolved ortho-phosphate. Instantaneous loading rates were similar for both parameters to total phosphorus loading rates, showing peaks during spring runoff as well as after major rainfall events. Tide Creek had the highest loading rates for both parameters on both dates, while the outflow loading rates were generally quite low and indiscernible from the inflows.

Cumulatively, Tide Creek had the highest loads for both total dissolved phosphorus (61 kg) and ortho-phosphate (33 kg). The outflow had relative low loads of total dissolved phosphorus (26 kg) and the lowest loads of ortho-phosphate (4 kg). The much lower loads for the dissolved phosphorus constituents in the outflow relative to total phosphorus reflects the fact that the majority of phosphorus in the outflow was likely bound to sediment particles. As discussed previously, the higher sediment load (as TSS) in the outflow likely contributed to the high total phosphorus loads.

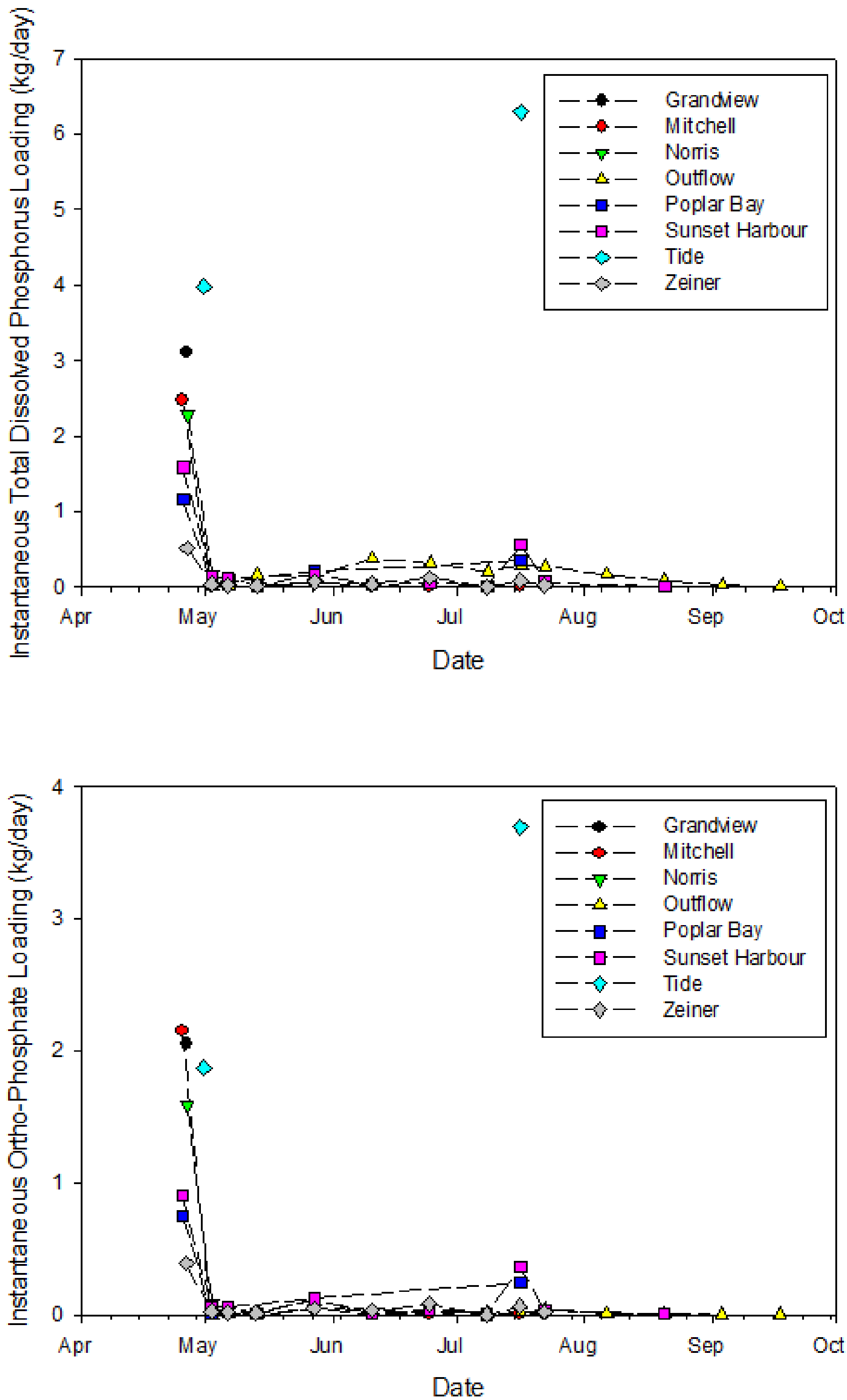


Figure 4-11 2013 Pigeon Lake Stream Instantaneous Total Dissolved Phosphorus and Ortho-Phosphate Loads

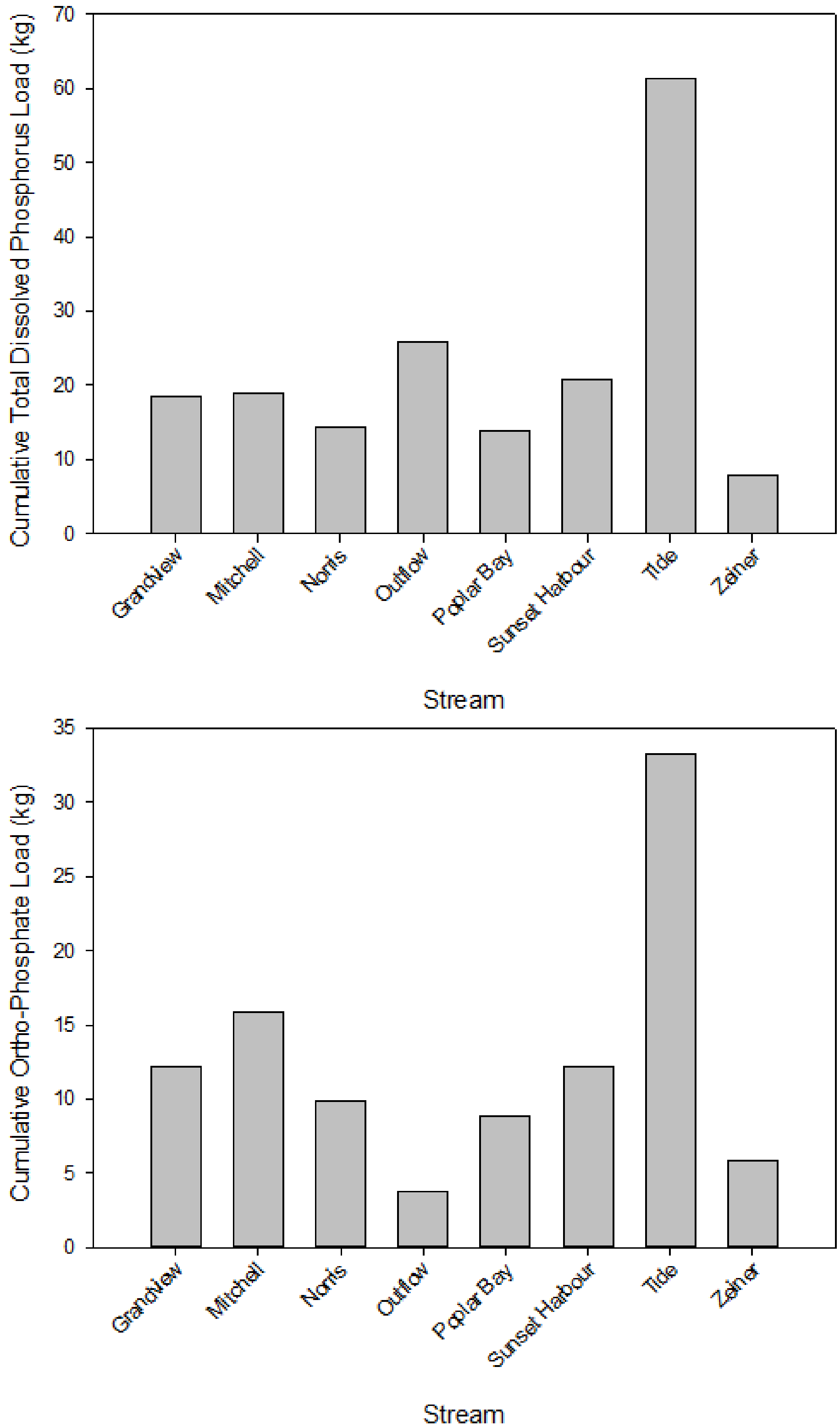


Figure 4-12 2013 Pigeon Lake Cumulative Total Dissolved Phosphorus and Ortho-Phosphate Loads

4.4 Stream Nutrient Loadings Summary

Discharge rates were similar for most inflowing streams, with maximum rates occurring during spring freshet. Peaks were also observed after significant rainfall events. Tide Creek had high discharge rates, reflecting the size of this stream. However, flow was only measured on two dates, thus despite its size, Tide Creek cumulative discharge was not a great deal higher than other measured inflows. The outflow had measurable flows on most sampling dates and reflected the increasing and decreasing water levels of Pigeon Lake.

For most nutrient parameters, Zeiner had the lowest loading rates despite often higher nutrient concentrations. This is the result of lower discharge rates in Zeiner relative to other Pigeon Lake streams. Similarly, although nutrient concentrations in Tide Creek were close to concentrations observed at other inflows, loading rates were often highest at this location.

While the outflow had higher and more continuous flows, cumulative loadings were only highest in the outflow for ammonia, TKN, total nitrogen and total phosphorus. Total nitrogen was primarily comprised of TKN indicating that most nitrogen in the outflow was organic in nature despite the relatively low TOC and DOC concentrations observed in the outflow. Total phosphorus loads were higher in the outflow primarily due to peaks in total phosphorus concentration associated with peaks in TSS from storm related events and potentially suspended biological material.

5.0 GROUNDWATER QUALITY

Groundwater refers to sub-surface waters contained within interstitial pores and cracks in the soil. While generally not a large component of a lake water balance, groundwater inputs and outputs become more important in lakes with small watersheds such as Pigeon Lake where the relative volume of surface water entering the lake is smaller. Much is unknown about the size and movement of groundwater into and out of lakes in Alberta due to the difficulty of monitoring these aspects, however typical water balances do assume a certain quantity entering the lake and offsetting surface outflows and evaporation to some degree. As groundwater contains dissolved constituents such as nutrients, it is important to monitor in order to ascertain potential impact from this resource.

Twelve groundwater samples were collected from domestic wells located within the Pigeon Lake watershed on October 22 and 23, 2013 (Table 5-1 and Figure 5-1). Samples were collected following guidance outlined in U.S. Office of Surface Mining Reclamation and Enforcement (2012). In short, resident volunteers at Pigeon Lake allowed access to domestic wells servicing their residence. Samples were collected after purging the outside line for a minimum of 15 minutes. Samples were submitted to an accredited analytical laboratory for analyses of nutrients, total dissolved solids, total suspended solids, organic carbon, and bacteriological parameters. Additional information collected from volunteer residents included well age, well depth, and frequency of use. Complete results are presented in Appendix 5-1 and discussed in further detail in the following sections.

Table 5-1 2013 Pigeon Lake Groundwater Sampling Locations and Dates

Sample ID	Location	Date
13GWE01506	Crystal Keys	22-Oct-13
13GWE01500	Ma-Me-O	22-Oct-13
13GWE01501	Rundle's Mission	22-Oct-13
13GWE01502	Itaska Beach	22-Oct-13
13GWE01503	Golden Day's Beach	22-Oct-13
13GWE01504	Grandview Beach 1	22-Oct-13
13GWE01505	Crystal Springs	22-Oct-13
13GWE01510	Grandview Beach 2	23-Oct-13
13GWE01509	Leduc County @ Hwy 616 RR 11	23-Oct-13
13GWE01511	Sunset Harbour	23-Oct-13
13GWE01508	Silver Beach	23-Oct-13
13GWE01507	Johnsonia Beach	23-Oct-13

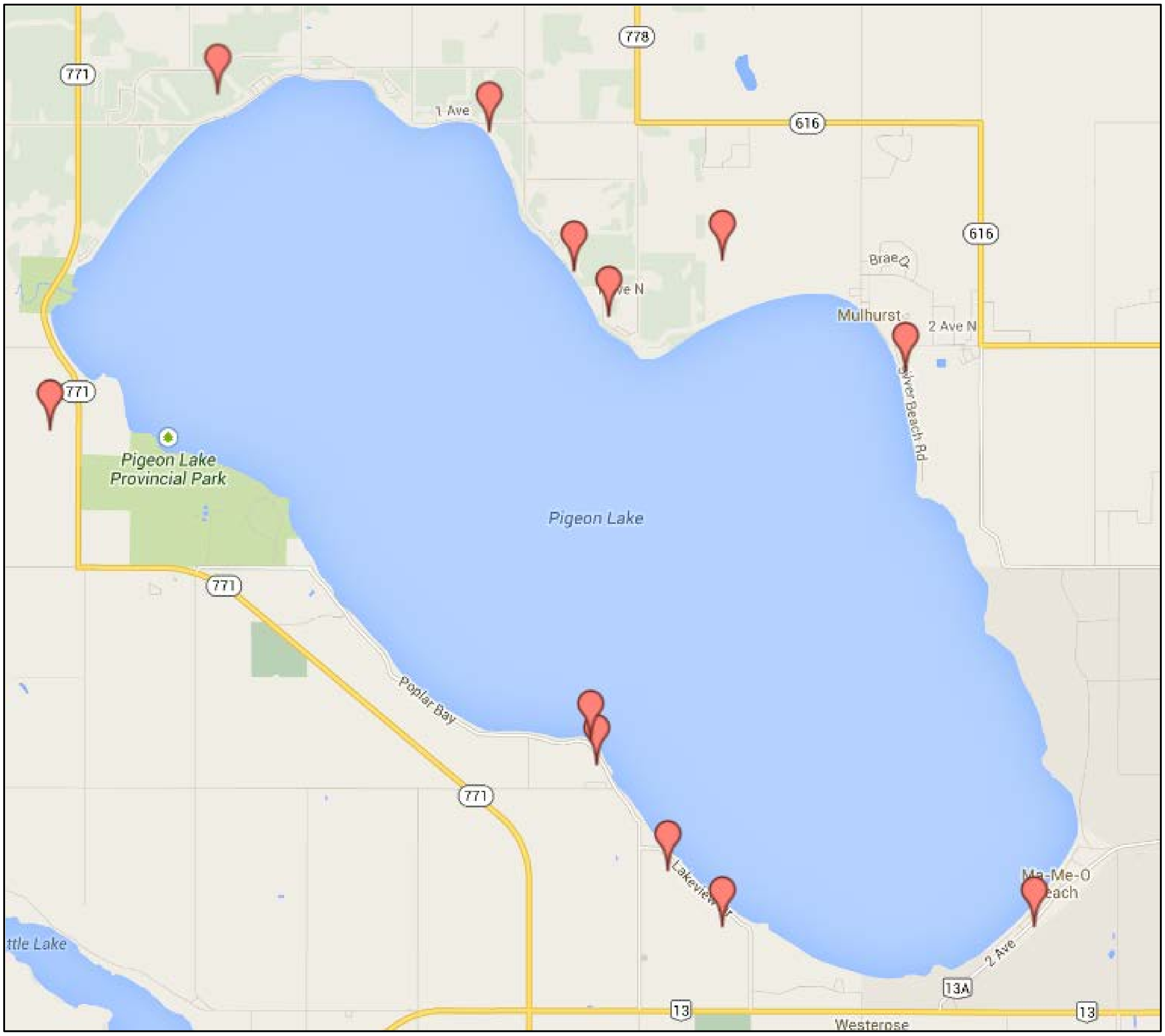


Figure 5-1 2013 Pigeon Lake Groundwater Sampling Locations

5.1 Nutrients

Nutrients were sampled from groundwater wells primarily to determine potential loading from groundwater into Pigeon Lake. Parameters collected were the same as for the streams and lake, including various nitrogen and phosphorus components. Summary statistics are presented in Table 5-2.

Table 5-2 2013 Pigeon Lake Groundwater Nutrient Summary Statistics

Measure	Total Kjeldahl Nitrogen	Ammonia	Total Nitrogen	Total Phosphorus	Total Dissolved Phosphorus	Ortho-phosphate
Mean	0.327	0.276	0.349	0.032	0.029	0.023
Median	0.305	0.231	0.315	0.023	0.024	0.023
Minimum	0.074	0.009	0.074	0.002	0.001	0.001
Maximum	0.596	0.540	0.596	0.111	0.102	0.054
5th percentile	0.080	0.014	0.143	0.005	<0.001	<0.001
10th percentile	0.097	0.033	0.211	0.007	0.002	0.002
90th percentile	0.540	0.539	0.544	0.061	0.054	0.042
95th percentile	0.567	0.540	0.570	0.085	0.076	0.048

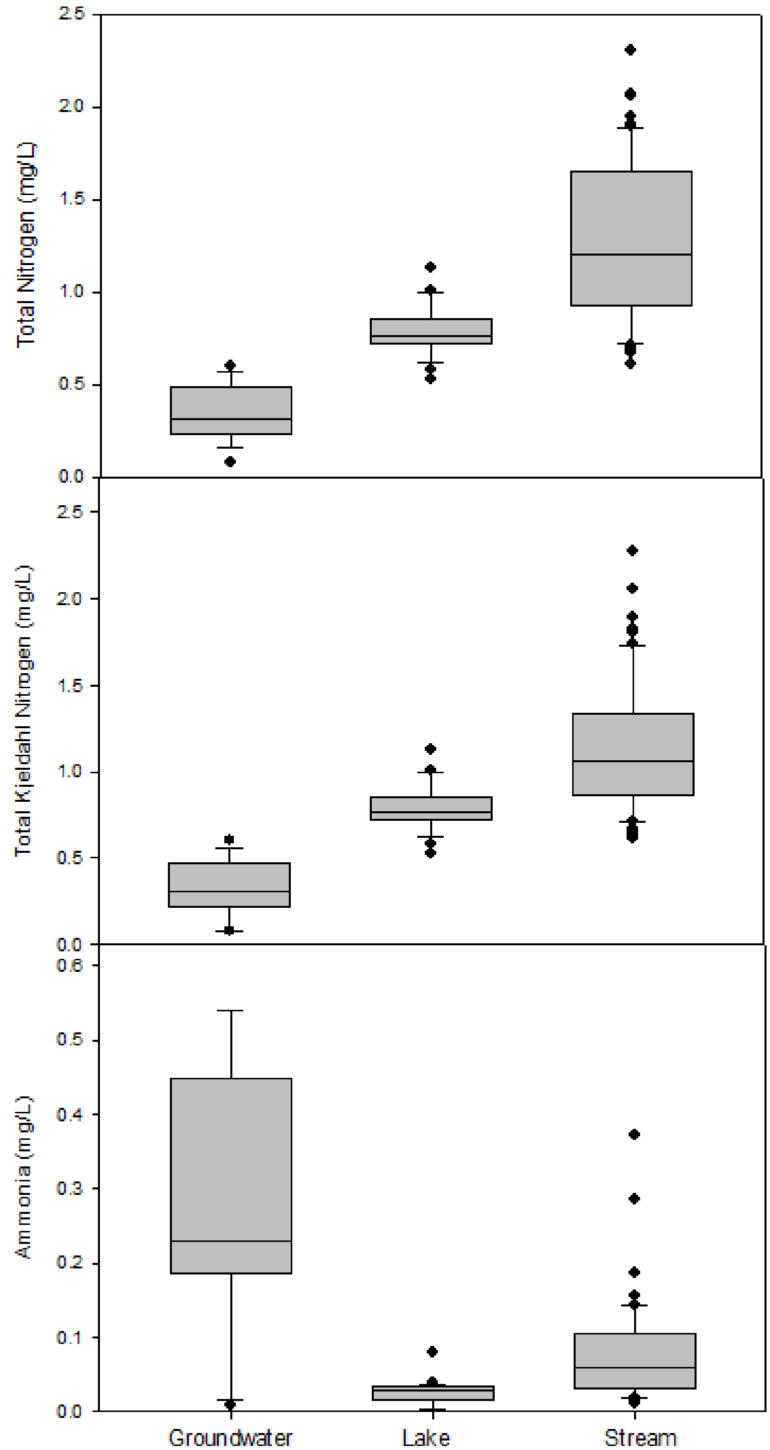
All values in mg/L

5.1.1 Nitrogen

A summary of nitrogen components found in detectable quantities is presented in Figure 5-2. Both nitrate and nitrite were below analytical detection limits in all samples collected. Ammonia ranged in concentration from 0.009 to 0.540 mg/L (median 0.231 mg/L) while total Kjeldahl nitrogen (TKN) ranged in concentration from 0.074 to 0.596 mg/L (median 0.305 mg/L). Total nitrogen, calculated as the sum of inorganic and organic nitrogen components, ranged from 0.074 to 0.596 mg/L (median 0.315 mg/L).

Relative to stream and lake nitrogen concentrations, TKN and total nitrogen concentrations in groundwater samples were much lower. Median TKN values for the lake and streams were 0.76 and 1.07 mg/L respectively while total nitrogen values were 0.76 and 1.20 mg/L respectively. Ammonia concentrations, however, were much higher in groundwater samples relative to the lake and streams (medians of 0.029 and 0.059 mg/L respectively).

As TKN is a measure of organic nitrogen, ammonia (NH_3) and ammonium (NH_4^+), it appears that groundwater contains a much higher fraction of ammonia relative to surface water. Ammonia typically occurs at concentrations lower than 0.2 mg/L in groundwater (Bouwer and Crowe, 1988) however surveys of raw drinking water in Alberta has shown that average ammonia concentrations range from 0.2 to 0.6 mg/L (Health Canada, 2013). Concentrations observed from Pigeon Lake fall well within this range.



Note: Boxes delineate 25th and 75th percentiles around the median. Whiskers represent 10th and 90th percentiles.

Figure 5-2 2013 Pigeon Lake Groundwater, Lake and Stream Box and Whisker Plots for Nitrogen Parameters

5.1.2 Phosphorus

Samples for phosphorus parameters included total and dissolved phosphorus and ortho-phosphate. A summary of results for these three parameters is presented in Figure 5-3. Minimum detected concentrations for ortho-phosphate and dissolved phosphorus were below detection limit (<0.001 mg/L) while the minimum value for total phosphorus was 0.002 mg/L. Maximum concentrations for ortho-phosphate, dissolved phosphorus and total phosphorus were 0.054, 0.102, and 0.111 mg/L respectively. Median concentrations for the same three parameters were 0.023, 0.024, and 0.023 mg/L.

Concentrations of all three phosphorus parameters were very similar to each other, indicating the majority of phosphorus is in the dissolved phase. While the median value for dissolved phosphorus was slightly higher than that of total phosphorus, this was confirmed to be within acceptable analytical variability, emphasizing how similar concentrations amongst the three parameters were.

Median concentrations of phosphorus in groundwater were much lower relative to stream concentrations (0.124, 0.053, and 0.031 for total, dissolved and ortho-phosphate respectively). However, concentrations in groundwater were higher than those of Pigeon Lake (0.023, 0.007, and 0.001 mg/L for total, dissolved and ortho-phosphate respectively).

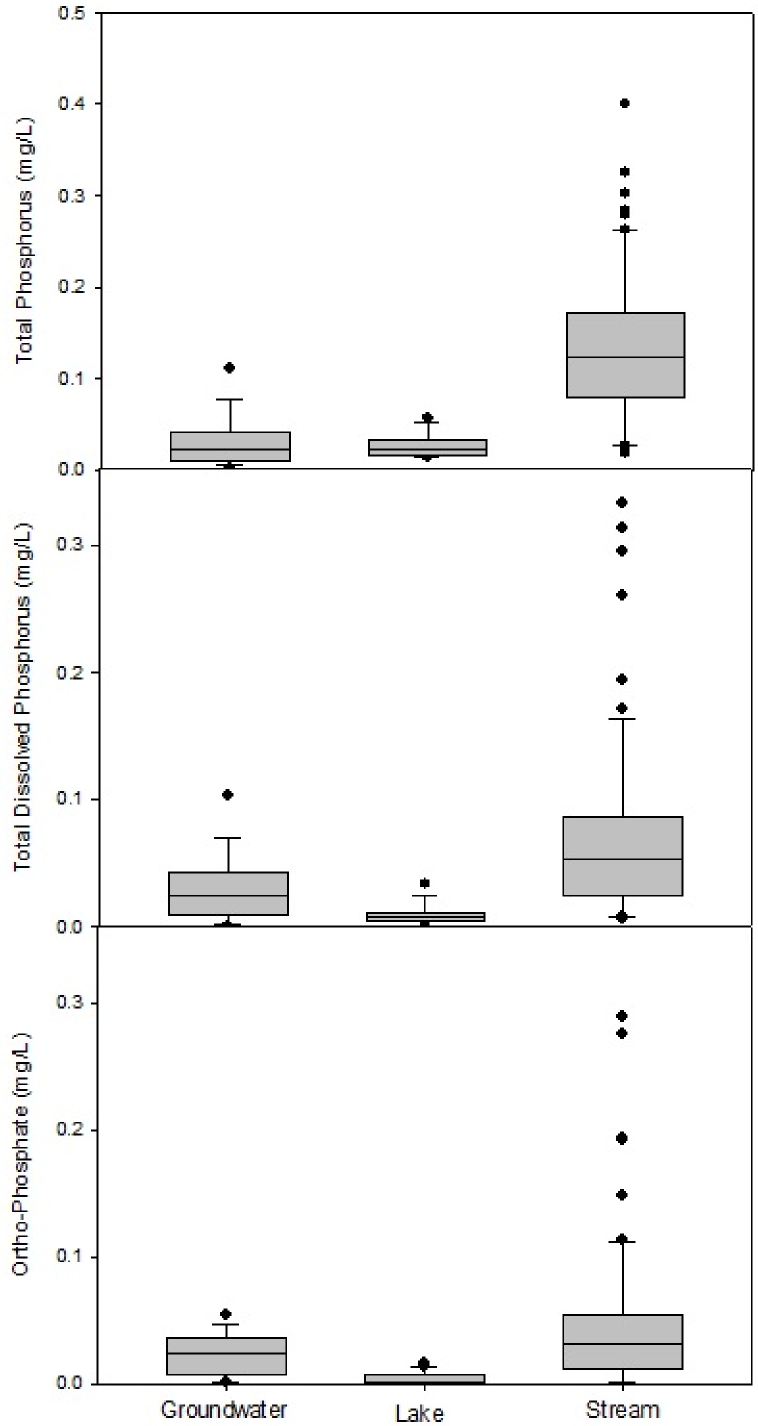
5.2 Total suspended solids, total dissolved solids and organic carbon

Summary statistics for total dissolved solids (TDS), total organic carbon (TOC) and dissolved organic carbon (DOC) are presented in Table 5-3 and Figure 5-4. Total suspended solids (TSS), a measure of particulate matter >0.45µm in size, was below detection limit (3 mg/L) in all but one groundwater sample hence is not discussed further below.

Table 5-3 2013 Pigeon Lake Groundwater TDS, TOC and DOC Summary Statistics

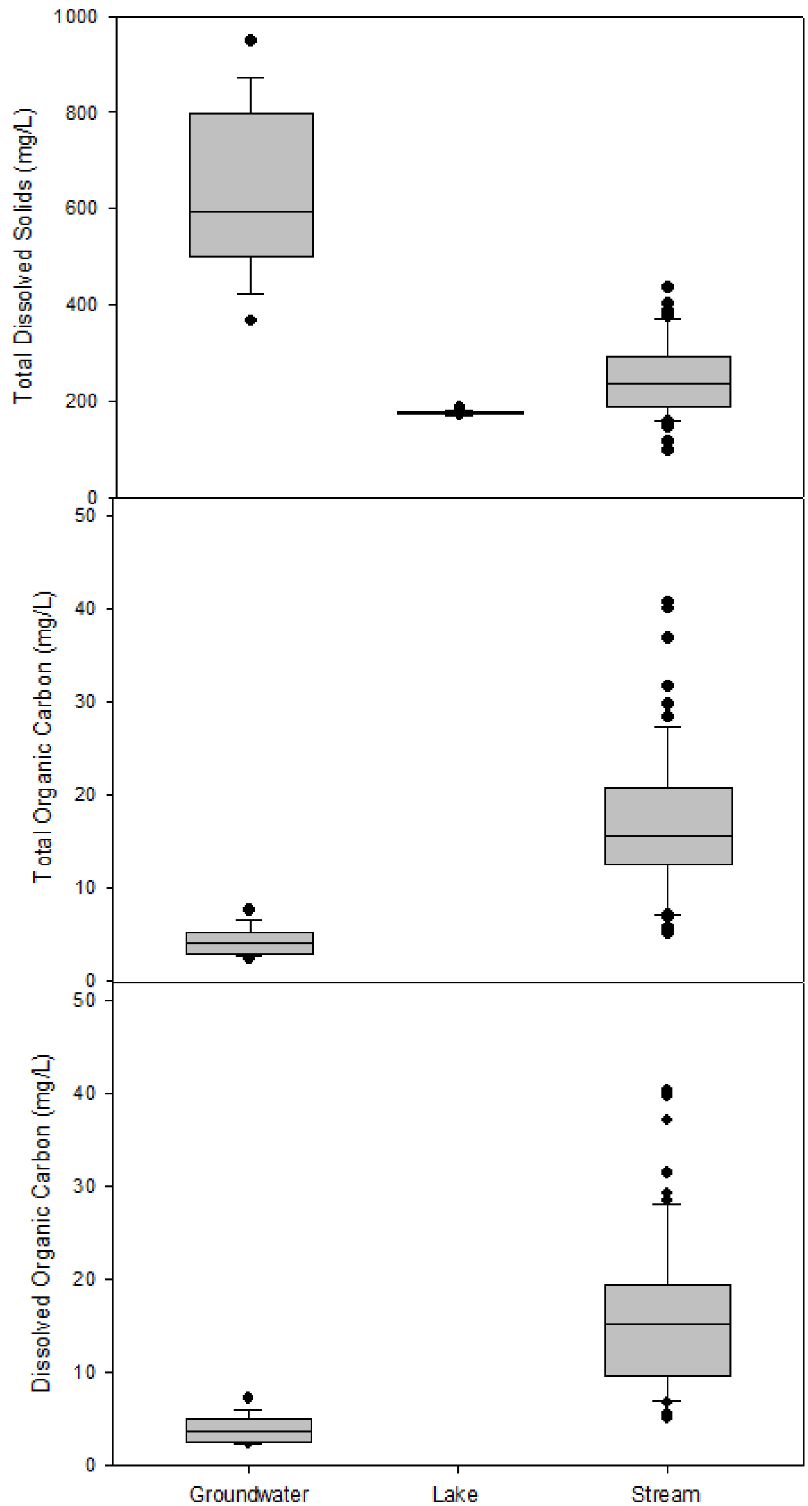
Measure	Total Dissolved Solids	Total Organic Carbon	Dissolved Organic Carbon
Mean	636	4.2	3.9
Median	593	4.1	3.8
Minimum	367	2.3	2.3
Maximum	949	7.5	7.2
5th percentile	412	2.5	2.4
10th percentile	451	2.7	2.4
90th percentile	839	5.9	5.6
95th percentile	890	6.7	6.3

All values in mg/L



Note: Boxes delineate 25th and 75th percentiles around the median. Whiskers represent 10th and 90th percentiles.

Figure 5-3 2013 Pigeon Lake Groundwater, Lake and Stream Box and Whisker Plots for Phosphorus Parameters



Note: Boxes delineate 25th and 75th percentiles around the median. Whiskers represent 10th and 90th percentiles.

Figure 5-4 2013 Pigeon Lake Groundwater, Lake and Stream Box and Whisker Plots for TDS, TOC and DOC

TDS, a measure of dissolved constituents (primarily major ions like chloride, sodium, magnesium, etc.) ranged from 367 to 949 mg/L (median 593 mg/L). DOC and TOC ranged from a minimum of 2.3 mg/L for both to maximums of 7.2 and 7.5 mg/L respectively (medians of 3.75 and 4.05 mg/L for DOC and TOC).

TOC and DOC were higher in streams (medians of 15.6 and 15.2 mg/L respectively). Both stream TDS (median 239 mg/L) and lake TDS (176 mg/L) were much lower relative to groundwater samples. TOC and DOC were not measured in Pigeon Lake. The apparent differences between groundwater chemistry and surface water chemistry reflects the fact that groundwater is in contact with inorganic material (low organic content, greater dissolution of major ions into solution), while surface water is in contact with material higher in organic content (organic top soils).

5.3 Groundwater Bacteriological Parameters

Both *E.coli* and faecal coliform bacteria were sampled for from all groundwater wells. These bacteria are of significant human health concern, especially if present in drinking water. While these bacteria are not usually present in groundwater, wells which are not maintained properly may become contaminated. None of the twelve wells sampled had detectable quantities of either bacteriological parameter.

5.4 Well Depth and Age

Additional aspects collected during sampling included the depth of the well and the year the well was drilled. Depths varied from 7.62 to 53.34m, while the year the wells were drilled varied from 1964 to 2011 (Appendix 5-1). To determine if relationships between water chemistry parameters and either depth or age existed, scatter plots for each parameter were created (Appendix 5-2). In addition, linear regressions were conducted on raw and transformed data. In all cases, there did not appear to be any relationship between a given parameter and either age or depth of the well.

While the above analysis was, for practical purposes, rudimentary, there was sufficient evidence to suggest that a given parameter concentration was independent of the well depth or age and was instead reflective of surrounding geology. This also provides further support to the assumption that the wells sampled were likely free from surface contamination.

5.5 Groundwater Summary

Groundwater samples collected from the Pigeon Lake watershed showed a degree of variability amongst samples, but also some consistent trends relative to lake and stream water chemistry. While most nitrogen components had relatively low concentrations in groundwater, ammonia was much higher than stream and lake concentrations. Phosphorus concentrations were highest in streams, but lower in Pigeon Lake relative to groundwater. Finally, dissolved constituents, as measured by TDS concentration, was higher in groundwater samples relative to the streams and lake, while being lower in organic content (measured as TOC and DOC), likely reflecting chemistry of surrounding geology.

All groundwater wells sampled had no detectable quantities of faecal coliform bacteria, indicating wells were likely not contaminated. This is further supported by the fact that parameters were not significantly related to well depth or age which can be an indicator of surface contamination.

6.0 SEDIMENT CHEMISTRY

Sediment samples were collected from Pigeon Lake in 2013 to provide site specific data for supporting the development of the nutrient budget as well as to provide supporting data for the exploration of the potential for dredging to reduce in-lake nutrient (specifically phosphorus) concentrations. Sediment cores were collected in early June from a total of six sites ranging in depth to account for spatial variability with location and depth (Table 6-1 and Figure 6-1). Individual cores were further sub-divided into shallow and deep sections (0-10cm and >10cm), bagged and sent to ALS laboratories for analysis.

Complete analytical results are available in Appendix 6-1 while select parameters are discussed in more detail in the following sections.

Table 6-1 2013 Pigeon Lake Sediment Sample Locations

Name	Date Sampled	Location	Sample Depth (m)
Shallow Spot #1	June 5	+52° 58' 33.70", -113° 57' 46.70"	0.7
Shallow Spot #2	June 5	+53° 1' 48.50", -114° 7' 44.70"	4.0
Shallow Spot #3	June 10	+53° 4' 27.17", -114° 5' 0.10"	1.2
Medium Spot #1	June 5	+52° 58' 46.90", -114° 1' 19.00"	6.5
Medium Spot #2	June 5	+53° 3' 17.50", -114° 5' 14.00"	7.5
Deep Spot #1	June 5	+53° 0' 0.95", -114° 0' 22.50"	9.0

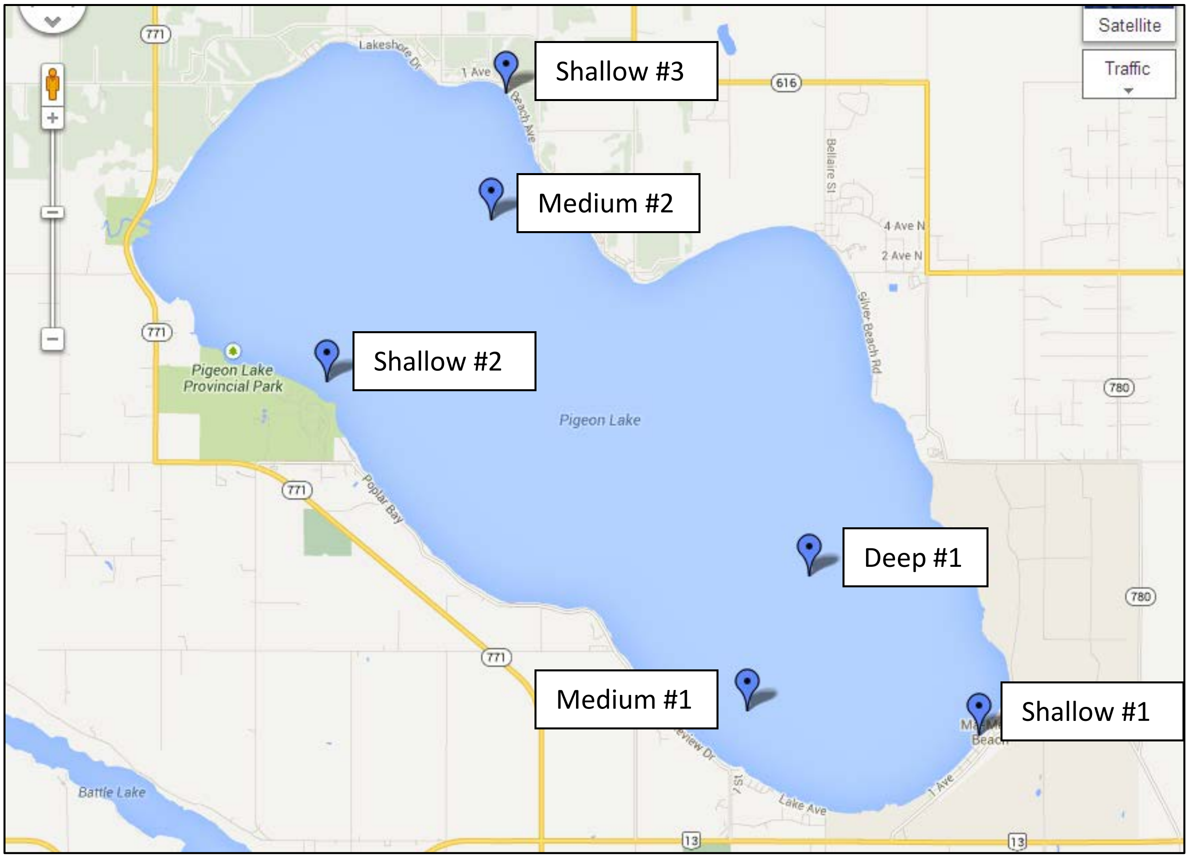


Figure 6-1 2013 Sediment Sampling Locations, Pigeon Lake

6.1 Sediment Composition and Carbon Content

Figure 6-2 presents an overview of sediment composition for the cores collected from Pigeon Lake. Sediment tended to be sandier in the shallow zones of Pigeon Lake and dominated by silt at deeper depths.

Carbon content tended to follow the pattern observed for composition, with highest carbon content occurring in samples with higher silt content (Figure 6-3). Silt content and carbon content are important to note as nutrient concentrations tend to be higher in sediments with higher organic and silt and clay content (more binding sites and more organic source matter).

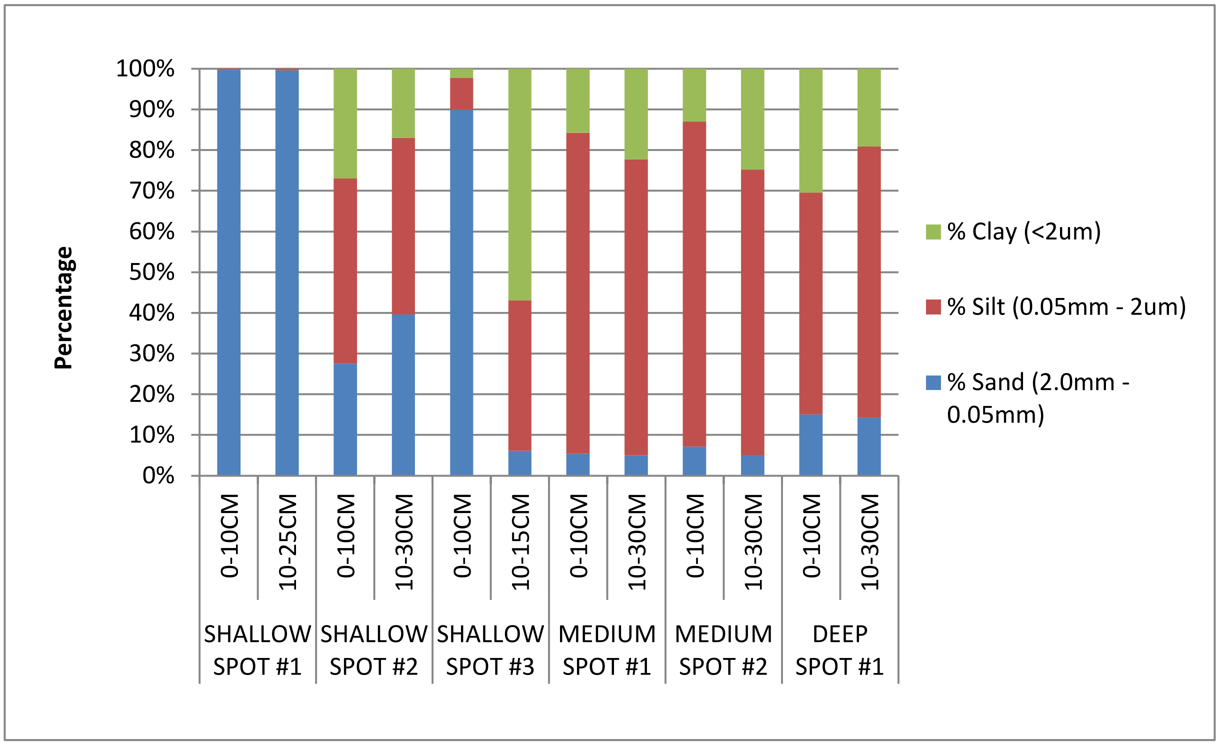


Figure 6-2 2013 Pigeon Lake Sediment Composition

For total phosphorus concentration, there was a significant positive relationship between total organic carbon content (r^2=0.782, p<0.001) and silt content (r^2=0.585, p=0.002) and a significant negative relationship with sand content (r^2=0.470, p=0.008). However, clay content was not a good predictor of phosphorus content in sediments, indicating phosphorus is more strongly associated with silt in Pigeon Lake sediments. Appendix 6-2 contains figures showing the relationship between these parameters.

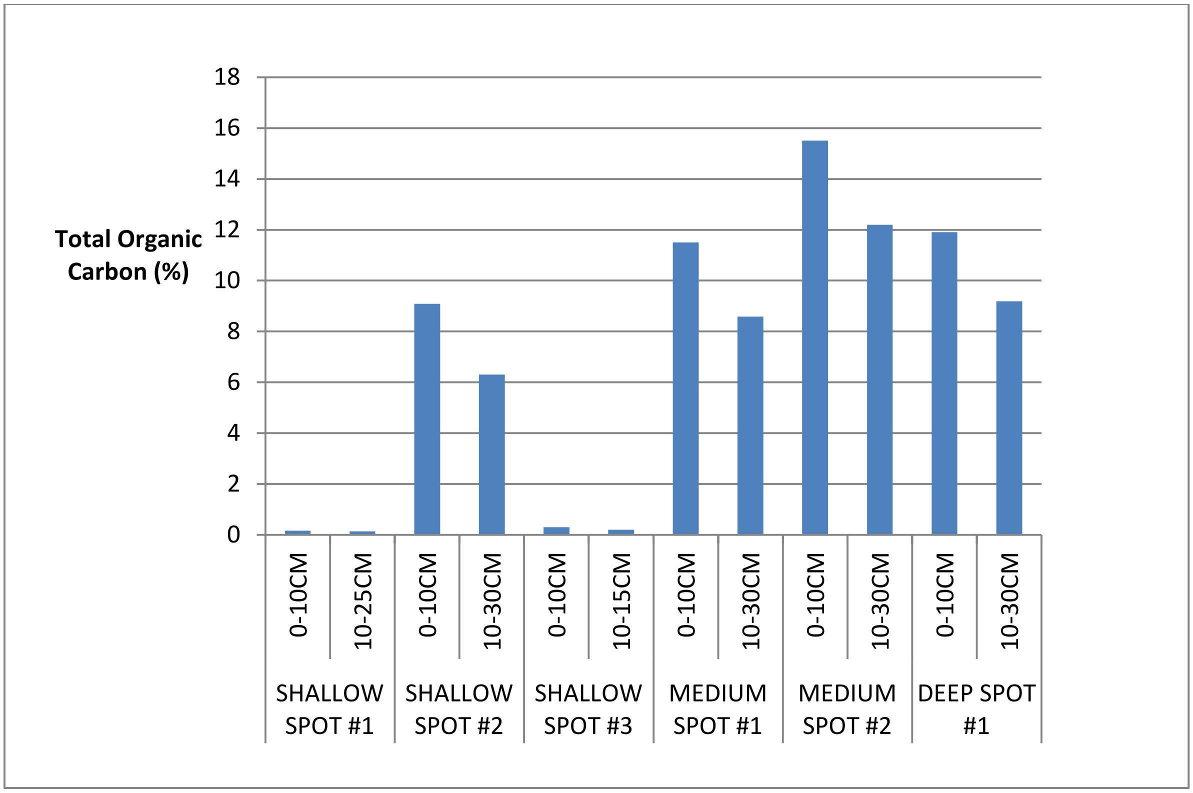


Figure 6-3 2013 Pigeon Lake Sediment Total Organic Carbon Content

6.2 Nutrients

Both phosphorus concentration and total nitrogen content were analyzed in all sediment samples collected at Pigeon Lake. Results for both are shown in Figures 6-4 and 6-5.

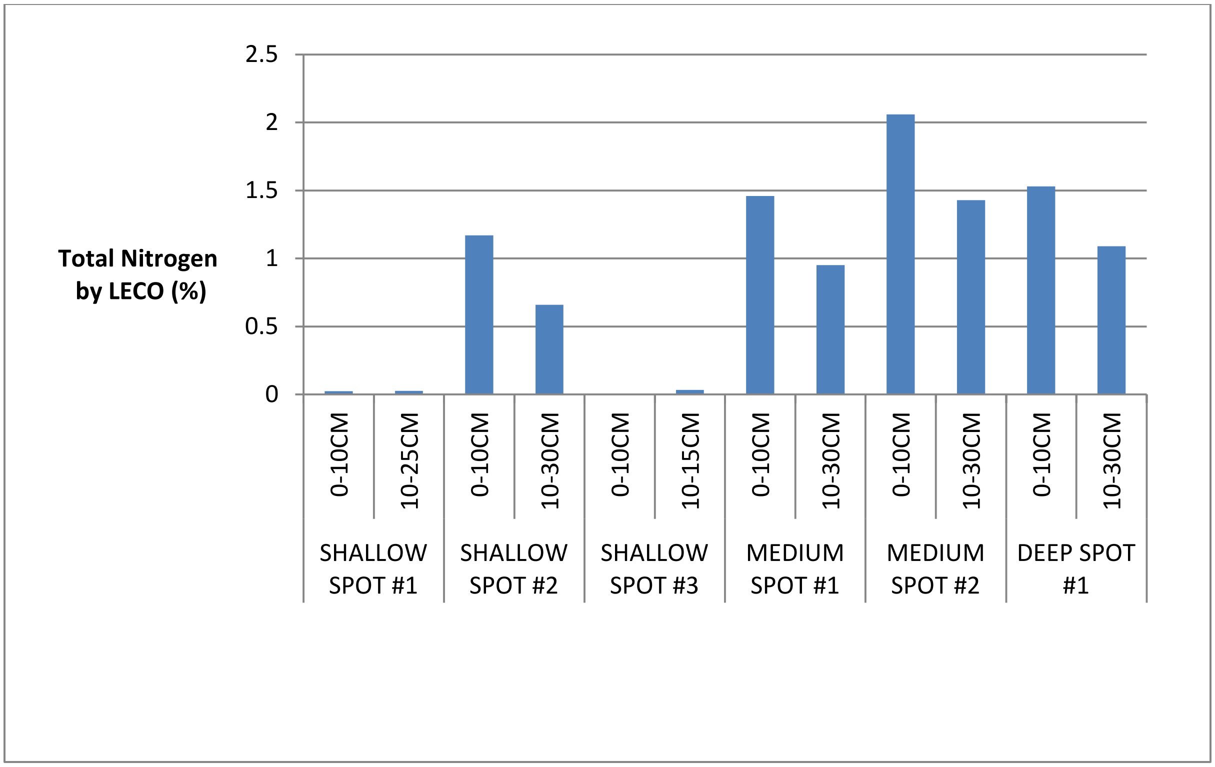


Figure 6-4 2013 Pigeon Lake Sediment Total Nitrogen Content

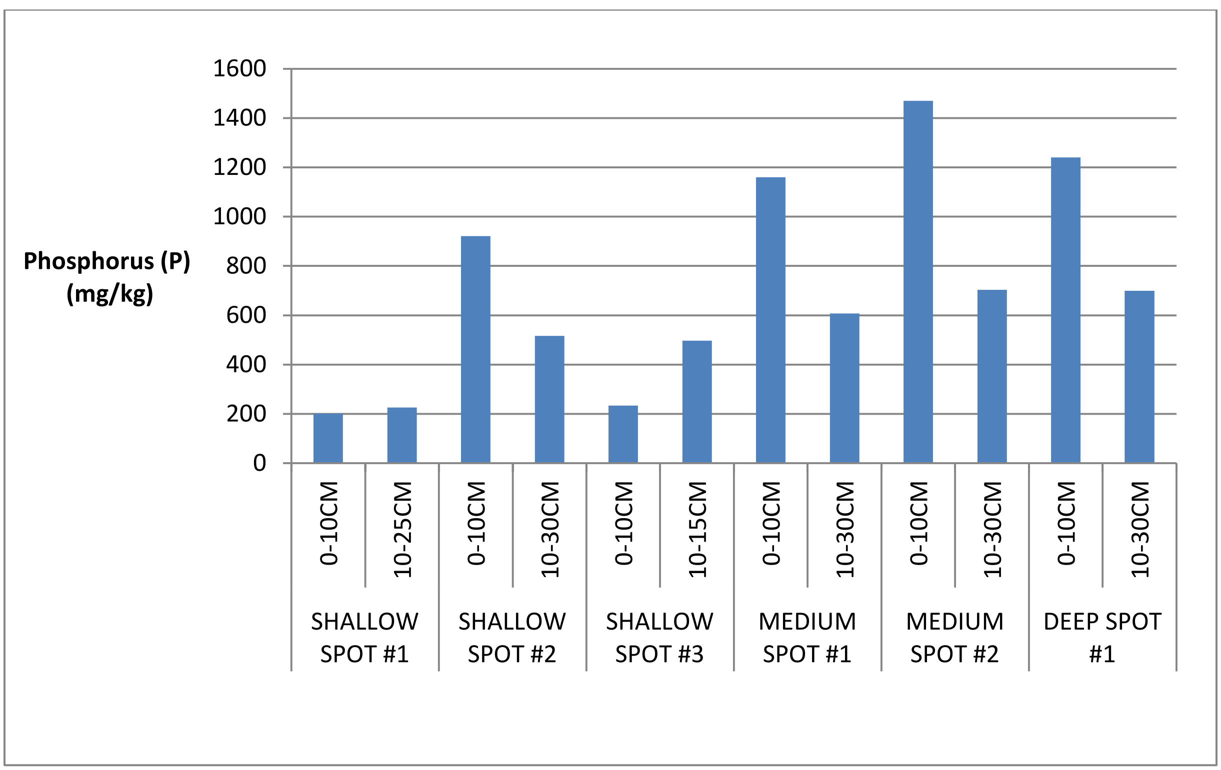


Figure 6-5 2013 Pigeon Lake Sediment Phosphorus Content

Phosphorus concentration ranged from 201 to 1,470 mg/kg while total nitrogen content ranged from <0.020 to 2.06%. For both nutrient parameters, concentrations tended to be higher in those sediments containing higher proportions of silt and higher concentrations of organic carbon. Concentrations for both nitrogen and phosphorus were typically lower in the deeper sections of a given core (*i.e.*, >10cm) than the shallower sections (*i.e.*, 0-10cm). Phosphorus concentration and nitrogen content were strongly correlated to each other (r^2=0.849, p=0.012, Appendix 6-2) indicating that as phosphorus concentrations increase in sediments, so does total nitrogen content.

While the concentration of phosphorus in sediments may seem extremely high relative to surface waters, it is important to keep in mind that the analysis conducted by the lab is a strong digestion technique and represents both biologically available and bound sediment phosphorus. It is likely that, while higher than water phosphorus concentrations, the biologically available phosphorus content of sediments is much lower than the total phosphorus content.

6.3 Moisture Content

Differences in nutrient concentrations are also attributable to differences in moisture content. Shallow sections of sediments have higher moisture content relative to deeper sections and sandier sediments hold lower moisture content relative to silt laden sediments (Figure 6-6). As analytical results for parameters such as total phosphorus are expressed on a dry weight basis (i.e., mg/kg of dry material), it is important to normalize results to account for moisture and compare wet (i.e., *in situ*) nutrient content.

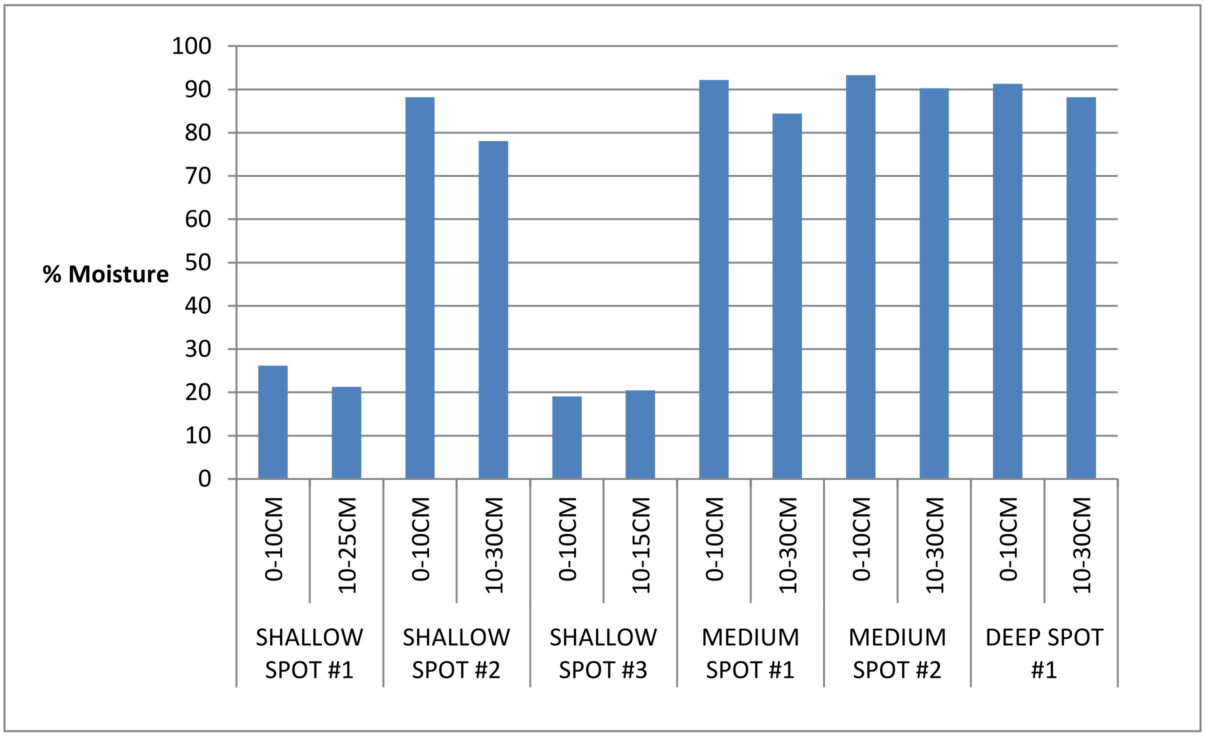


Figure 6-6 2013 Pigeon Lake Sediment Moisture Content

When normalized for moisture content, phosphorus concentration per kilogram of wet material is very similar across sediment types and sectional depths (Figure 6-7). To put this into context, sandier sediments have lower phosphorus content but also have lower moisture content. Therefore, a larger volume of sediment would need to be collected to achieve the equivalent wet weight of material removed as a higher moisture content sediment and would therefore remove a larger amount of phosphorus.

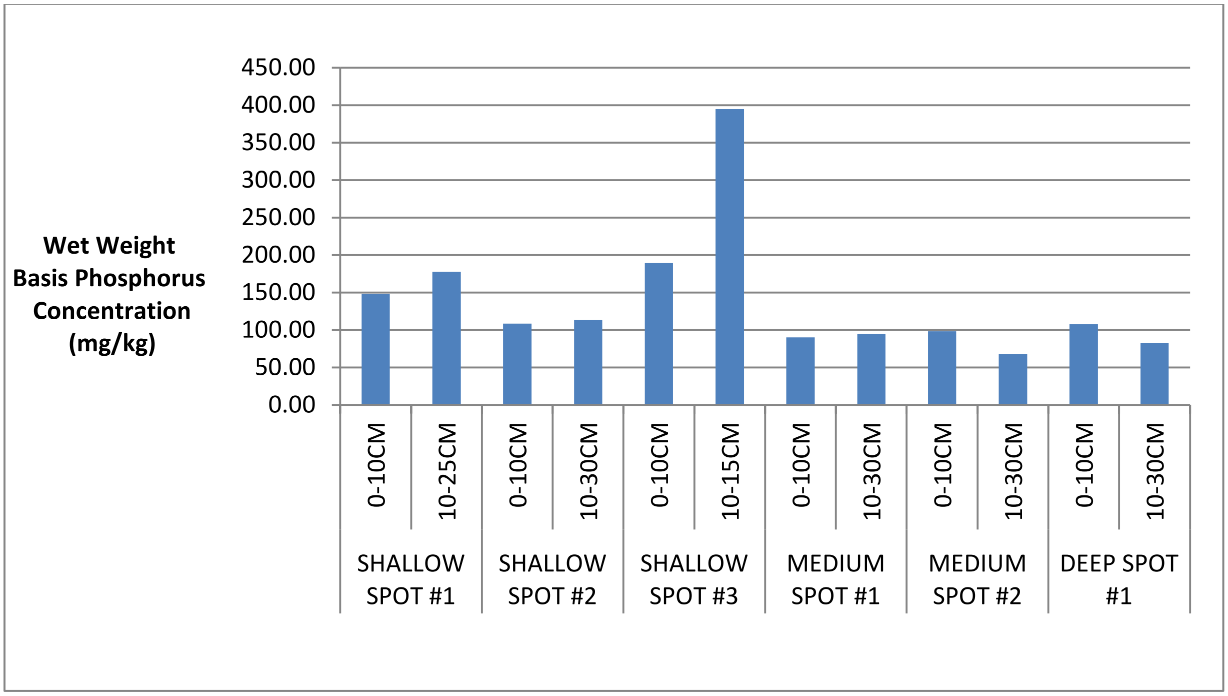


Figure 6-7 2013 Pigeon Lake Phosphorus Content Normalized for Moisture Content

6.4 Sediment Summary

Analytical results of Pigeon Lake sediment demonstrated variability in composition and organic carbon content, and as a result, differences in nutrient concentrations. Nutrient concentrations tended to be higher in sediments with higher silt and organic carbon content and tended to be higher in shallow sections of sediment cores (0-10cm) relative to deeper sections (>10cm).

The examination of sediment phosphorus concentration at shallow and deep sections within the core is important from a lake chemistry standpoint. Within a lake, phosphorus is released and bound to the sediment under differing states of redox potential. It has been long established that the chemically interactive zone (i.e., depth to which phosphorus may be actively released to the overlying water) is typically in the upper 10cm of sediment (Søndergaard *et al* 2003, Wetzel 1983, Boström *et al* 1982). This means that the phosphorus in the lower depths of the sediment is essentially 'bound up' and not actively releasing to the overlying water column. Disturbance or removal of the overlying sediment would result in chemical reactivation and release of phosphorus from those lower depths.

7.0 LAKE BIOLOGICAL PARAMETERS

7.1 Phytoplankton

7.1.1 Chlorophyll-a

Chlorophyll-*a* is a photosynthetic pigment possessed by both algae and cyanobacteria (blue-green algae). As concentrations of this pigment can easily be measured in a laboratory, chlorophyll-*a* is a good estimate of the amount of algae and cyanobacteria in the water.

Chlorophyll-*a* concentration remained fairly constant throughout the early summer months until mid-August when it increased dramatically (Figure 7-2). On June 5th chlorophyll-*a* concentration was 9.90 µg/L and remained low until August, averaging 4.50 µg/L throughout June and July. Early phytoplankton populations consisted primarily of true algae (not cyanobacteria) species from the taxonomic groups Cryptophyceae and Chrysophyceae. By August 14th, concentrations of chlorophyll-*a* had increased to 30.90 µg/L and continued to increase to an observed maximum of 49.20 µg/L on August 28th. A community composition shift accompanied these increases in chlorophyll-*a* concentration, with the phytoplankton community becoming dominated by species of cyanobacteria, primarily *Aphanizomenon flos-aquae* and *Aphanocapsa* sp. (Figure 7-1).

7.1.2 Microcystin

Microcystins are toxins produced by cyanobacteria (blue-green algae) which, when ingested, can cause severe liver damage. Microcystins are produced by many species of cyanobacteria which are common to Alberta's lakes, and are thought to be the one of the most common cyanobacteria toxins. In Alberta, recreational guidelines for microcystin are set at 20 µg/L. 2013 microcystin samples for Pigeon Lake were collected from composite samples and are presented in Figure 7-1. Appendix 7-2 contains all microcystin data collected from Pigeon Lake in 2013.

Microcystin concentrations remained relatively low throughout 2013. This is likely because the dominant cyanobacteria species observed in Pigeon Lake in 2013 was *Aphanizomenon flos-aquae,* which is not known to produce microcystins (Neilan et. al, 1999). Microcystin concentrations ranged from a minimum of 0.05 µg/L on July 4th to a maximum of 0.83 µg/L on September 19th. This maximum concentration corresponded to increases in densities of known microcystin producing species such as *Anabaena* spp. and *Microcystis* spp. All microcystin concentrations measured were well below the recreational guidelines of 20 µg/L.

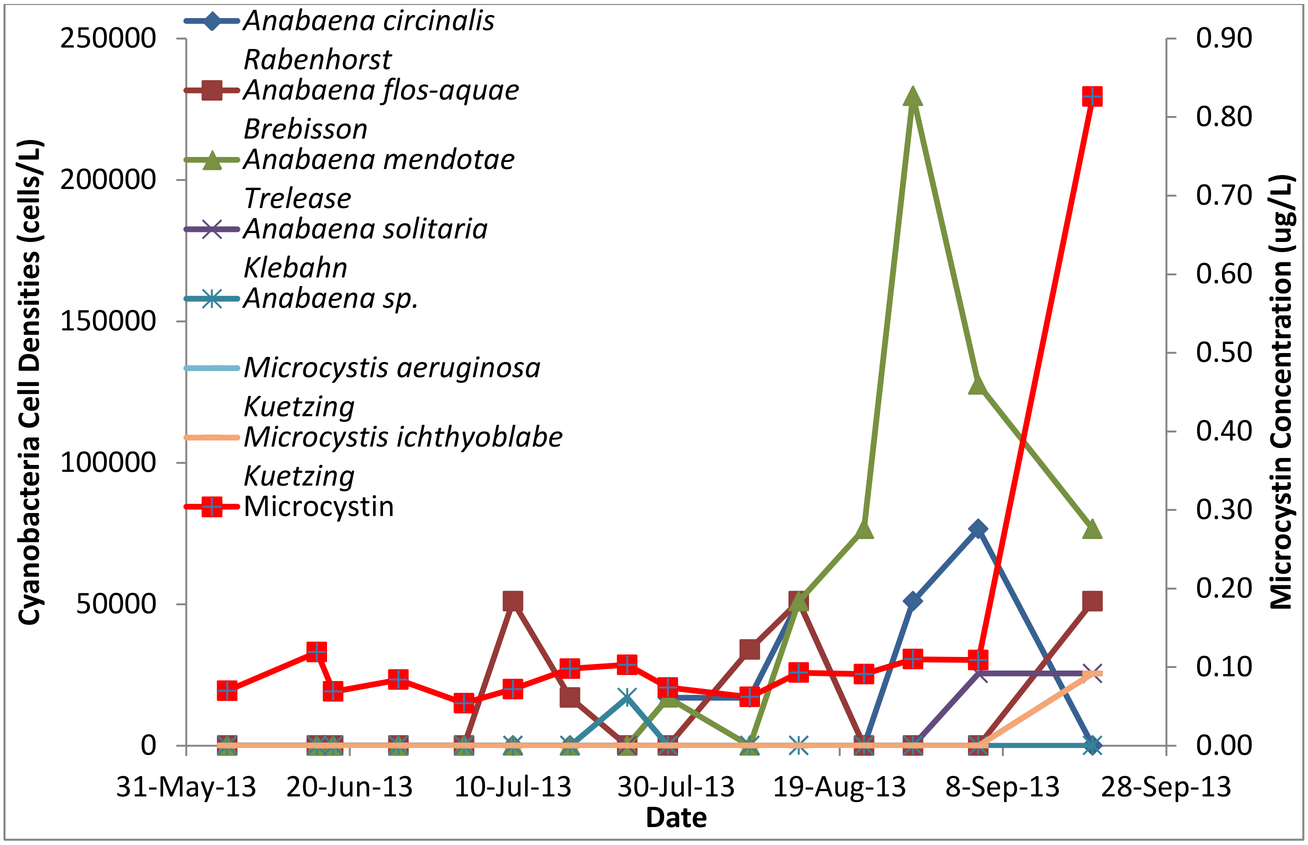


Figure 7-1 2013 Pigeon Lake Cyanobacteria Cell Densities and Microcystin Concentration

7.1.3 Phytoplankton Taxonomy

Identifying the numbers and types of phytoplankton in Pigeon Lake can provide insight into nutrient dynamics, food-web dynamics, and lake toxicity. Phytoplankton taxonomy samples were collected on each sampling trip during the summer of 2013. Samples were collected from the euphotic zone using euphotic tubing with a 1-way foot valve at each of the 10 composite sites. Samples were preserved with Lugol's solution and formaldehyde and sent to a taxonomist for identification and enumeration. All taxonomy data is presented in Appendix 7-1. In addition to taxonomic results, richness, evenness, and the Shannon diversity index were also calculated. Richness refers to the number of unique species present, evenness evaluates the spread of individuals across species, and diversity considers richness and evenness to provide an overall measure of diversity.

Early in the summer the phytoplankton community was dominated by true algae primarily the diatoms *Asterionella formosa* and *Synedra* sp., Chrysophyceae, and Dinophyceae (Figure 7-2). Cyanobacteria (blue-green algae) was present early in the summer, and showed an increase in relative biomass on June 18th. After July, a diversity of cyanobacteria species made up the majority of the phytoplankton community, with *Aphanizomenon flos-aquae* as the dominant species (Figure 7-1).

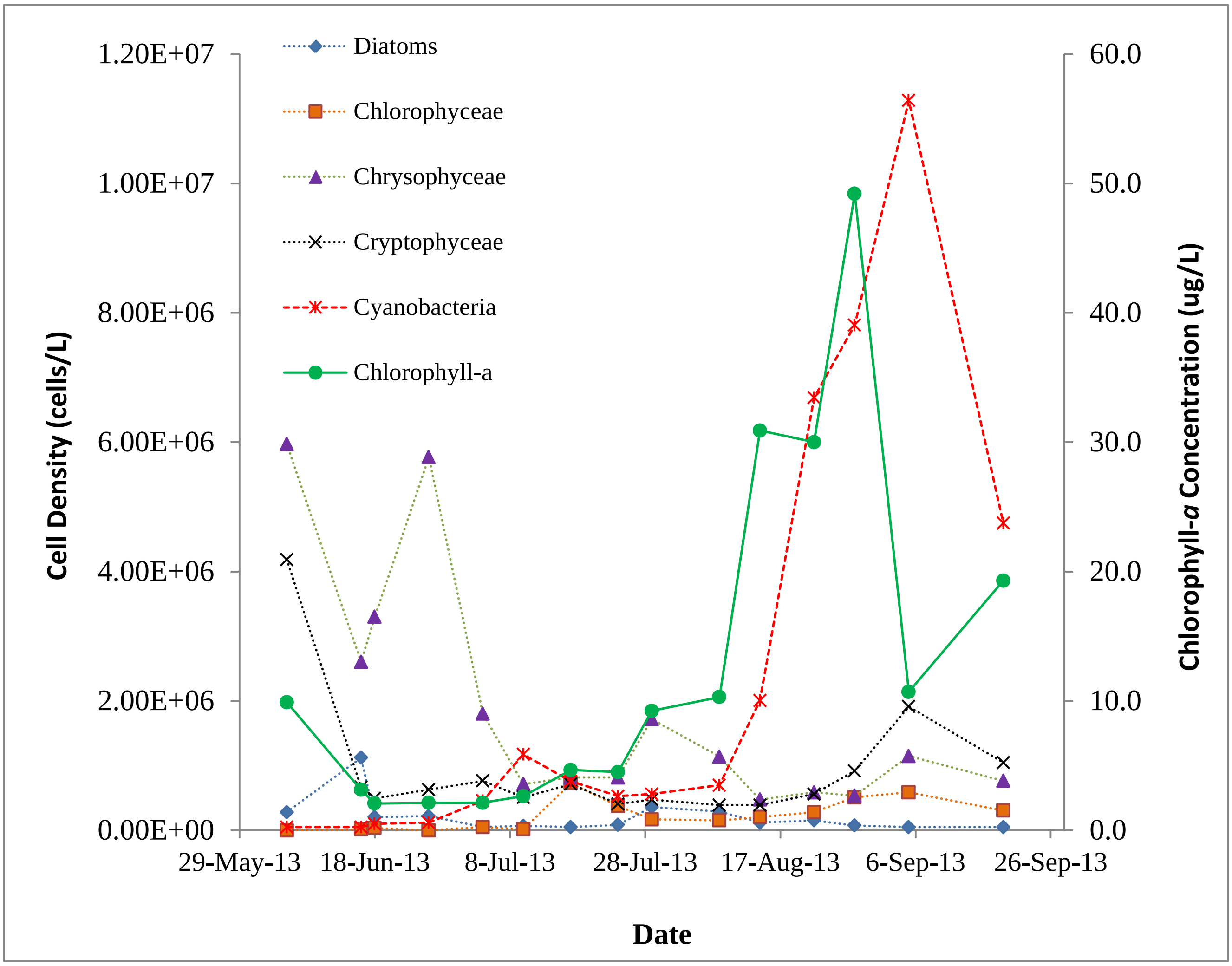


Figure 7-2 2013 Pigeon Lake Phytoplankton Densities

Relative percent biomass for all algal groupings is shown in Figure 7-3. Algal biomass in Pigeon Lake was dominated by Chrysophyceae and Cryptophyceae early in 2013, with Dinophyceae appearing for a short period in July. By early August, algal community biomass was dominated almost entirely by cyanobacteria as conditions became more favourable for their growth leading to bloom conditions.

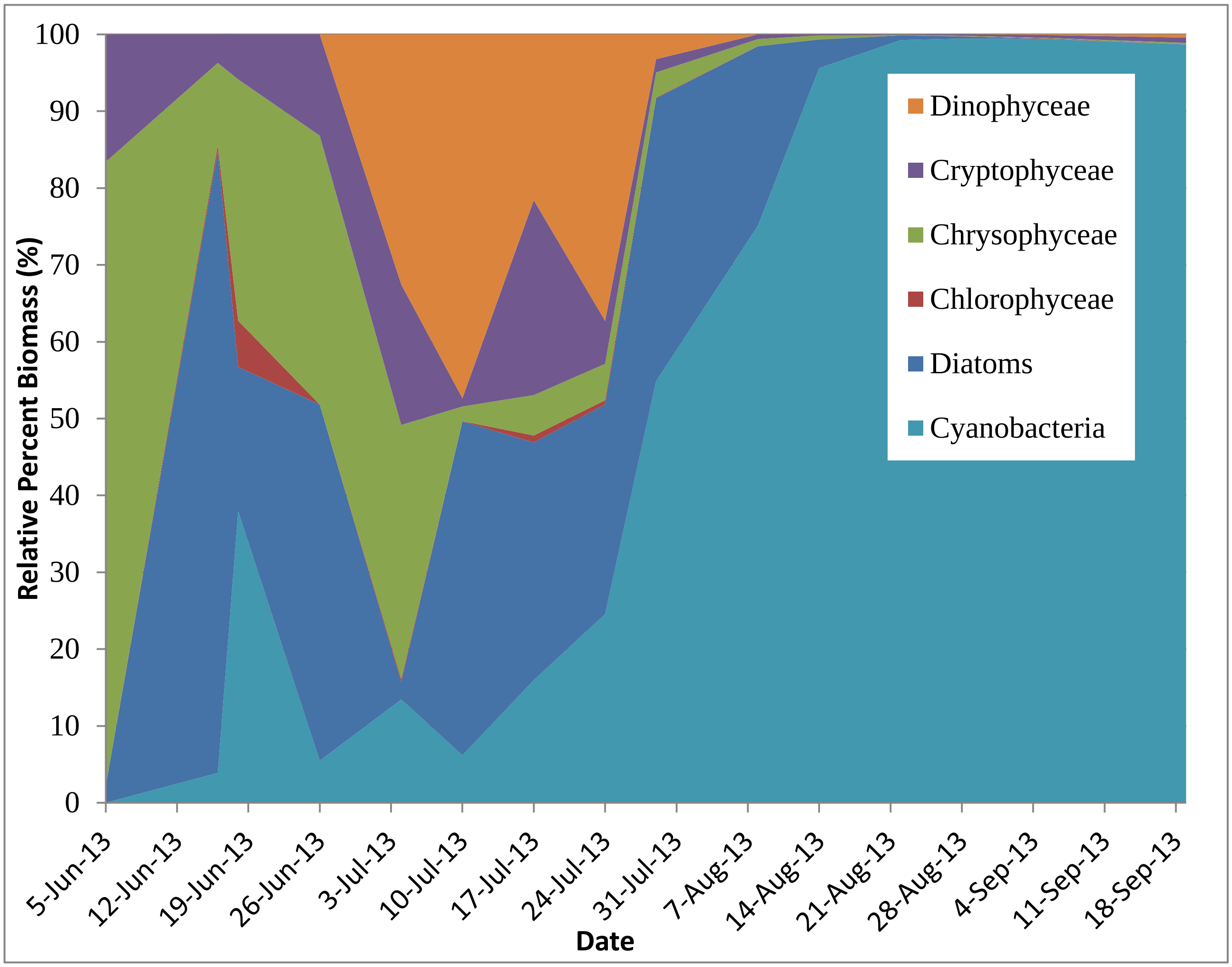


Figure 7-3 2013 Pigeon Lake Phytoplankton Percent Biomass

Richness, evenness, and diversity indices were calculated for the 2013 Pigeon Lake phytoplankton community and are presented in Figure 7-4. Species richness fluctuated between a minimum of 20 on June 26th and a maximum of 31 on June 16th. Throughout the summer the number of unique species fluctuated around an average of 24. Evenness appeared to respond strongly to the cyanobacteria bloom observed in August. As the population became dominated by high densities of cyanobacteria species, evenness dropped from a maximum of 0.73 on July 24th to a minimum of 0.31 on August 22nd. Finally, diversity dropped significantly during the August cyanobacteria bloom, measuring a minimum of 0.89 on August 15th, compared to a maximum of 2.49 on June 16th.

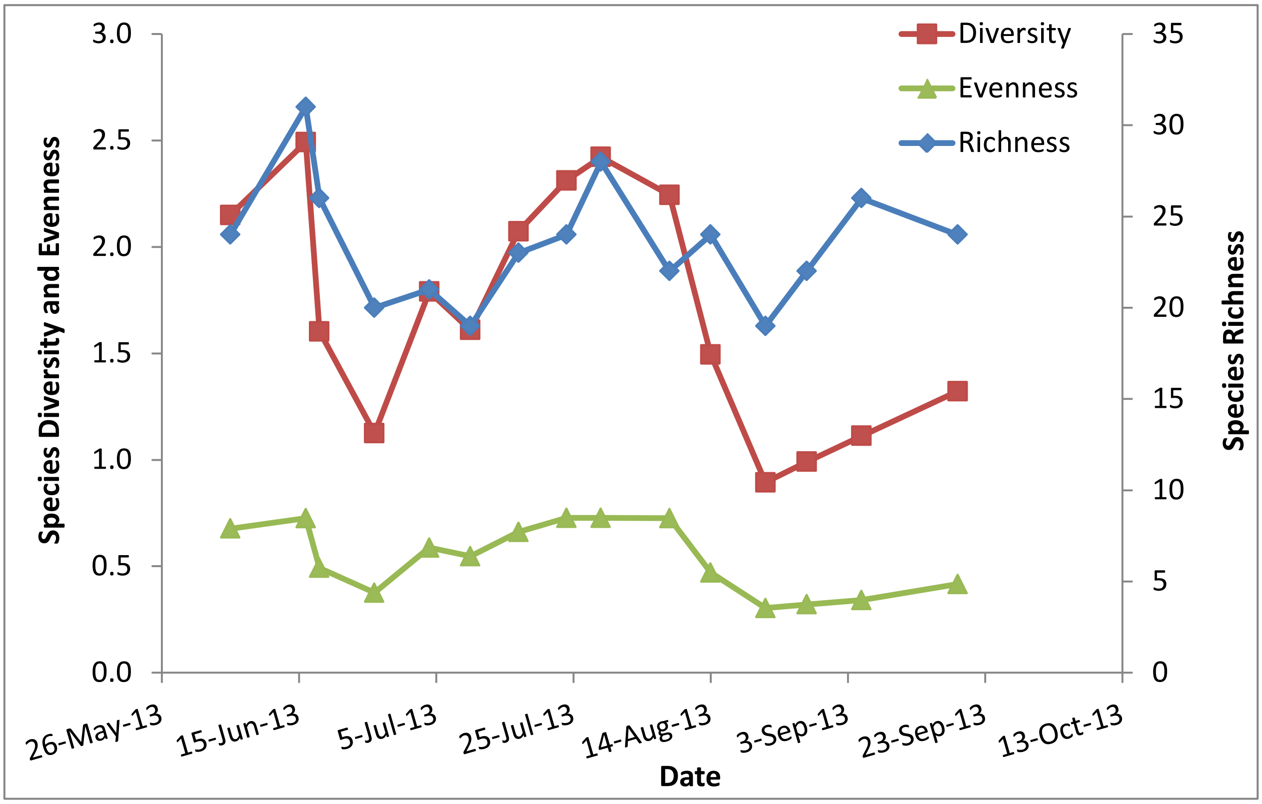


Figure 7-4 2013 Pigeon Lake Phytoplankton Diversity

7.2 Bloom Chemistry

To better determine partitioning of nutrients in the algal community and evaluate potential harvesting control methods of cyanobacteria (blue-green algae) samples were collected during two periods of cyanobacteria surface blooms and nutrient chemistry analyzed. Samples were collected from composite sites as well as along shoreline areas where cyanobacteria had collected. A 500 µm kick-net was used to concentrate the samples, and the samples submitted for analysis. Complete analytical results are included in Appendix 7-3 and summary results presented in Table 7-1.

Table 7-1 2013 Pigeon Lake Bloom Chemistry

Date	% Moisture	Dry Weight Total Phosphorus (mg/kg)	Wet Weight Total Phosphorus (mg/kg)	Wet Weight Required to Remove 1 kg TP (kg)
22-Aug	97.1	2,570	75	13,417
28-Aug	96.0	3,150	126	7,937

Variability existed between the two samples collected. On August 22nd, 75 mg of TP was present per kg of wet cyanobacteria, and on August 28th, 126 mg of TP was present per kg of wet cyanobacteria. These concentrations indicate that cyanobacteria may bind a significant portion of lake phosphorus concentrations during growth and bloom conditions.

Large amounts of wet cyanobacteria, 7,937-13,417 kg, would need to be removed in order to remove 1 kg of phosphorus (Table 7-1). While lower phosphorus concentrations than sediment dredging (see Section 6), harvesting would likely be more cost efficient, have reduced environmental impacts and would have the added benefit of improving lake aesthetics.

7.3 Zooplankton

7.3.1 Zooplankton Taxonomy

Zooplankton are small microscopic invertebrates which graze primarily upon phytoplankton in lake ecosystems and in turn serve as a food source for other organisms such as fish. Zooplankton samples were collected on each sampling trip during the summer of 2013. Samples were retrieved at the profile site using a 63 µm zooplankton net hauled from 1-m off the bottom of the sediments to the lakes surface. Zooplankton were preserved with buffered formalin and sent to a taxonomist for identification and enumeration. Complete results are provided in Appendix 7-4. In addition to taxonomic results, richness, evenness, and diversity were also calculated.

In terms of community composition, the rotifer community was dominated by the filter feeding species *Keratella cochlearis,* one of the most common species

of freshwater rotifers. Dominant cladocerans included the large, common filter feeders *Daphnia pulex* and *Diaphanosoma* sp*.,* and dominant copepods included the omnivorous *Diacyclops thomasi* (Figure 7-5).

Biomass of zooplankton fluctuated throughout the summer (Figures 7-6 and 7-7). In early summer, zooplankton biomass peaked when the phytoplankton population was dominated by non-cyanobacteria species. During the large cyanobacteria bloom at the end of August, zooplankton biomass (not including juveniles) was low dropping to 46.2 µg/L on August 28th from 147.3 ug/L on July 24th. Zooplankton biomass did not recover until early September (Figure 7-6). Although phytoplankton density was highest mid-summer, the phytoplankton population was dominated by relatively unpalatable *Aphanizomenon flos-aquae* which likely reduced zooplankton grazing rates and reproduction.

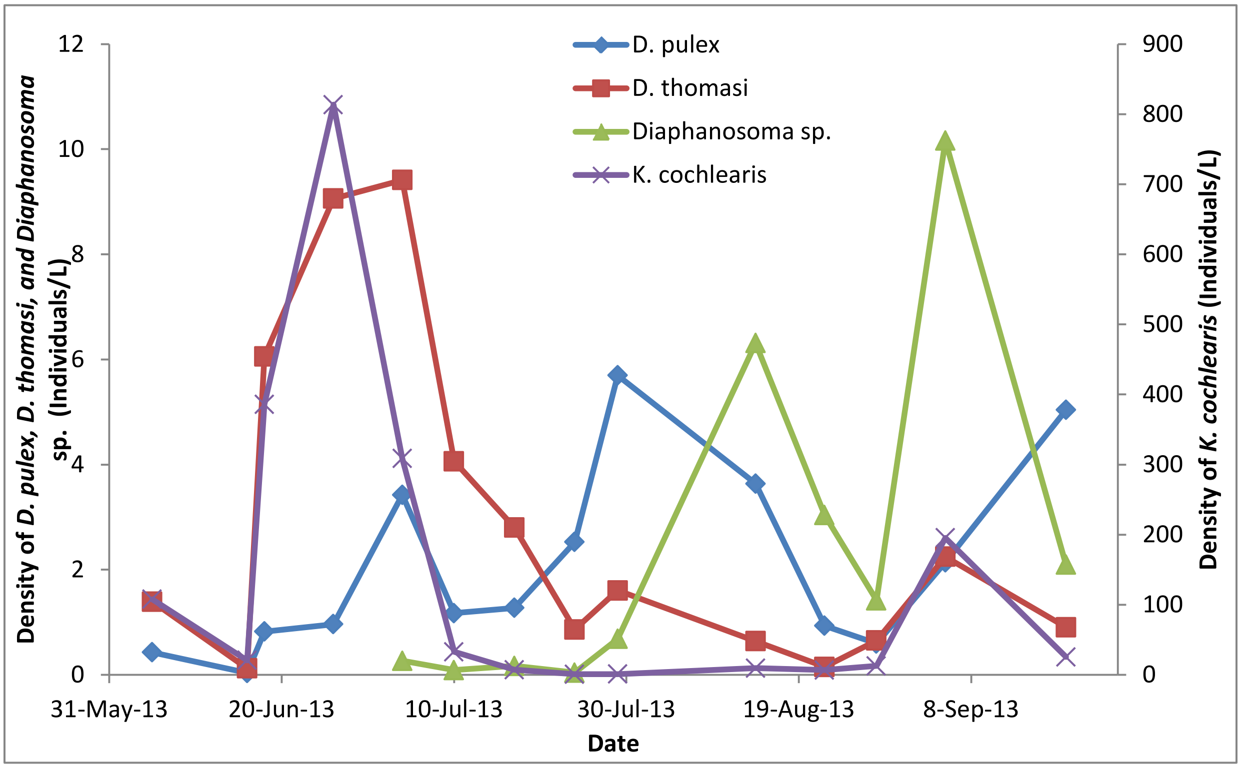


Figure 7-5 2013 Pigeon Lake Zooplankton Densities

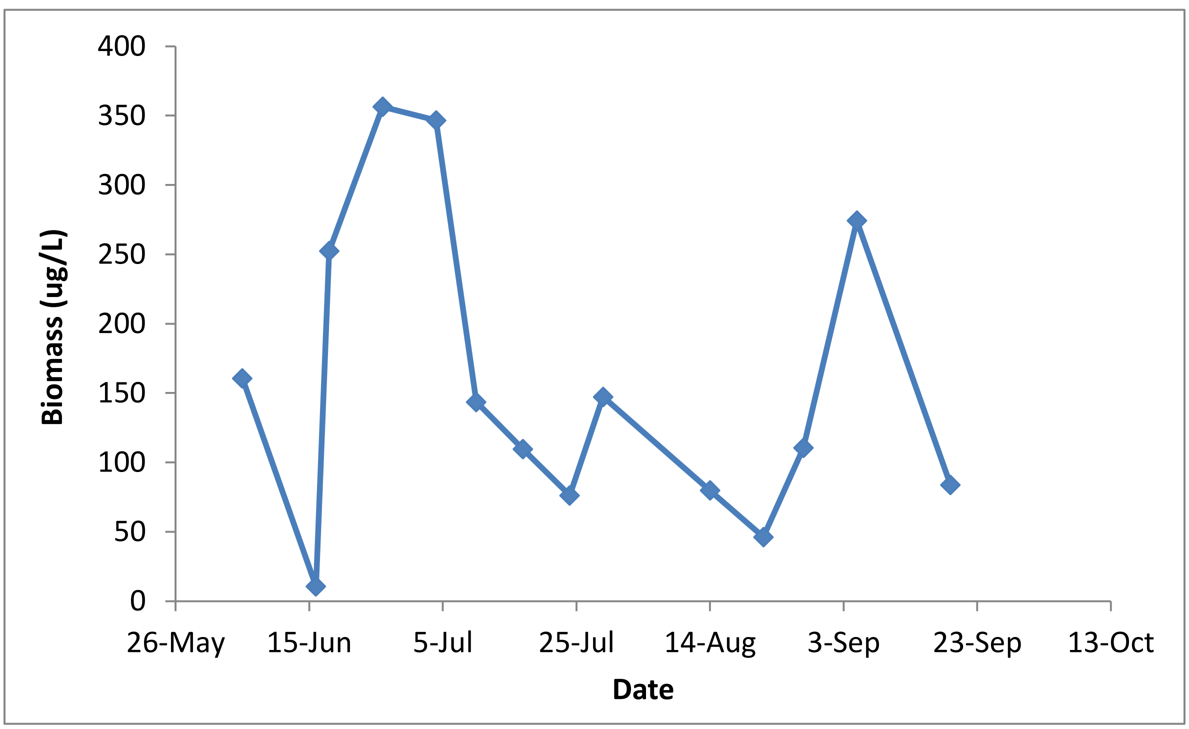


Figure 7-6 2013 Pigeon Lake Zooplankton Biomass

Zooplankton biomass was dominated primarily by juveniles throughout most of the open water period (Figure 7-7). However, overall juvenile biomass declined through the year as larger bodied copepods (Cyclapoida and Calanoida) and cladocerans began to increase in numbers. By late September, large bodied cladocerns and calanoid copepods made up the majority of Pigeon Lake's zooplankton community biomass.

Despite the decreases in biomass during the cyanobacteria bloom, diversity indices did not appear to be strongly affected. Small decreases in diversity and evenness were observed at the end of the cyanobacteria bloom on September 3rd, though these indices appeared to recover by the final sample on September 19th (Figure 7-8). Diversity tended to increase through the summer. This likely reflected a shift in the zooplankton community from one dominated by juveniles to a community which included adult organisms.

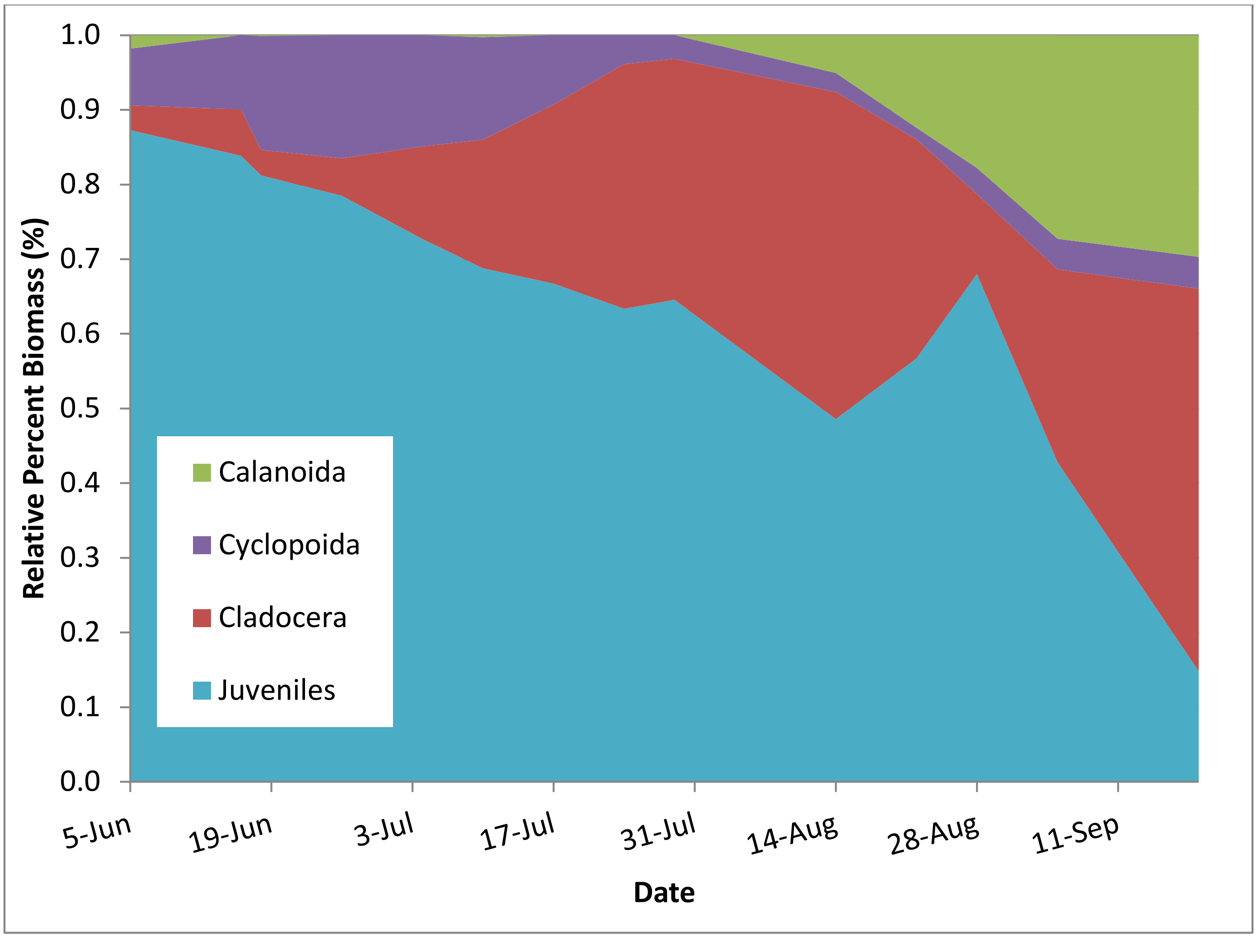


Figure 7-7 2013 Pigeon Lake Zooplankton Percent Biomass

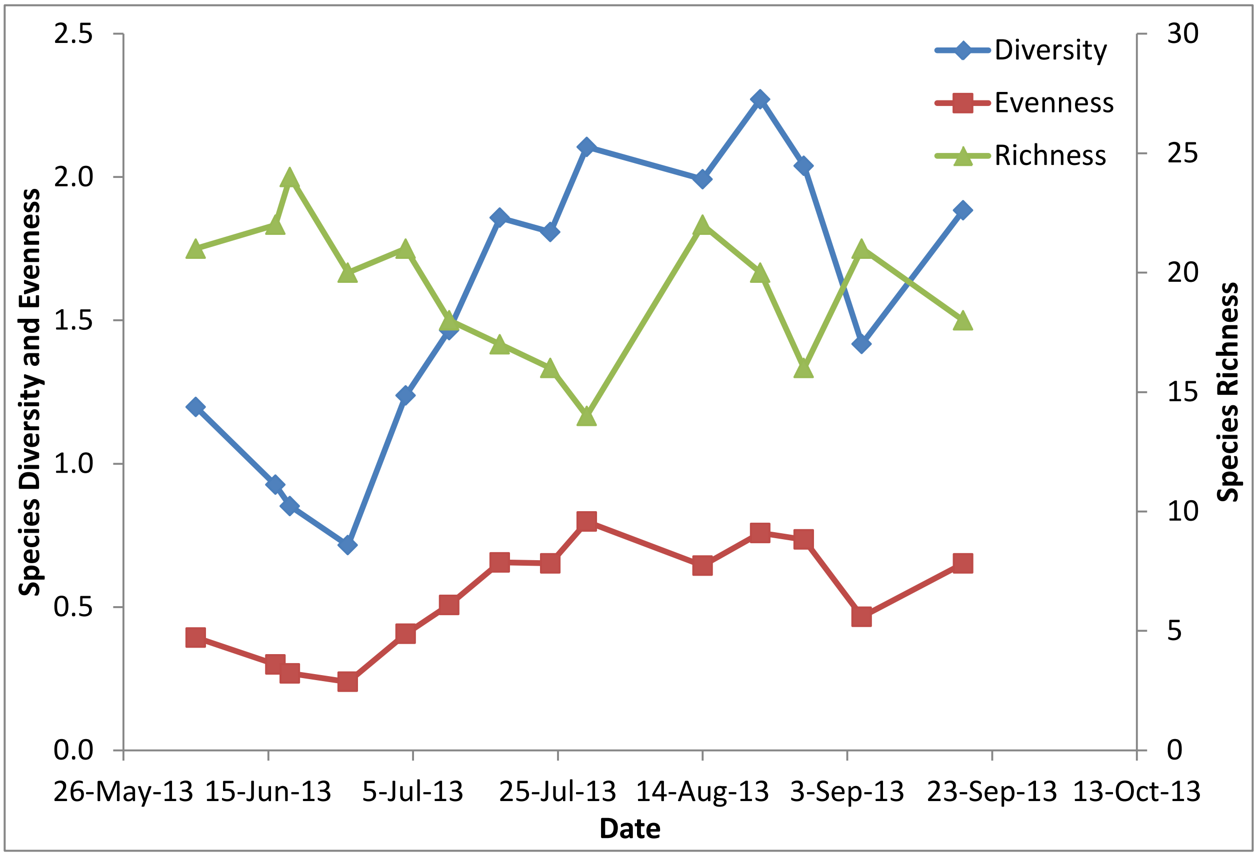


Figure 7-8 2013 Pigeon Lake Zooplankton Diversity

7.4 Lake Bacteriological Parameters

Faecal bacteria such as *Escherichia coli* (*E. coli*) can be indicators of contamination from sewage or faecal matter and may pose a threat to human health when present in recreational water bodies. In addition, faecal bacteria may act as indirect indicators of nutrient loading, as sewage is high in important nutrients such as phosphorus and nitrogen. In 2013, faecal coliform and *E. coli* counts measured below the detection limit (<10 cells/100 mL) on all sampling trips (Appendix 2-1).

7.5 Lake Biology Summary

The 2013 Pigeon Lake phytoplankton community shifted from groups with a preference for cooler water temperatures early in the summer to cyanobacteria later in the summer. As cyanobacteria populations became more dominant, diversity of the phytoplankton community also decreased. Zooplankton density predominantly followed the algal community, showing peaks in most grazers during the early and late summer while declining during cyanobacterial blooms. This likely reflects the fact that many species of cyanobacteria, including those present in Pigeon Lake, are not readily grazed by filter feeding zooplankton due to palatability or size. Despite the decrease in zooplankton density, diversity remained constant or increased. This was likely the result of increasing adult zooplankton and decreasing juveniles which typically can not be identified to species level.

8.0 CONCLUSIONS

Sampling during 2013 at Pigeon Lake and surrounding watershed was conducted for a much broader suite of parameters and on a more frequent basis in order to support activities such as the development of a nutrient budget and assessment of methods to reduce the frequency and intensity of nuisance blue-green algae blooms. While some variables showed little variation with season, others were quite variable on a week to week basis.

Pigeon Lake is typically not stratified as shown in profiles of temperature, dissolved oxygen, pH and conductivity. However, seasonal variability for these and several other water quality parameters was observed. For some parameters, such as pH, alkalinity, dissolved oxygen, water clarity and nutrient concentrations, seasonal variability likely reflected changes in the algal community as well. pH, alkalinity and water clarity declined during peak blooms while dissolved oxygen concentrations, especially at the surface, increased. Chlorophyll-*a* concentrations exhibited a strong positive relationship with total phosphorus but were inversely related to dissolved phosphorus concentrations, suggesting preferential uptake of dissolved fractions of phosphorus by the phytoplankton community.

In the streams, concentrations of many parameters tended to be highest during the spring runoff and after significant storm events, both of which tend wash accumulated upland material into the streams. Concentrations for most parameters at the inflowing streams were generally similar reflecting surrounding land-use while the outflow was quite different and reflected lake conditions. Dissolved oxygen, pH and TSS tended to be higher relative to streams while conductivity, TDP, ammonia, TKN, total nitrogen, total phosphorus, total dissolved phosphorus, ortho-phosphate, TOC and DOC were lower.

Discharge rates were similar for most inflowing streams, with maximum rates occurring during spring freshet and after significant rainfall events. Tide Creek had high discharge rates, reflecting the size of this stream, but flow was only measured on two dates. Thus, while this creek is large, its cumulative annual discharge was not significantly higher than other measured inflows. The outflow had higher measurable flows on most sampling dates relative to inflowing streams and reflected the increasing and decreasing water levels of Pigeon Lake.

For most nutrient parameters, Zeiner had the lowest loading rates despite often higher nutrient concentrations. This is the result of lower discharge rates in Zeiner relative to other Pigeon Lake streams. Similarly, although nutrient concentrations in Tide Creek were close to concentrations observed at other inflows, loading rates were often highest at this location.

Groundwater samples collected from the Pigeon Lake watershed did show variability in the parameters analyzed, however this was not attributed to well depth or age. Relative to Pigeon Lake and stream water chemistry, most nitrogen components had relatively low concentrations in groundwater with the exception of ammonia which was much higher than stream and lake concentrations. Phosphorus concentrations were highest in streams, but lower in Pigeon Lake relative to groundwater. Finally, TDS concentration was higher in groundwater samples relative to the streams and lake, while organic content (measured as TOC and DOC) was lower. These differences likely reflected chemistry of surrounding geology.

Pigeon Lake sediments demonstrated variability in composition and organic carbon content, and as a result, differences in nutrient concentrations. Nutrient concentrations tended to be higher in sediments with higher silt and organic carbon content and tended to be higher in shallow sections of sediment cores (0-10cm) relative to deeper sections (>10cm). Shallower samples closer to the shoreline tended to have higher amounts of sand as opposed to mid and deep samples which consisted of higher amounts of silt and clay.

The 2013 Pigeon Lake phytoplankton community shifted from true algal groups with a preference for cooler water temperatures such as Chrysophyceae, Cryptophyceae and diatoms early in the summer to cyanobacteria later in the summer. As cyanobacteria populations became more dominant, diversity of the phytoplankton community also decreased. Despite cyanobacteria being the predominant component of the phytoplankton community in later summer at Pigeon Lake, microcystin levels were relatively low reflecting the fact that predominant species comprising the cyanobacterial community do not produce microcystin.

Zooplankton density reflected the algal community, showing peaks in most species during the early and late summer. However, during the cyanobacterial bloom in August, zooplankton density declined. This was likely due to palatability or size issues. Despite the decline in zooplankton density, diversity remained constant or increased through the summer likely reflecting maturation of the zooplankton community from one dominated primarily by juveniles to adult forms.

Overall, data collected provided insight into potential causes of blooms, helped support the development of a nutrient budget in order to partition phosphorus sources in the watershed and to objectively evaluate what management approaches may be most appropriate for improving the water quality in the lake. Detailed lake and watershed sampling contributed greatly to the existing data and knowledge base on Pigeon Lake.

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10.0 APPENDICES

Appendix 2-1
2013 Pigeon Lake Chemistry Data

2013 Pigeon Lake Chemistry Data

Sample No.	Station No.	Station Name	Description	QC Sample?	Comment	Sample Date	Alkalinity Total CaCO3 (mg/L)	Aluminum Total Recoverable (ug/L)	Ammonia (NH3) (mg/L)	Antimony Total Recoverable (ug/L)	Arsenic Total Recoverable (ug/L)	Barium Total Recoverable (ug/L)	Beryllium Total Recoverable (ug/L)
13SWE02793	AB05FA0480	Pigeon Lake	Composite	N		5-Jun-13	168		0.0378				
13SWE02833	AB05FA0480	Pigeon Lake	Composite	N		16-Jun-13	164		L0.005				
13SWE06602	AB05FA0480	Pigeon Lake	Composite	N		18-Jun-13	167		L0.005				
13SWE06620	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	18-Jun-13	166		L0.005				
13SWE06621	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	18-Jun-13	168		L0.005				
13SWE06631	AB05FA0480	Pigeon Lake	Composite	N		26-Jun-13	164	8.7	0.0055	0.0695	1.17	98.7	0.005
13SWE06653	AB05FA0480	Pigeon Lake	Composite	N		4-Jul-13	168		0.0109				
13SWE06684	AB05FA0480	Pigeon Lake	Composite	N		10-Jul-13	164		0.0302				
13SWE06713	AB05FA0480	Pigeon Lake	Composite	N		17-Jul-13	160		0.0247				
13SWE06742	AB05FA0480	Pigeon Lake	Composite	N		24-Jul-13	158		0.0314				
13SWE06761	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	24-Jul-13	160		0.0348				
13SWE06762	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	24-Jul-13	161		0.0344				
13SWE06764	AB05FA0480	Pigeon Lake	Composite	N		29-Jul-13	165		0.0246				
13SWE06783	AB05FA0480	Pigeon Lake	Composite	Y	QC Sample - True Split	29-Jul-13	165		0.0223				
13SWE06794	AB05FA0480	Pigeon Lake	Composite	N		8-Aug-13	165		0.0209				
13SWE06913	AB05FA0480	Pigeon Lake	Composite	N		14-Aug-13	164		0.0305				
13SWE06962	AB05FA0480	Pigeon Lake	Composite	N		22-Aug-13	163		0.0273				
13SWE06979	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	22-Aug-13	166		0.0308				
13SWE06980	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	22-Aug-13	166		0.0357				
13SWE06983	AB05FA0480	Pigeon Lake	Composite	N		28-Aug-13	168		0.0326				
13SWE07012	AB05FA0480	Pigeon Lake	Composite	N		5-Sep-13	160	3.59	0.0787	0.0799	2	87	L0.003
13SWE07046	AB05FA0480	Pigeon Lake	Composite	N		19-Sep-13	161		0.02				
13SWE07064	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	19-Sep-13	186		0.0339				
13SWE07065	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	19-Sep-13	163		0.0299				

2013 Pigeon Lake Chemistry Data

Sample No.	Station No.	Station Name	Description	QC Sample?	Comment	Sample Date	Bicarbonate (Calcd_) (mg/L)	Bismuth Total Recoverable (ug/L)	Boron Total Recoverable (ug/L)	Cadmium Total Recoverable (ug/L)	Calcium Dissolved (mg/L)	Calcium Total Recoverable (mg/L)	Carbonate (Calcd_) (mg/L)
13SWE02793	AB05FA0480	Pigeon Lake	Composite	N		5-Jun-13	200				26		L5
13SWE02833	AB05FA0480	Pigeon Lake	Composite	N		16-Jun-13	195				29.5		L5
13SWE06602	AB05FA0480	Pigeon Lake	Composite	N		18-Jun-13	194				29.6		L5
13SWE06620	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	18-Jun-13	194				28.9		L5
13SWE06621	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	18-Jun-13	198				29.5		L5
13SWE06631	AB05FA0480	Pigeon Lake	Composite	N		26-Jun-13	194	L0.001	28.4	0.004	28.7	26.2	L5
13SWE06653	AB05FA0480	Pigeon Lake	Composite	N		4-Jul-13	189				28		7.9
13SWE06684	AB05FA0480	Pigeon Lake	Composite	N		10-Jul-13	200				26.3		L5
13SWE06713	AB05FA0480	Pigeon Lake	Composite	N		17-Jul-13	195				28.1		L5
13SWE06742	AB05FA0480	Pigeon Lake	Composite	N		24-Jul-13	192				28.6		L5
13SWE06761	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	24-Jul-13	195				28.3		L5
13SWE06762	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	24-Jul-13	196				28.2		L5
13SWE06764	AB05FA0480	Pigeon Lake	Composite	N		29-Jul-13	201				27.8		L5
13SWE06783	AB05FA0480	Pigeon Lake	Composite	Y	QC Sample - True Split	29-Jul-13	200				28.5		L5
13SWE06794	AB05FA0480	Pigeon Lake	Composite	N		8-Aug-13	202				27.7		L5
13SWE06913	AB05FA0480	Pigeon Lake	Composite	N		14-Aug-13	189				28.3		5.4
13SWE06962	AB05FA0480	Pigeon Lake	Composite	N		22-Aug-13	194				25.9		L5
13SWE06979	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	22-Aug-13	194				26.8		L5
13SWE06980	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	22-Aug-13	194				26.9		L5
13SWE06983	AB05FA0480	Pigeon Lake	Composite	N		28-Aug-13	193				27.7		5.7
13SWE07012	AB05FA0480	Pigeon Lake	Composite	N		5-Sep-13	189	L0.001	34.4	0.0055	26	30	L5
13SWE07046	AB05FA0480	Pigeon Lake	Composite	N		19-Sep-13	191				26.1		L5
13SWE07064	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	19-Sep-13	224				26.4		L5
13SWE07065	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	19-Sep-13	194				25.7		L5

2013 Pigeon Lake Chemistry Data

Sample No.	Station No.	Station Name	Description	QC Sample?	Comment	Sample Date	Chloride Dissolved (mg/L)	Chlorine Total Recoverable (mg/L)	Chlorophyll a (mg/m3)	Chromium Total Recoverable (ug/L)	Cobalt Total Recoverable (ug/L)	Coliforms Fecal (No/100 ml)	Colour (Visual) At Site (n/a)
13SWE02793	AB05FA0480	Pigeon Lake	Composite	N		5-Jun-13	3.08		9.9			10	0
13SWE02833	AB05FA0480	Pigeon Lake	Composite	N		16-Jun-13	3.19		3.14			L10	0
13SWE06602	AB05FA0480	Pigeon Lake	Composite	N		18-Jun-13	3.05		2.08			L10	0
13SWE06620	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	18-Jun-13	3.01						
13SWE06621	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	18-Jun-13	2.99						
13SWE06631	AB05FA0480	Pigeon Lake	Composite	N		26-Jun-13	3.44	1.82	2.13	0.241	L0.001	L10	0
13SWE06653	AB05FA0480	Pigeon Lake	Composite	N		4-Jul-13	3.13		2.14			L10	0
13SWE06684	AB05FA0480	Pigeon Lake	Composite	N		10-Jul-13	3.09		2.64			L10	0
13SWE06713	AB05FA0480	Pigeon Lake	Composite	N		17-Jul-13	3.24		4.66			L10	0
13SWE06742	AB05FA0480	Pigeon Lake	Composite	N		24-Jul-13	3.38		4.5			L10	0
13SWE06761	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	24-Jul-13	3.35						
13SWE06762	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	24-Jul-13	3.35						
13SWE06764	AB05FA0480	Pigeon Lake	Composite	N		29-Jul-13	3.18		9.23			L10	0
13SWE06783	AB05FA0480	Pigeon Lake	Composite	Y	QC Sample - True Split	29-Jul-13	3.24		7.43			L10	
13SWE06794	AB05FA0480	Pigeon Lake	Composite	N		8-Aug-13	3.22		10.3			L10	1
13SWE06913	AB05FA0480	Pigeon Lake	Composite	N		14-Aug-13	3.34		30.9			L10	2
13SWE06962	AB05FA0480	Pigeon Lake	Composite	N		22-Aug-13	3.16		30			L10	2
13SWE06979	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	22-Aug-13	3.18						
13SWE06980	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	22-Aug-13	3.15						
13SWE06983	AB05FA0480	Pigeon Lake	Composite	N		28-Aug-13	3.22		49.2			L10	2
13SWE07012	AB05FA0480	Pigeon Lake	Composite	N		5-Sep-13	3.12	2.41	10.7	0.125	0.0141	10	1
13SWE07046	AB05FA0480	Pigeon Lake	Composite	N		19-Sep-13	3.13		19.3			L10	0
13SWE07064	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	19-Sep-13	3.21						
13SWE07065	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	19-Sep-13	3.13						

2013 Pigeon Lake Chemistry Data

Sample No.	Station No.	Station Name	Description	QC Sample?	Comment	Sample Date	Copper Total Recoverable (ug/L)	Escherichia Coli (No/100 ml)	Euphotic Depth (m)	Fluoride Dissolved (mg/L)	Total (Calcd_) Caco3 (mg/L)	Hydroxide (Calcd_) (mg/L)	Ionic Balance %
13SWE02793	AB05FA0480	Pigeon Lake	Composite	N		5-Jun-13		L10	5.6	0.092	118	L5	97.7
13SWE02833	AB05FA0480	Pigeon Lake	Composite	N		16-Jun-13		L10	5	0.109	130	L5	107
13SWE06602	AB05FA0480	Pigeon Lake	Composite	N		18-Jun-13		L10	7.4	0.101	132	L5	111
13SWE06620	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	18-Jun-13				0.101	127	L5	107
13SWE06621	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	18-Jun-13				0.104	129	L5	106
13SWE06631	AB05FA0480	Pigeon Lake	Composite	N		26-Jun-13	0.313	L10	9.7	0.115	124	L5	103
13SWE06653	AB05FA0480	Pigeon Lake	Composite	N		4-Jul-13		L10	9	0.11	124	L5	100
13SWE06684	AB05FA0480	Pigeon Lake	Composite	N		10-Jul-13		L10	9.1	0.111	114	L5	94
13SWE06713	AB05FA0480	Pigeon Lake	Composite	N		17-Jul-13		L10	7	0.104	121	L5	101
13SWE06742	AB05FA0480	Pigeon Lake	Composite	N		24-Jul-13		L10	8	0.102	125	L5	104
13SWE06761	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	24-Jul-13				0.12	127	L5	104
13SWE06762	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	24-Jul-13				0.113	124	L5	102
13SWE06764	AB05FA0480	Pigeon Lake	Composite	N		29-Jul-13		L10	6	0.151	125	L5	101
13SWE06783	AB05FA0480	Pigeon Lake	Composite	Y	QC Sample - True Split	29-Jul-13		L10		0.15	126	L5	102
13SWE06794	AB05FA0480	Pigeon Lake	Composite	N		8-Aug-13		L10	5.2	0.111	119	L5	95.7
13SWE06913	AB05FA0480	Pigeon Lake	Composite	N		14-Aug-13		L10	4.6	0.126	122	L5	99.9
13SWE06962	AB05FA0480	Pigeon Lake	Composite	N		22-Aug-13		L10	4.4	0.114	115	L5	97.9
13SWE06979	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	22-Aug-13				0.107	118	L5	98.6
13SWE06980	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	22-Aug-13				0.108	119	L5	100
13SWE06983	AB05FA0480	Pigeon Lake	Composite	N		28-Aug-13		L10	3	0.1	122	L5	99.1
13SWE07012	AB05FA0480	Pigeon Lake	Composite	N		5-Sep-13	1.56	L10	5	0.105	118	L5	104
13SWE07046	AB05FA0480	Pigeon Lake	Composite	N		19-Sep-13		L10	5	0.106	119	L5	104
13SWE07064	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	19-Sep-13				0.1	120	L5	89.8
13SWE07065	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	19-Sep-13				0.107	116	L5	100

2013 Pigeon Lake Chemistry Data

Sample No.	Station No.	Station Name	Description	QC Sample?	Comment	Sample Date	Iron Dissolved (mg/L)	Iron Total Recoverable (ug/L)	Lead Total Recoverable - Pb (ug/L)	Lithium Total Recoverable (ug/L)	Magnesium Dissolved (mg/L)	Manganese Dissolved (mg/L)	Manganese Total Recoverable (ug/L)
13SWE02793	AB05FA0480	Pigeon Lake	Composite	N		5-Jun-13	L0.03				12.8	L0.005	
13SWE02833	AB05FA0480	Pigeon Lake	Composite	N		16-Jun-13	L0.03				13.6	L0.005	
13SWE06602	AB05FA0480	Pigeon Lake	Composite	N		18-Jun-13	L0.03				14.1	L0.005	
13SWE06620	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	18-Jun-13	L0.03				13.4	L0.005	
13SWE06621	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	18-Jun-13	L0.03				13.4	L0.005	
13SWE06631	AB05FA0480	Pigeon Lake	Composite	N		26-Jun-13	L0.03	L2	0.0308	8.8	12.8	L0.005	6.38
13SWE06653	AB05FA0480	Pigeon Lake	Composite	N		4-Jul-13	L0.03				13.2	L0.005	
13SWE06684	AB05FA0480	Pigeon Lake	Composite	N		10-Jul-13	L0.03				11.8	L0.005	
13SWE06713	AB05FA0480	Pigeon Lake	Composite	N		17-Jul-13	L0.03				12.4	L0.005	
13SWE06742	AB05FA0480	Pigeon Lake	Composite	N		24-Jul-13	L0.03				13	L0.005	
13SWE06761	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	24-Jul-13	L0.03				13.6	L0.005	
13SWE06762	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	24-Jul-13	L0.03				12.9	L0.005	
13SWE06764	AB05FA0480	Pigeon Lake	Composite	N		29-Jul-13	L0.03				13.4	L0.005	
13SWE06783	AB05FA0480	Pigeon Lake	Composite	Y	QC Sample - True Split	29-Jul-13	L0.03				13.3	L0.005	
13SWE06794	AB05FA0480	Pigeon Lake	Composite	N		8-Aug-13	L0.03				12.1	L0.005	
13SWE06913	AB05FA0480	Pigeon Lake	Composite	N		14-Aug-13	L0.03				12.5	L0.005	
13SWE06962	AB05FA0480	Pigeon Lake	Composite	N		22-Aug-13	L0.03				12.3	L0.005	
13SWE06979	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	22-Aug-13	L0.03				12.3	L0.005	
13SWE06980	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	22-Aug-13	L0.03				12.6	L0.005	
13SWE06983	AB05FA0480	Pigeon Lake	Composite	N		28-Aug-13	L0.03				12.8	L0.005	
13SWE07012	AB05FA0480	Pigeon Lake	Composite	N		5-Sep-13	L0.03	L2	0.0268	13.3	12.8	0.0194	74.6
13SWE07046	AB05FA0480	Pigeon Lake	Composite	N		19-Sep-13	L0.03				13	0.0052	
13SWE07064	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	19-Sep-13	L0.03				13.2	0.0134	
13SWE07065	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	19-Sep-13	L0.03				12.7	L0.005	

2013 Pigeon Lake Chemistry Data

Sample No.	Station No.	Station Name	Description	QC Sample?	Comment	Sample Date	Molybdenum Total Recoverable (ug/L)	Nickel Total Recoverable (ug/L)	Nitrogen Dissolved Nitrate (mg/L)	Nitrogen Dissolved Nitrite (mg/L)	Nitrogen Dissolved NO3 & NO2 (mg/L)	Nitrogen Total Kjeldahl (TKN) (mg/L)	Total Nitrogen (mg/L)
13SWE02793	AB05FA0480	Pigeon Lake	Composite	N		5-Jun-13			0.007	L0.002	0.007	0.526	0.533
13SWE02833	AB05FA0480	Pigeon Lake	Composite	N		16-Jun-13			L0.006	L0.002	L0.006	0.625	0.625
13SWE06602	AB05FA0480	Pigeon Lake	Composite	N		18-Jun-13			L0.006	L0.002	L0.006	0.761	0.761
13SWE06620	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	18-Jun-13			L0.006	L0.002	L0.006	0.715	0.715
13SWE06621	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	18-Jun-13			L0.006	L0.002	L0.006	0.823	0.823
13SWE06631	AB05FA0480	Pigeon Lake	Composite	N		26-Jun-13	0.708	L0.005	L0.006	L0.002	L0.006	0.625	0.625
13SWE06653	AB05FA0480	Pigeon Lake	Composite	N		4-Jul-13			L0.006	L0.002	L0.006	0.789	0.789
13SWE06684	AB05FA0480	Pigeon Lake	Composite	N		10-Jul-13			L0.006	L0.002	L0.006	0.754	0.754
13SWE06713	AB05FA0480	Pigeon Lake	Composite	N		17-Jul-13			L0.006	L0.002	L0.006	0.701	0.701
13SWE06742	AB05FA0480	Pigeon Lake	Composite	N		24-Jul-13			L0.006	L0.002	L0.006	0.577	0.577
13SWE06761	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	24-Jul-13			L0.006	L0.002	L0.006	0.753	0.753
13SWE06762	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	24-Jul-13			L0.006	L0.002	L0.006	0.828	0.828
13SWE06764	AB05FA0480	Pigeon Lake	Composite	N		29-Jul-13			L0.006	L0.002	L0.006	0.756	0.756
13SWE06783	AB05FA0480	Pigeon Lake	Composite	Y	QC Sample - True Split	29-Jul-13			L0.006	L0.002	L0.006	0.764	0.764
13SWE06794	AB05FA0480	Pigeon Lake	Composite	N		8-Aug-13			L0.006	L0.002	L0.006	0.819	0.819
13SWE06913	AB05FA0480	Pigeon Lake	Composite	N		14-Aug-13			L0.006	L0.002	L0.006	1.01	1.01
13SWE06962	AB05FA0480	Pigeon Lake	Composite	N		22-Aug-13			0.0096	L0.002	0.0096	0.796	0.8056
13SWE06979	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	22-Aug-13			0.0107	L0.002	0.0107	0.721	0.7317
13SWE06980	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	22-Aug-13			0.0117	L0.002	0.0117	0.748	0.7597
13SWE06983	AB05FA0480	Pigeon Lake	Composite	N		28-Aug-13			L0.006	L0.002	L0.006	1.13	1.13
13SWE07012	AB05FA0480	Pigeon Lake	Composite	N		5-Sep-13	0.799	0.0442	L0.006	L0.002	L0.006	0.915	0.915
13SWE07046	AB05FA0480	Pigeon Lake	Composite	N		19-Sep-13			0.0389	L0.002	0.0389	0.992	1.0309
13SWE07064	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	19-Sep-13			0.0462	L0.002	0.0462	0.992	1.0382
13SWE07065	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	19-Sep-13			0.0474	0.0023	0.0497	0.876	0.9257

2013 Pigeon Lake Chemistry Data

Sample No.	Station No.	Station Name	Description	QC Sample?	Comment	Sample Date	Odour Apparent In Sample (n/a)	pH (lab) (pH units)	Phosphate Dissolved Ortho (mg/L)	Phosphorus Total (P) (mg/L)	Phosphorus Total Dissolved (mg/L)	Potassium Dissolved (mg/L)	Secchi Disk Transparency (m)
13SWE02793	AB05FA0480	Pigeon Lake	Composite	N		5-Jun-13	0	8.39		0.0163	0.0056	6.6	2.8
13SWE02833	AB05FA0480	Pigeon Lake	Composite	N		16-Jun-13	0	8.39		0.0153	0.0047	6.74	2.5
13SWE06602	AB05FA0480	Pigeon Lake	Composite	N		18-Jun-13	0	8.48		0.0325	0.0045	6.82	3.7
13SWE06620	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	18-Jun-13		8.48		0.0128	0.0047	6.6	
13SWE06621	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	18-Jun-13		8.43		0.0148	0.0046	6.62	
13SWE06631	AB05FA0480	Pigeon Lake	Composite	N		26-Jun-13	0	8.41		0.0233	0.0056	6.46	5.2
13SWE06653	AB05FA0480	Pigeon Lake	Composite	N		4-Jul-13	0	8.56		0.0132	0.0053	6.57	4.5
13SWE06684	AB05FA0480	Pigeon Lake	Composite	N		10-Jul-13	0	8.2	L0.001	0.015	0.0049	6.53	5.7
13SWE06713	AB05FA0480	Pigeon Lake	Composite	N		17-Jul-13	0	7.93	0.003	0.0189	0.0095	6.72	3.5
13SWE06742	AB05FA0480	Pigeon Lake	Composite	N		24-Jul-13	0	8.06	0.0013	0.0152	0.0072	6.27	4
13SWE06761	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	24-Jul-13		8.23	0.0021	0.0249	0.0091	6.37	
13SWE06762	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	24-Jul-13		8.23	0.0055	0.0225	0.0122	6.17	
13SWE06764	AB05FA0480	Pigeon Lake	Composite	N		29-Jul-13	0	8.27	0.0086	0.0196	0.01	6.51	3
13SWE06783	AB05FA0480	Pigeon Lake	Composite	Y	QC Sample - True Split	29-Jul-13		8.32	0.0057	0.0268	0.0102	6.56	
13SWE06794	AB05FA0480	Pigeon Lake	Composite	N		8-Aug-13	0	8.28	L0.001	0.0241	0.0067	6.42	2.6
13SWE06913	AB05FA0480	Pigeon Lake	Composite	N		14-Aug-13	0	8.46	L0.001	0.0298	0.0049	6.69	2.3
13SWE06962	AB05FA0480	Pigeon Lake	Composite	N		22-Aug-13	1	8.35	L0.001	0.0477	0.0032	6.31	2.2
13SWE06979	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	22-Aug-13		8.43	L0.001	0.0204	0.0018	6.39	
13SWE06980	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	22-Aug-13		8.44	L0.001	0.0228	0.007	6.46	
13SWE06983	AB05FA0480	Pigeon Lake	Composite	N		28-Aug-13	1	8.48	L0.001	0.0397	0.0077	6.5	1.5
13SWE07012	AB05FA0480	Pigeon Lake	Composite	N		5-Sep-13	0	8.4	L0.001	0.0335	0.0091	6.99	2.5
13SWE07046	AB05FA0480	Pigeon Lake	Composite	N		19-Sep-13	0	8.38	0.0136	0.056	0.024	6.79	2.5
13SWE07064	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	19-Sep-13		8.36	0.0166	0.0573	0.0332	6.95	
13SWE07065	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	19-Sep-13		8.36	0.0122	0.0507	0.024	6.82	

2013 Pigeon Lake Chemistry Data

Sample No.	Station No.	Station Name	Description	QC Sample?	Comment	Sample Date	Selenium Total Recoverable (ug/L)	Silica Dissolved (mg/L)	Silver Total Recoverable (ug/L)	Sodium Dissolved (mg/L)	Specific Conductance (Lab) (uS/cm)	Strontium Total Recoverable (ug/L)	Sulphate Dissolved (mg/L)
13SWE02793	AB05FA0480	Pigeon Lake	Composite	N		5-Jun-13		15.5		20.8	320		6.67
13SWE02833	AB05FA0480	Pigeon Lake	Composite	N		16-Jun-13		14.7		21.1	321		6.78
13SWE06602	AB05FA0480	Pigeon Lake	Composite	N		18-Jun-13		16		22.1	319		6.61
13SWE06620	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	18-Jun-13		15.6		21.5	321		6.56
13SWE06621	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	18-Jun-13		15.9		21.7	322		6.5
13SWE06631	AB05FA0480	Pigeon Lake	Composite	N		26-Jun-13	L0.1	15.1	0.0247	20.2	323	393	6.79
13SWE06653	AB05FA0480	Pigeon Lake	Composite	N		4-Jul-13		14.6		21.7	327		6.66
13SWE06684	AB05FA0480	Pigeon Lake	Composite	N		10-Jul-13		14.3		19.4	323		6.47
13SWE06713	AB05FA0480	Pigeon Lake	Composite	N		17-Jul-13		14.6		19.5	321		6.38
13SWE06742	AB05FA0480	Pigeon Lake	Composite	N		24-Jul-13		15.1		19.6	314		6.57
13SWE06761	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	24-Jul-13		15.3		20.3	320		6.6
13SWE06762	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	24-Jul-13		15.5		20.2	317		6.47
13SWE06764	AB05FA0480	Pigeon Lake	Composite	N		29-Jul-13		15		20.7	323		6.47
13SWE06783	AB05FA0480	Pigeon Lake	Composite	Y	QC Sample - True Split	29-Jul-13		14.7		20.8	322		6.46
13SWE06794	AB05FA0480	Pigeon Lake	Composite	N		8-Aug-13		14.7		19.4	319		6.29
13SWE06913	AB05FA0480	Pigeon Lake	Composite	N		14-Aug-13		14		20.5	323		6.31
13SWE06962	AB05FA0480	Pigeon Lake	Composite	N		22-Aug-13		14.6		19.8	312		6.1
13SWE06979	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	22-Aug-13		14.3		19.3	319		6.14
13SWE06980	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	22-Aug-13		14.3		20	318		6.13
13SWE06983	AB05FA0480	Pigeon Lake	Composite	N		28-Aug-13		1.54		21.7	315		6.28
13SWE07012	AB05FA0480	Pigeon Lake	Composite	N		5-Sep-13	L0.1	17.2	0.031	20.8	317	265	5.68
13SWE07046	AB05FA0480	Pigeon Lake	Composite	N		19-Sep-13		18.9		21.2	318		5.65
13SWE07064	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	19-Sep-13		18.3		20.9	319		5.74
13SWE07065	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	19-Sep-13		17.6		20.6	318		5.56

2013 Pigeon Lake Chemistry Data

Sample No.	Station No.	Station Name	Description	QC Sample?	Comment	Sample Date	Temperature Air (Deg C)	Thallium Total Recoverable (ug/L)	Thorium Total Recoverable (ug/L)	Tin Total Recoverable (ug/L)	Titanium Total Recoverable (ug/L)	Dissolved Solids (Calcd_) (mg/L)	Total Water Depth (m)
13SWE02793	AB05FA0480	Pigeon Lake	Composite	N		5-Jun-13						177	10
13SWE02833	AB05FA0480	Pigeon Lake	Composite	N		16-Jun-13						179	9.6
13SWE06602	AB05FA0480	Pigeon Lake	Composite	N		18-Jun-13	17.3					183	8.5
13SWE06620	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	18-Jun-13						180	
13SWE06621	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	18-Jun-13						182	
13SWE06631	AB05FA0480	Pigeon Lake	Composite	N		26-Jun-13		0.0019	L0.0003	L0.03	1.86	177	9.7
13SWE06653	AB05FA0480	Pigeon Lake	Composite	N		4-Jul-13	21					180	10.3
13SWE06684	AB05FA0480	Pigeon Lake	Composite	N		10-Jul-13	21.1					172	9.1
13SWE06713	AB05FA0480	Pigeon Lake	Composite	N		17-Jul-13	25.1					172	9.5
13SWE06742	AB05FA0480	Pigeon Lake	Composite	N		24-Jul-13	19.2					172	9.1
13SWE06761	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	24-Jul-13						175	
13SWE06762	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	24-Jul-13						174	
13SWE06764	AB05FA0480	Pigeon Lake	Composite	N		29-Jul-13	11.8					177	9.3
13SWE06783	AB05FA0480	Pigeon Lake	Composite	Y	QC Sample - True Split	29-Jul-13						178	
13SWE06794	AB05FA0480	Pigeon Lake	Composite	N		8-Aug-13	13.5					174	9.6
13SWE06913	AB05FA0480	Pigeon Lake	Composite	N		14-Aug-13	19.4					176	10
13SWE06962	AB05FA0480	Pigeon Lake	Composite	N		22-Aug-13	15.3					172	9.1
13SWE06979	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	22-Aug-13						174	
13SWE06980	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	22-Aug-13						175	
13SWE06983	AB05FA0480	Pigeon Lake	Composite	N		28-Aug-13	14.1					179	9.9
13SWE07012	AB05FA0480	Pigeon Lake	Composite	N		5-Sep-13	16.8	0.0016	L0.0003	0.146	1.74	171	10.1
13SWE07046	AB05FA0480	Pigeon Lake	Composite	N		19-Sep-13	18					173	9.5
13SWE07064	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	19-Sep-13						188	
13SWE07065	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	19-Sep-13						173	

2013 Pigeon Lake Chemistry Data

Sample No.	Station No.	Station Name	Description	QC Sample?	Comment	Sample Date	Turbidity (Visual) At Site (n/a)	Uranium Total Recoverable (ug/L)	Vanadium Total Recoverable (ug/L)	Zinc Total Recoverable (ug/L)
13SWE02793	AB05FA0480	Pigeon Lake	Composite	N		5-Jun-13	0			
13SWE02833	AB05FA0480	Pigeon Lake	Composite	N		16-Jun-13	0			
13SWE06602	AB05FA0480	Pigeon Lake	Composite	N		18-Jun-13	0			
13SWE06620	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	18-Jun-13				
13SWE06621	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	18-Jun-13				
13SWE06631	AB05FA0480	Pigeon Lake	Composite	N		26-Jun-13	0	0.249	0.215	0.382
13SWE06653	AB05FA0480	Pigeon Lake	Composite	N		4-Jul-13	0			
13SWE06684	AB05FA0480	Pigeon Lake	Composite	N		10-Jul-13	0			
13SWE06713	AB05FA0480	Pigeon Lake	Composite	N		17-Jul-13	0			
13SWE06742	AB05FA0480	Pigeon Lake	Composite	N		24-Jul-13	1			
13SWE06761	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	24-Jul-13				
13SWE06762	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	24-Jul-13				
13SWE06764	AB05FA0480	Pigeon Lake	Composite	N		29-Jul-13	1			
13SWE06783	AB05FA0480	Pigeon Lake	Composite	Y	QC Sample - True Split	29-Jul-13				
13SWE06794	AB05FA0480	Pigeon Lake	Composite	N		8-Aug-13	1			
13SWE06913	AB05FA0480	Pigeon Lake	Composite	N		14-Aug-13	0			
13SWE06962	AB05FA0480	Pigeon Lake	Composite	N		22-Aug-13	0			
13SWE06979	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	22-Aug-13				
13SWE06980	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	22-Aug-13				
13SWE06983	AB05FA0480	Pigeon Lake	Composite	N		28-Aug-13	0			
13SWE07012	AB05FA0480	Pigeon Lake	Composite	N		5-Sep-13	0	0.219	0.238	2.62
13SWE07046	AB05FA0480	Pigeon Lake	Composite	N		19-Sep-13	0			
13SWE07064	AB05FA0490	Pigeon Lake	Profile at centre	N	1m below water surface.	19-Sep-13				
13SWE07065	AB05FA0490	Pigeon Lake	Profile at centre	N	1m above sediment.	19-Sep-13				

Appendix 2-2
2013 Pigeon Lake Profile Data

2013 Pigeon Lake Profile Data

Sample No.	Station No.	Station Name	Description	Sample Date	Depth Of Sampling From Surface (m)	Oxygen Dissolved (Field Meter) (mg/L)	pH (field) (pH units)	Redox Potential (mV)	Specific Conductance (Field) (uS/cm)	Temperature Water (Deg C)
13SWE02794	AB05FA0490	Pigeon Lake	Profile at centre	5-Jun-13	0.1	11.41	8.7	89	317.7	14.06
13SWE02795	AB05FA0490	Pigeon Lake	Profile at centre	5-Jun-13	0.5	11.41	8.7	87	317.9	14.01
13SWE02796	AB05FA0490	Pigeon Lake	Profile at centre	5-Jun-13	1	11.53	8.67	69	317.7	14.16
13SWE02797	AB05FA0490	Pigeon Lake	Profile at centre	5-Jun-13	1.5	11.49	8.68	69	317.6	13.85
13SWE02798	AB05FA0490	Pigeon Lake	Profile at centre	5-Jun-13	2	11.56	8.68	70	317.5	13.8
13SWE02799	AB05FA0490	Pigeon Lake	Profile at centre	5-Jun-13	2.5	11.59	8.68	71	317.5	13.76
13SWE02800	AB05FA0490	Pigeon Lake	Profile at centre	5-Jun-13	3	11.59	8.67	72	317.8	13.67
13SWE02801	AB05FA0490	Pigeon Lake	Profile at centre	5-Jun-13	3.5	11.53	8.68	71	317.6	13.63
13SWE02802	AB05FA0490	Pigeon Lake	Profile at centre	5-Jun-13	4	11.45	8.67	72	317.6	13.61
13SWE02803	AB05FA0490	Pigeon Lake	Profile at centre	5-Jun-13	4.5	11.38	8.65	74	317.4	13.59
13SWE02804	AB05FA0490	Pigeon Lake	Profile at centre	5-Jun-13	5	11.31	8.66	73	317.5	13.57
13SWE02805	AB05FA0490	Pigeon Lake	Profile at centre	5-Jun-13	5.5	11.24	8.65	73	317.9	13.48
13SWE02806	AB05FA0490	Pigeon Lake	Profile at centre	5-Jun-13	6.5	11.14	8.65	74	317.5	13.42
13SWE02807	AB05FA0490	Pigeon Lake	Profile at centre	5-Jun-13	7.5	11.25	8.64	75	317.6	13.42
13SWE02808	AB05FA0490	Pigeon Lake	Profile at centre	5-Jun-13	8.5	8.45	8.25	87	324.5	12.39
13SWE02809	AB05FA0490	Pigeon Lake	Profile at centre	5-Jun-13	9	4.47	7.81	102	327.1	11.03
13SWE02834	AB05FA0490	Pigeon Lake	Profile at centre	16-Jun-13	0.1	8.97	8.49	177	323.5	13.9
13SWE02835	AB05FA0490	Pigeon Lake	Profile at centre	16-Jun-13	0.5	8.99	8.49	178	323.6	13.9
13SWE02836	AB05FA0490	Pigeon Lake	Profile at centre	16-Jun-13	1	8.99	8.49	178	323.6	13.89
13SWE02837	AB05FA0490	Pigeon Lake	Profile at centre	16-Jun-13	1.5	8.98	8.5	178	323.3	13.93
13SWE02838	AB05FA0490	Pigeon Lake	Profile at centre	16-Jun-13	2	8.97	8.5	179	323.6	13.91
13SWE02839	AB05FA0490	Pigeon Lake	Profile at centre	16-Jun-13	2.5	9	8.49	179	323.6	13.92
13SWE02840	AB05FA0490	Pigeon Lake	Profile at centre	16-Jun-13	3	9	8.5	179	324.2	13.85
13SWE02841	AB05FA0490	Pigeon Lake	Profile at centre	16-Jun-13	3.5	8.97	8.5	179	323.8	13.86
13SWE02842	AB05FA0490	Pigeon Lake	Profile at centre	16-Jun-13	4	8.97	8.5	180	323.8	13.78
13SWE02843	AB05FA0490	Pigeon Lake	Profile at centre	16-Jun-13	4.5	8.98	8.49	180	323.8	13.72
13SWE02844	AB05FA0490	Pigeon Lake	Profile at centre	16-Jun-13	5	8.93	8.5	180	324.2	13.63
13SWE02845	AB05FA0490	Pigeon Lake	Profile at centre	16-Jun-13	6	8.91	8.49	181	323.7	13.59
13SWE02846	AB05FA0490	Pigeon Lake	Profile at centre	16-Jun-13	7	8.88	8.49	181	323.8	13.57
13SWE02847	AB05FA0490	Pigeon Lake	Profile at centre	16-Jun-13	7.5	8.88	8.49	182	323.7	13.57
13SWE02848	AB05FA0490	Pigeon Lake	Profile at centre	16-Jun-13	8	8.89	8.49	182	323.7	13.57
13SWE02849	AB05FA0490	Pigeon Lake	Profile at centre	16-Jun-13	8.5	8.85	8.5	183	323.9	13.56
13SWE02850	AB05FA0490	Pigeon Lake	Profile at centre	16-Jun-13	9	8.83	8.49	183	324	13.57
13SWE06603	AB05FA0490	Pigeon Lake	Profile at centre	18-Jun-13	0.1	9	8.53	149	324.2	14.53
13SWE06604	AB05FA0490	Pigeon Lake	Profile at centre	18-Jun-13	0.5	8.99	8.53	150	323.9	14.53
13SWE06605	AB05FA0490	Pigeon Lake	Profile at centre	18-Jun-13	1	9	8.53	151	324	14.52
13SWE06606	AB05FA0490	Pigeon Lake	Profile at centre	18-Jun-13	1.5	9	8.53	152	323.9	14.52
13SWE06607	AB05FA0490	Pigeon Lake	Profile at centre	18-Jun-13	2	8.99	8.53	153	324	14.51
13SWE06608	AB05FA0490	Pigeon Lake	Profile at centre	18-Jun-13	2.5	8.99	8.54	153	323.9	14.52
13SWE06609	AB05FA0490	Pigeon Lake	Profile at centre	18-Jun-13	3	8.99	8.54	154	323.6	14.51
13SWE06610	AB05FA0490	Pigeon Lake	Profile at centre	18-Jun-13	3.5	9.02	8.54	154	324	14.5
13SWE06611	AB05FA0490	Pigeon Lake	Profile at centre	18-Jun-13	4	8.99	8.54	155	323.9	14.47
13SWE06612	AB05FA0490	Pigeon Lake	Profile at centre	18-Jun-13	4.5	8.86	8.52	156	324.5	14.34
13SWE06613	AB05FA0490	Pigeon Lake	Profile at centre	18-Jun-13	5	8.98	8.51	157	324.2	14.06
13SWE06614	AB05FA0490	Pigeon Lake	Profile at centre	18-Jun-13	5.5	8.85	8.51	157	324.1	13.94

2013 Pigeon Lake Profile Data

13SWE06615	AB05FA0490	Pigeon Lake	Profile at centre	18-Jun-13	6	8.72	8.5	158	324.2	13.88
13SWE06616	AB05FA0490	Pigeon Lake	Profile at centre	18-Jun-13	6.5	8.45	8.48	158	324	13.84
13SWE06617	AB05FA0490	Pigeon Lake	Profile at centre	18-Jun-13	7	8.43	8.48	159	324.4	13.81
13SWE06618	AB05FA0490	Pigeon Lake	Profile at centre	18-Jun-13	7.5	8.35	8.47	160	325.1	13.8
13SWE06619	AB05FA0490	Pigeon Lake	Profile at centre	18-Jun-13	8	7.6	8.38	161	325.5	13.76
13SWE06632	AB05FA0490	Pigeon Lake	Profile at centre	26-Jun-13	0.1	8.58	8.41	221	325.7	16.43
13SWE06633	AB05FA0490	Pigeon Lake	Profile at centre	26-Jun-13	0.5	8.58	8.42	221	325.9	16.42
13SWE06634	AB05FA0490	Pigeon Lake	Profile at centre	26-Jun-13	1	8.57	8.41	221	326.1	16.43
13SWE06635	AB05FA0490	Pigeon Lake	Profile at centre	26-Jun-13	1.5	8.59	8.41	221	325.9	16.44
13SWE06636	AB05FA0490	Pigeon Lake	Profile at centre	26-Jun-13	2	8.59	8.42	221	326.1	16.44
13SWE06637	AB05FA0490	Pigeon Lake	Profile at centre	26-Jun-13	2.5	8.58	8.42	221	326.1	16.44
13SWE06638	AB05FA0490	Pigeon Lake	Profile at centre	26-Jun-13	3	8.58	8.41	220	325.9	16.39
13SWE06639	AB05FA0490	Pigeon Lake	Profile at centre	26-Jun-13	3.5	8.55	8.41	221	325.9	16.38
13SWE06640	AB05FA0490	Pigeon Lake	Profile at centre	26-Jun-13	4	8.53	8.42	220	326	16.35
13SWE06641	AB05FA0490	Pigeon Lake	Profile at centre	26-Jun-13	4.5	8.52	8.41	220	326.3	16.32
13SWE06642	AB05FA0490	Pigeon Lake	Profile at centre	26-Jun-13	5	8.5	8.41	221	326	16.33
13SWE06643	AB05FA0490	Pigeon Lake	Profile at centre	26-Jun-13	5.5	8.45	8.41	221	326	16.32
13SWE06644	AB05FA0490	Pigeon Lake	Profile at centre	26-Jun-13	6	8.27	8.38	221	325.8	16.12
13SWE06645	AB05FA0490	Pigeon Lake	Profile at centre	26-Jun-13	6.5	6.97	8.18	224	327.9	15.38
13SWE06646	AB05FA0490	Pigeon Lake	Profile at centre	26-Jun-13	7	5.46	8.04	225	329.2	14.74
13SWE06647	AB05FA0490	Pigeon Lake	Profile at centre	26-Jun-13	7.5	5.32	8.01	226	329.4	14.72
13SWE06648	AB05FA0490	Pigeon Lake	Profile at centre	26-Jun-13	8	5.16	7.99	227	329.5	14.68
13SWE06649	AB05FA0490	Pigeon Lake	Profile at centre	26-Jun-13	8.5	5.01	7.97	227	329.7	14.66
13SWE06650	AB05FA0490	Pigeon Lake	Profile at centre	26-Jun-13	9	4.71	7.94	228	330	14.62
13SWE06651	AB05FA0490	Pigeon Lake	Profile at centre	26-Jun-13	9.5	3.89	7.84	229	331	14.51
13SWE06654	AB05FA0490	Pigeon Lake	Profile at centre	4-Jul-13	0.1	8.15	8.4	228	329.5	19.99
13SWE06655	AB05FA0490	Pigeon Lake	Profile at centre	4-Jul-13	0.5	8.14	8.4	228	329.3	20
13SWE06656	AB05FA0490	Pigeon Lake	Profile at centre	4-Jul-13	1	8.14	8.39	229	329.3	20.01
13SWE06657	AB05FA0490	Pigeon Lake	Profile at centre	4-Jul-13	1.5	8.14	8.39	229	329.3	20
13SWE06658	AB05FA0490	Pigeon Lake	Profile at centre	4-Jul-13	2	8.13	8.39	229	329.4	19.98
13SWE06659	AB05FA0490	Pigeon Lake	Profile at centre	4-Jul-13	2.5	8.14	8.39	229	329.3	20
13SWE06660	AB05FA0490	Pigeon Lake	Profile at centre	4-Jul-13	3	8.11	8.38	229	329.2	19.97
13SWE06661	AB05FA0490	Pigeon Lake	Profile at centre	4-Jul-13	3.5	8.1	8.38	229	329.2	19.96
13SWE06662	AB05FA0490	Pigeon Lake	Profile at centre	4-Jul-13	4	8.09	8.38	229	329.3	19.95
13SWE06663	AB05FA0490	Pigeon Lake	Profile at centre	4-Jul-13	4.5	7.94	8.35	230	329.8	19.88
13SWE06664	AB05FA0490	Pigeon Lake	Profile at centre	4-Jul-13	5	7.96	8.35	230	330	19.71
13SWE06665	AB05FA0490	Pigeon Lake	Profile at centre	4-Jul-13	5.5	8.15	8.37	230	329	19.11
13SWE06666	AB05FA0490	Pigeon Lake	Profile at centre	4-Jul-13	6	8.23	8.37	230	328.8	19.09
13SWE06667	AB05FA0490	Pigeon Lake	Profile at centre	4-Jul-13	6.5	8.21	8.37	230	328.8	19
13SWE06668	AB05FA0490	Pigeon Lake	Profile at centre	4-Jul-13	7	8.19	8.36	231	328.8	18.94
13SWE06669	AB05FA0490	Pigeon Lake	Profile at centre	4-Jul-13	7.5	7.91	8.32	231	329.1	18.74
13SWE06670	AB05FA0490	Pigeon Lake	Profile at centre	4-Jul-13	8	6.82	8.22	232	330.1	18.31
13SWE06671	AB05FA0490	Pigeon Lake	Profile at centre	4-Jul-13	8.5	5.67	8.02	234	331.6	17.76
13SWE06672	AB05FA0490	Pigeon Lake	Profile at centre	4-Jul-13	9	2.52	7.65	239	334.3	17.04
13SWE06673	AB05FA0490	Pigeon Lake	Profile at centre	4-Jul-13	9.5	1.43	7.62	240	334.6	16.26
13SWE06674	AB05FA0490	Pigeon Lake	Profile at centre	4-Jul-13	10	1.17	7.61	240	334.7	16.23
13SWE06685	AB05FA0490	Pigeon Lake	Profile at centre	10-Jul-13	0.1	8.24	8.42	220	327.1	19.88
13SWE06686	AB05FA0490	Pigeon Lake	Profile at centre	10-Jul-13	0.5	8.23	8.41	220	327.5	19.89

2013 Pigeon Lake Profile Data

13SWE06687	AB05FA0490	Pigeon Lake	Profile at centre	10-Jul-13	1	8.23	8.41	221	327.2	19.84
13SWE06688	AB05FA0490	Pigeon Lake	Profile at centre	10-Jul-13	1.5	8.24	8.41	221	327.1	19.83
13SWE06689	AB05FA0490	Pigeon Lake	Profile at centre	10-Jul-13	2	8.23	8.4	222	327.3	19.82
13SWE06690	AB05FA0490	Pigeon Lake	Profile at centre	10-Jul-13	2.5	8.24	8.4	222	327.2	19.81
13SWE06691	AB05FA0490	Pigeon Lake	Profile at centre	10-Jul-13	3	8.23	8.4	222	327.2	19.81
13SWE06692	AB05FA0490	Pigeon Lake	Profile at centre	10-Jul-13	3.5	8.23	8.4	222	327.3	19.8
13SWE06693	AB05FA0490	Pigeon Lake	Profile at centre	10-Jul-13	4	8.23	8.41	223	327.2	19.8
13SWE06694	AB05FA0490	Pigeon Lake	Profile at centre	10-Jul-13	4.5	8.14	8.39	223	327.3	19.68
13SWE06695	AB05FA0490	Pigeon Lake	Profile at centre	10-Jul-13	5	8.03	8.37	224	327.1	19.26
13SWE06696	AB05FA0490	Pigeon Lake	Profile at centre	10-Jul-13	5.5	7.89	8.35	225	327.2	19.19
13SWE06697	AB05FA0490	Pigeon Lake	Profile at centre	10-Jul-13	6	7.78	8.34	225	327.5	19.15
13SWE06698	AB05FA0490	Pigeon Lake	Profile at centre	10-Jul-13	6.5	7.8	8.34	226	327.2	19.13
13SWE06699	AB05FA0490	Pigeon Lake	Profile at centre	10-Jul-13	7	7.73	8.34	226	327.3	19.09
13SWE06700	AB05FA0490	Pigeon Lake	Profile at centre	10-Jul-13	7.5	7.64	8.33	227	327.4	19.07
13SWE06701	AB05FA0490	Pigeon Lake	Profile at centre	10-Jul-13	8	7.59	8.32	227	327.5	19.06
13SWE06702	AB05FA0490	Pigeon Lake	Profile at centre	10-Jul-13	8.5	5.07	8.01	231	330.5	18.91
13SWE06715	AB05FA0490	Pigeon Lake	Profile at centre	17-Jul-13	0.1	7.92	8.31	236	327.8	18.52
13SWE06716	AB05FA0490	Pigeon Lake	Profile at centre	17-Jul-13	0.5	7.92	8.3	237	327.9	18.51
13SWE06717	AB05FA0490	Pigeon Lake	Profile at centre	17-Jul-13	1	7.92	8.3	237	327.8	18.51
13SWE06718	AB05FA0490	Pigeon Lake	Profile at centre	17-Jul-13	1.5	7.92	8.3	237	327.8	18.52
13SWE06719	AB05FA0490	Pigeon Lake	Profile at centre	17-Jul-13	2	7.9	8.29	238	327.8	18.52
13SWE06720	AB05FA0490	Pigeon Lake	Profile at centre	17-Jul-13	2.5	7.91	8.29	238	327.9	18.52
13SWE06721	AB05FA0490	Pigeon Lake	Profile at centre	17-Jul-13	3	7.91	8.29	238	327.8	18.51
13SWE06722	AB05FA0490	Pigeon Lake	Profile at centre	17-Jul-13	3.5	7.92	8.3	238	327.9	18.52
13SWE06723	AB05FA0490	Pigeon Lake	Profile at centre	17-Jul-13	4	7.92	8.29	239	327.9	18.51
13SWE06724	AB05FA0490	Pigeon Lake	Profile at centre	17-Jul-13	4.5	7.89	8.29	239	327.8	18.51
13SWE06725	AB05FA0490	Pigeon Lake	Profile at centre	17-Jul-13	5	7.87	8.28	239	327.5	18.46
13SWE06726	AB05FA0490	Pigeon Lake	Profile at centre	17-Jul-13	5.5	7.83	8.25	239	327.8	18.34
13SWE06727	AB05FA0490	Pigeon Lake	Profile at centre	17-Jul-13	6	7.34	8.21	240	327.2	18.25
13SWE06728	AB05FA0490	Pigeon Lake	Profile at centre	17-Jul-13	6.5	7.23	8.2	240	326.9	18.18
13SWE06729	AB05FA0490	Pigeon Lake	Profile at centre	17-Jul-13	7	7.2	8.2	241	327.1	18.17
13SWE06730	AB05FA0490	Pigeon Lake	Profile at centre	17-Jul-13	7.5	7.18	8.2	241	327.1	18.16
13SWE06731	AB05FA0490	Pigeon Lake	Profile at centre	17-Jul-13	8	7.09	8.19	241	327.2	18.16
13SWE06732	AB05FA0490	Pigeon Lake	Profile at centre	17-Jul-13	8.5	6.99	8.18	242	327.2	18.15
13SWE07083	AB05FA0490	Pigeon Lake	Profile at centre	17-Jul-13	9	6.88	8.16	242	327	18.15
13SWE06743	AB05FA0490	Pigeon Lake	Profile at centre	24-Jul-13	0.1	8.17	8.37	179	330.2	20.13
13SWE06744	AB05FA0490	Pigeon Lake	Profile at centre	24-Jul-13	0.5	8.15	8.37	181	330.2	20.14
13SWE06745	AB05FA0490	Pigeon Lake	Profile at centre	24-Jul-13	1	8.16	8.37	182	330.3	20.14
13SWE06746	AB05FA0490	Pigeon Lake	Profile at centre	24-Jul-13	1.5	8.13	8.37	182	330	20.12
13SWE06747	AB05FA0490	Pigeon Lake	Profile at centre	24-Jul-13	2	8.15	8.36	184	330.5	20.11
13SWE06748	AB05FA0490	Pigeon Lake	Profile at centre	24-Jul-13	2.5	8.09	8.35	185	330.6	20.09
13SWE06749	AB05FA0490	Pigeon Lake	Profile at centre	24-Jul-13	3	8.08	8.35	185	330.3	20.07
13SWE06750	AB05FA0490	Pigeon Lake	Profile at centre	24-Jul-13	3.5	8.08	8.35	186	330.3	20.03
13SWE06751	AB05FA0490	Pigeon Lake	Profile at centre	24-Jul-13	4	8.01	8.34	186	330.4	19.92
13SWE06752	AB05FA0490	Pigeon Lake	Profile at centre	24-Jul-13	4.5	7.81	8.31	187	330.5	19.61
13SWE06753	AB05FA0490	Pigeon Lake	Profile at centre	24-Jul-13	5	7.69	8.3	187	330.6	19.57
13SWE06754	AB05FA0490	Pigeon Lake	Profile at centre	24-Jul-13	5.5	7.57	8.28	188	330.5	19.54
13SWE06755	AB05FA0490	Pigeon Lake	Profile at centre	24-Jul-13	6	7.51	8.28	188	330.7	19.53
13SWE06756	AB05FA0490	Pigeon Lake	Profile at centre	24-Jul-13	6.5	7.5	8.27	189	330.7	19.52

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13SWE06757	AB05FA0490	Pigeon Lake	Profile at centre	24-Jul-13	7	7.43	8.27	189	330.6	19.5
13SWE06758	AB05FA0490	Pigeon Lake	Profile at centre	24-Jul-13	7.5	7.3	8.25	190	330.8	19.45
13SWE06759	AB05FA0490	Pigeon Lake	Profile at centre	24-Jul-13	8	7.15	8.24	190	331	19.44
13SWE06760	AB05FA0490	Pigeon Lake	Profile at centre	24-Jul-13	8.5	6.08	8.13	192	331.8	19.38
13SWE06765	AB05FA0490	Pigeon Lake	Profile at centre	29-Jul-13	0.1	7.87	8.36	245	331	18.35
13SWE06766	AB05FA0490	Pigeon Lake	Profile at centre	29-Jul-13	0.5	7.88	8.36	244	331	18.37
13SWE06767	AB05FA0490	Pigeon Lake	Profile at centre	29-Jul-13	1	7.88	8.36	243	330.8	18.37
13SWE06768	AB05FA0490	Pigeon Lake	Profile at centre	29-Jul-13	1.5	7.86	8.35	243	330.7	18.37
13SWE06769	AB05FA0490	Pigeon Lake	Profile at centre	29-Jul-13	2	7.88	8.34	242	331	18.37
13SWE06770	AB05FA0490	Pigeon Lake	Profile at centre	29-Jul-13	2.5	7.87	8.34	242	330.8	18.36
13SWE06771	AB05FA0490	Pigeon Lake	Profile at centre	29-Jul-13	3	7.89	8.34	242	331	18.37
13SWE06772	AB05FA0490	Pigeon Lake	Profile at centre	29-Jul-13	3.5	7.88	8.33	242	330.8	18.37
13SWE06773	AB05FA0490	Pigeon Lake	Profile at centre	29-Jul-13	4	7.88	8.32	242	330.8	18.36
13SWE06774	AB05FA0490	Pigeon Lake	Profile at centre	29-Jul-13	4.5	7.87	8.33	242	331	18.37
13SWE06775	AB05FA0490	Pigeon Lake	Profile at centre	29-Jul-13	5	7.86	8.33	242	331	18.37
13SWE06776	AB05FA0490	Pigeon Lake	Profile at centre	29-Jul-13	5.5	7.85	8.33	242	330.8	18.37
13SWE06777	AB05FA0490	Pigeon Lake	Profile at centre	29-Jul-13	6	7.83	8.33	242	331	18.37
13SWE06778	AB05FA0490	Pigeon Lake	Profile at centre	29-Jul-13	7	7.84	8.33	241	330.7	18.37
13SWE06779	AB05FA0490	Pigeon Lake	Profile at centre	29-Jul-13	7.5	7.86	8.33	241	331	18.37
13SWE06780	AB05FA0490	Pigeon Lake	Profile at centre	29-Jul-13	8	7.84	8.33	241	331	18.37
13SWE06781	AB05FA0490	Pigeon Lake	Profile at centre	29-Jul-13	8.5	7.83	8.33	241	331	18.37
13SWE06782	AB05FA0490	Pigeon Lake	Profile at centre	29-Jul-13	9	7.59	8.3	241	331	18.37
13SWE06795	AB05FA0490	Pigeon Lake	Profile at centre	8-Aug-13	0.1	8.59	8.51	186	330.9	18.95
13SWE06796	AB05FA0490	Pigeon Lake	Profile at centre	8-Aug-13	0.5	8.59	8.51	188	330.9	18.96
13SWE06797	AB05FA0490	Pigeon Lake	Profile at centre	8-Aug-13	1	8.58	8.51	189	330.8	18.97
13SWE06798	AB05FA0490	Pigeon Lake	Profile at centre	8-Aug-13	1.5	8.58	8.5	190	330.8	18.96
13SWE06799	AB05FA0490	Pigeon Lake	Profile at centre	8-Aug-13	2	8.58	8.5	191	330.8	18.96
13SWE06800	AB05FA0490	Pigeon Lake	Profile at centre	8-Aug-13	2.5	8.58	8.5	191	330.9	18.97
13SWE06900	AB05FA0490	Pigeon Lake	Profile at centre	8-Aug-13	3	8.56	8.49	192	330.9	18.97
13SWE06901	AB05FA0490	Pigeon Lake	Profile at centre	8-Aug-13	3.5	8.56	8.49	193	330.9	18.97
13SWE06902	AB05FA0490	Pigeon Lake	Profile at centre	8-Aug-13	4	8.55	8.48	193	330.9	18.97
13SWE06903	AB05FA0490	Pigeon Lake	Profile at centre	8-Aug-13	4.5	8.56	8.49	194	330.9	18.95
13SWE06904	AB05FA0490	Pigeon Lake	Profile at centre	8-Aug-13	5	8.55	8.48	194	331.1	18.96
13SWE06905	AB05FA0490	Pigeon Lake	Profile at centre	8-Aug-13	5.5	8.58	8.48	195	330.8	18.96
13SWE06906	AB05FA0490	Pigeon Lake	Profile at centre	8-Aug-13	6.5	8.58	8.48	195	330.9	18.96
13SWE06907	AB05FA0490	Pigeon Lake	Profile at centre	8-Aug-13	7.5	8.53	8.48	196	330.9	18.96
13SWE06908	AB05FA0490	Pigeon Lake	Profile at centre	8-Aug-13	8	8.51	8.48	196	330.9	18.96
13SWE06909	AB05FA0490	Pigeon Lake	Profile at centre	8-Aug-13	8.5	8.53	8.48	196	331.1	18.94
13SWE06910	AB05FA0490	Pigeon Lake	Profile at centre	8-Aug-13	9	3.85	7.88	202	335.4	18.55
13SWE06914	AB05FA0490	Pigeon Lake	Profile at centre	14-Aug-13	0.1	10.33	8.69	207	328	19.69
13SWE06915	AB05FA0490	Pigeon Lake	Profile at centre	14-Aug-13	0.5	10.38	8.69	206	327.7	19.65
13SWE06916	AB05FA0490	Pigeon Lake	Profile at centre	14-Aug-13	1	10.39	8.69	205	327.7	19.59
13SWE06917	AB05FA0490	Pigeon Lake	Profile at centre	14-Aug-13	1.5	10.38	8.69	205	327.6	19.56
13SWE06918	AB05FA0490	Pigeon Lake	Profile at centre	14-Aug-13	2	10.31	8.68	205	327.9	19.54
13SWE06919	AB05FA0490	Pigeon Lake	Profile at centre	14-Aug-13	2.5	10.23	8.67	205	327.8	19.53
13SWE06920	AB05FA0490	Pigeon Lake	Profile at centre	14-Aug-13	3	10.13	8.66	205	328.1	19.51
13SWE06921	AB05FA0490	Pigeon Lake	Profile at centre	14-Aug-13	3.5	9.93	8.65	205	328.5	19.47
13SWE06922	AB05FA0490	Pigeon Lake	Profile at centre	14-Aug-13	4	9.56	8.6	205	328.9	19.38

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13SWE06923	AB05FA0490	Pigeon Lake	Profile at centre	14-Aug-13	4.5	9.3	8.56	206	329.2	19.27
13SWE06924	AB05FA0490	Pigeon Lake	Profile at centre	14-Aug-13	5.5	8.72	8.49	207	329.8	19.02
13SWE06925	AB05FA0490	Pigeon Lake	Profile at centre	14-Aug-13	6.5	7.91	8.4	209	331	18.74
13SWE06926	AB05FA0490	Pigeon Lake	Profile at centre	14-Aug-13	7.5	7.33	8.33	210	331.6	18.68
13SWE06927	AB05FA0490	Pigeon Lake	Profile at centre	14-Aug-13	8	7.05	8.31	211	332.2	18.64
13SWE06928	AB05FA0490	Pigeon Lake	Profile at centre	14-Aug-13	8.5	6.59	8.26	212	333	18.6
13SWE06929	AB05FA0490	Pigeon Lake	Profile at centre	14-Aug-13	9	6.05	8.18	213	333.7	18.45
13SWE06930	AB05FA0490	Pigeon Lake	Profile at centre	14-Aug-13	9.5	4.04	7.94	216	336.7	18.3
13SWE06963	AB05FA0490	Pigeon Lake	Profile at centre	22-Aug-13	0.1	8.38	8.68	194	323.9	19.25
13SWE06964	AB05FA0490	Pigeon Lake	Profile at centre	22-Aug-13	0.5	8.41	8.69	193	323.9	19.24
13SWE06965	AB05FA0490	Pigeon Lake	Profile at centre	22-Aug-13	0.5	8.42	8.69	193	323.9	19.22
13SWE06966	AB05FA0490	Pigeon Lake	Profile at centre	22-Aug-13	1	8.46	8.69	193	323.7	19.18
13SWE06967	AB05FA0490	Pigeon Lake	Profile at centre	22-Aug-13	1.5	8.52	8.68	192	323.6	19.16
13SWE06968	AB05FA0490	Pigeon Lake	Profile at centre	22-Aug-13	2	8.48	8.69	192	323.6	19.15
13SWE06969	AB05FA0490	Pigeon Lake	Profile at centre	22-Aug-13	2.5	8.42	8.67	191	323.7	19.13
13SWE06970	AB05FA0490	Pigeon Lake	Profile at centre	22-Aug-13	3	8.35	8.67	191	323.8	19.12
13SWE06971	AB05FA0490	Pigeon Lake	Profile at centre	22-Aug-13	3.5	8.2	8.66	191	323.8	19.12
13SWE06972	AB05FA0490	Pigeon Lake	Profile at centre	22-Aug-13	4	8.18	8.65	191	323.9	19.11
13SWE06973	AB05FA0490	Pigeon Lake	Profile at centre	22-Aug-13	4.5	8.17	8.65	190	323.9	19.11
13SWE06974	AB05FA0490	Pigeon Lake	Profile at centre	22-Aug-13	5.5	8.16	8.65	190	323.9	19.11
13SWE06975	AB05FA0490	Pigeon Lake	Profile at centre	22-Aug-13	6.5	8.15	8.64	190	323.8	19.11
13SWE06976	AB05FA0490	Pigeon Lake	Profile at centre	22-Aug-13	7.5	8.17	8.64	190	324.3	19.11
13SWE06977	AB05FA0490	Pigeon Lake	Profile at centre	22-Aug-13	8	8.05	8.64	189	324	19.1
13SWE06978	AB05FA0490	Pigeon Lake	Profile at centre	22-Aug-13	8.5	7.99	7.89	172	324.4	19.1
13SWE06984	AB05FA0490	Pigeon Lake	Profile at centre	28-Aug-13	0.1	8.61	8.63	186	323.4	19.2
13SWE06985	AB05FA0490	Pigeon Lake	Profile at centre	28-Aug-13	0.5	8.61	8.61	186	323.3	19.2
13SWE06986	AB05FA0490	Pigeon Lake	Profile at centre	28-Aug-13	1	8.47	8.61	185	323.3	19.2
13SWE06987	AB05FA0490	Pigeon Lake	Profile at centre	28-Aug-13	1.5	8.53	8.59	185	323.5	19.2
13SWE06988	AB05FA0490	Pigeon Lake	Profile at centre	28-Aug-13	2	8.33	8.58	184	323.4	19.18
13SWE06989	AB05FA0490	Pigeon Lake	Profile at centre	28-Aug-13	2.5	8.25	8.57	184	323.8	19.18
13SWE06990	AB05FA0490	Pigeon Lake	Profile at centre	28-Aug-13	3	8.28	8.57	184	323.6	19.17
13SWE06991	AB05FA0490	Pigeon Lake	Profile at centre	28-Aug-13	3.5	8.22	8.56	184	323.7	19.18
13SWE06992	AB05FA0490	Pigeon Lake	Profile at centre	28-Aug-13	4	8.25	8.56	184	323.7	19.18
13SWE06993	AB05FA0490	Pigeon Lake	Profile at centre	28-Aug-13	5	8.19	8.56	184	323.8	19.18
13SWE06994	AB05FA0490	Pigeon Lake	Profile at centre	28-Aug-13	6	8.19	8.56	183	323.8	19.18
13SWE06995	AB05FA0490	Pigeon Lake	Profile at centre	28-Aug-13	7	8.15	8.56	183	323.8	19.17
13SWE06996	AB05FA0490	Pigeon Lake	Profile at centre	28-Aug-13	7.5	8.05	8.55	183	323.9	19.17
13SWE06997	AB05FA0490	Pigeon Lake	Profile at centre	28-Aug-13	8	7.62	8.5	184	324.4	19.15
13SWE06998	AB05FA0490	Pigeon Lake	Profile at centre	28-Aug-13	8.5	6.6	8.41	185	325.8	19.09
13SWE06999	AB05FA0490	Pigeon Lake	Profile at centre	28-Aug-13	9	6.54	8.4	185	326	19.09
13SWE07000	AB05FA0490	Pigeon Lake	Profile at centre	28-Aug-13	9.5	6.26	8.38	186	326.1	19.08
13SWE07013	AB05FA0490	Pigeon Lake	Profile at centre	5-Sep-13	0.1	7.5	8.56	153	320	19.32
13SWE07014	AB05FA0490	Pigeon Lake	Profile at centre	5-Sep-13	0.5	7.47	8.56	152	319.8	19.32
13SWE07015	AB05FA0490	Pigeon Lake	Profile at centre	5-Sep-13	1	7.52	8.56	152	320	19.32
13SWE07016	AB05FA0490	Pigeon Lake	Profile at centre	5-Sep-13	1.5	7.45	8.54	151	320.1	19.32
13SWE07017	AB05FA0490	Pigeon Lake	Profile at centre	5-Sep-13	2	7.35	8.55	151	320.1	19.32
13SWE07018	AB05FA0490	Pigeon Lake	Profile at centre	5-Sep-13	2.5	7.45	8.55	151	320.2	19.32

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13SWE07019	AB05FA0490	Pigeon Lake	Profile at centre	5-Sep-13	3	7.34	8.54	150	320.1	19.32
13SWE07020	AB05FA0490	Pigeon Lake	Profile at centre	5-Sep-13	3.5	7.42	8.54	150	320.2	19.32
13SWE07021	AB05FA0490	Pigeon Lake	Profile at centre	5-Sep-13	4	7.43	8.54	150	320.1	19.32
13SWE07022	AB05FA0490	Pigeon Lake	Profile at centre	5-Sep-13	4.5	7.36	8.54	150	320.1	19.32
13SWE07023	AB05FA0490	Pigeon Lake	Profile at centre	5-Sep-13	5	7.41	8.54	150	320.2	19.32
13SWE07024	AB05FA0490	Pigeon Lake	Profile at centre	5-Sep-13	6	7.41	8.54	149	319.8	19.32
13SWE07025	AB05FA0490	Pigeon Lake	Profile at centre	5-Sep-13	7	6.88	8.46	150	321.8	19.28
13SWE07026	AB05FA0490	Pigeon Lake	Profile at centre	5-Sep-13	7.5	5.18	8.35	152	323.7	19.09
13SWE07027	AB05FA0490	Pigeon Lake	Profile at centre	5-Sep-13	8	1.82	7.93	157	331.5	18.72
13SWE07028	AB05FA0490	Pigeon Lake	Profile at centre	5-Sep-13	8.5	1.46	7.88	160	333.7	18.65
13SWE07029	AB05FA0490	Pigeon Lake	Profile at centre	5-Sep-13	9	1.42	7.87	160	333.8	18.62
13SWE07030	AB05FA0490	Pigeon Lake	Profile at centre	5-Sep-13	9.5	1.38	7.86	160	333.7	18.62
13SWE07047	AB05FA0490	Pigeon Lake	Profile at centre	19-Sep-13	0.1	7.83	8.41	208	323.7	17.09
13SWE07048	AB05FA0490	Pigeon Lake	Profile at centre	19-Sep-13	0.5	7.83	8.4	206	323.7	17.09
13SWE07049	AB05FA0490	Pigeon Lake	Profile at centre	19-Sep-13	1	7.84	8.4	205	323.6	17.09
13SWE07050	AB05FA0490	Pigeon Lake	Profile at centre	19-Sep-13	1.5	7.83	8.4	204	323.6	17.09
13SWE07051	AB05FA0490	Pigeon Lake	Profile at centre	19-Sep-13	2	7.84	8.4	203	323.9	17.09
13SWE07052	AB05FA0490	Pigeon Lake	Profile at centre	19-Sep-13	2.5	7.83	8.38	202	323.8	17.09
13SWE07053	AB05FA0490	Pigeon Lake	Profile at centre	19-Sep-13	3	7.81	8.39	202	323.8	17.09
13SWE07054	AB05FA0490	Pigeon Lake	Profile at centre	19-Sep-13	3.5	7.81	8.38	201	323.7	17.06
13SWE07055	AB05FA0490	Pigeon Lake	Profile at centre	19-Sep-13	4	7.8	8.38	201	323.7	17.03
13SWE07056	AB05FA0490	Pigeon Lake	Profile at centre	19-Sep-13	4.5	7.78	8.37	200	323.7	17
13SWE07057	AB05FA0490	Pigeon Lake	Profile at centre	19-Sep-13	5	7.84	8.37	200	323.8	16.94
13SWE07058	AB05FA0490	Pigeon Lake	Profile at centre	19-Sep-13	6	7.85	8.37	199	323.7	16.9
13SWE07059	AB05FA0490	Pigeon Lake	Profile at centre	19-Sep-13	7	7.8	8.37	199	323.7	16.88
13SWE07060	AB05FA0490	Pigeon Lake	Profile at centre	19-Sep-13	7.5	7.77	8.36	198	323.9	16.87
13SWE07061	AB05FA0490	Pigeon Lake	Profile at centre	19-Sep-13	8	7.75	8.36	198	323.8	16.88
13SWE07062	AB05FA0490	Pigeon Lake	Profile at centre	19-Sep-13	8.5	7.7	8.35	198	323.9	16.87
13SWE07063	AB05FA0490	Pigeon Lake	Profile at centre	19-Sep-13	9	7.69	8.35	198	324	16.88

Appendix 3-1
2013 Pigeon Lake Stream Chemistry Data

2013 Pigeon Lake Stream Chemistry Data

Sample No.	Station No.	Station Name	Station Description	QC Sample?	Sample Date	Ammonia (NH3) (mg/L)	Carbon Dissolved Organic (mg/L)	Carbon Total Organic (TOC) (mg/L)	Cloud Cover %	Coliforms Fecal (No/100 ml)	Colour (Visual) At Site N/A
13SWE02755	AB05FA2040	Grandview Heights Creek	At Summer Village Of Grandview Heights	N	26-Apr-13	0.0585	18.1	17.6	60	30	1
13SWE02751	AB05FA2025	Mitchell Beach Creek	In Mitchell Beach Summer Village	N	25-Apr-13	0.372	15.2	16.1	10	136	1
13SWE02758	AB05FA2025	Mitchell Beach Creek	In Mitchell Beach Summer Village	N	2-May-13	0.187	15	15.4		L10	1
13SWE02768	AB05FA2025	Mitchell Beach Creek	In Mitchell Beach Summer Village	N	6-May-13	0.114	13	12.7	0	20	1
13SWE02776	AB05FA2025	Mitchell Beach Creek	In Mitchell Beach Summer Village	N	13-May-13	0.0279		13.9	50	L10	1
13SWE02780	AB05FA2025	Mitchell Beach Creek	In Mitchell Beach Summer Village	N	27-May-13	0.0238	14.7	15.5	50	L10	1
13SWE02822	AB05FA2025	Mitchell Beach Creek	In Mitchell Beach Summer Village	N	10-Jun-13	0.0309	18.3	18.5	100	10	0
13SWE06622	AB05FA2025	Mitchell Beach Creek	In Mitchell Beach Summer Village	N	24-Jun-13	0.0417	19.8	21.1	10	70	0
13SWE06675	AB05FA2025	Mitchell Beach Creek	In Mitchell Beach Summer Village	N	8-Jul-13	0.144	21.4	21.6	0	400	1
13SWE06704	AB05FA2025	Mitchell Beach Creek	In Mitchell Beach Summer Village	N	16-Jul-13	0.0677	19.9	20.7	0	340	1
13SWE06733	AB05FA2025	Mitchell Beach Creek	In Mitchell Beach Summer Village	N	22-Jul-13	0.108	23.8	23.7	0	40	1
13SWE02754	AB05FA2045	Norris Beach Creek	At Summer Village Of Norris Beach.	N	26-Apr-13	0.0494	15.2	15.1	90	10	0
13SWE02762	AB05FA2045	Norris Beach Creek	At Summer Village Of Norris Beach.	N	2-May-13	0.0355	13.5	13.6	50	L10	1
13SWE02763	AB05FA2045	Norris Beach Creek	At Summer Village Of Norris Beach.	Y (temporal triplicate)	2-May-13	0.0333	13.9	13.3			
13SWE02764	AB05FA2045	Norris Beach Creek	At Summer Village Of Norris Beach.	Y (temporal triplicate)	2-May-13	0.0335	13.8	13.5			
13SWE02760	AB05FA2055	Pigeon Lake Creek	At Hwy 13 (Pigeon Lake Outflow)	N	2-May-13	0.285	5.3	5.3	70	L10	0
13SWE02772	AB05FA2055	Pigeon Lake Creek	At Hwy 13 (Pigeon Lake Outflow)	N	6-May-13	0.131	5.6	5	0	L10	0
13SWE02779	AB05FA2055	Pigeon Lake Creek	At Hwy 13 (Pigeon Lake Outflow)	N	13-May-13	0.156	6.9	7		30	1
13SWE02784	AB05FA2055	Pigeon Lake Creek	At Hwy 13 (Pigeon Lake Outflow)	N	27-May-13	0.0103	6.8	7.2	50	L10	0
13SWE02825	AB05FA2055	Pigeon Lake Creek	At Hwy 13 (Pigeon Lake Outflow)	N	10-Jun-13	0.016	7.9	8.1	100	82	1
13SWE06629	AB05FA2055	Pigeon Lake Creek	At Hwy 13 (Pigeon Lake Outflow)	N	24-Jun-13	0.011	7.7	7.9	20	L10	0
13SWE06682	AB05FA2055	Pigeon Lake Creek	At Hwy 13 (Pigeon Lake Outflow)	N	8-Jul-13	0.0211	6.8	6.7	100	L10	0
13SWE06711	AB05FA2055	Pigeon Lake Creek	At Hwy 13 (Pigeon Lake Outflow)	N	16-Jul-13		21.9	24.1		27	2
13SWE06740	AB05FA2055	Pigeon Lake Creek	At Hwy 13 (Pigeon Lake Outflow)	N	22-Jul-13	0.0282	6.9	7.1	100	18	0
13SWE06792	AB05FA2055	Pigeon Lake Creek	At Hwy 13 (Pigeon Lake Outflow)	N	6-Aug-13	0.0322	5.1	5.63	15	18	0
13SWE06960	AB05FA2055	Pigeon Lake Creek	At Hwy 13 (Pigeon Lake Outflow)	N	20-Aug-13	0.0279	7.5	8.6	50	100	0
13SWE07009	AB05FA2055	Pigeon Lake Creek	At Hwy 13 (Pigeon Lake Outflow)	N	3-Sep-13	0.0392	7	8.2	30	9	0
13SWE07040	AB05FA2055	Pigeon Lake Creek	At Hwy 13 (Pigeon Lake Outflow)	N	17-Sep-13	0.059	7	9.9	0	780	1
13SWE07041	AB05FA2055	Pigeon Lake Creek	At Hwy 13 (Pigeon Lake Outflow)	Y (temporal triplicate)	17-Sep-13	0.0331	7	8.3			
13SWE07042	AB05FA2055	Pigeon Lake Creek	At Hwy 13 (Pigeon Lake Outflow)	Y (temporal triplicate)	17-Sep-13	0.0319	7.1	9.6			
13SWE02752	AB05FA2035	Poplar Bay Creek	At Summer Village Of Poplar Bay	N	25-Apr-13	0.0902	14.6	13.7		70	1
13SWE02766	AB05FA2035	Poplar Bay Creek	At Summer Village Of Poplar Bay	N	2-May-13	0.155	13.6	13.8		10	1
13SWE02771	AB05FA2035	Poplar Bay Creek	At Summer Village Of Poplar Bay	N	6-May-13	0.114	11.5	12.4		L10	1
13SWE02783	AB05FA2035	Poplar Bay Creek	At Summer Village Of Poplar Bay	N	27-May-13	0.0794	16.4	16.5	5	470	0
13SWE06708	AB05FA2035	Poplar Bay Creek	At Summer Village Of Poplar Bay	N	16-Jul-13		15.9	15.7	0	2600	2
13SWE02753	AB05FA2030	Sunset Harbour Creek	At Hwy 771	N	25-Apr-13	0.127	15.2	14.4	30	73	1
13SWE02765	AB05FA2030	Sunset Harbour Creek	At Hwy 771	N	2-May-13	0.123	14.6	14.3		L10	1
13SWE02770	AB05FA2030	Sunset Harbour Creek	At Hwy 771	N	6-May-13	0.0882	13.5	13.9	0	20	0
13SWE02778	AB05FA2030	Sunset Harbour Creek	At Hwy 771	N	13-May-13	0.0122	13.9	14	50	9	1
13SWE02782	AB05FA2030	Sunset Harbour Creek	At Hwy 771	N	27-May-13	0.0551	17.8	17.4	75	8800	0
13SWE02824	AB05FA2030	Sunset Harbour Creek	At Hwy 771	N	10-Jun-13	0.0165	18.2	18	10	70	1
13SWE06625	AB05FA2030	Sunset Harbour Creek	At Hwy 771	N	24-Jun-13	0.0463	17.3	18	10	73	1
13SWE06678	AB05FA2030	Sunset Harbour Creek	At Hwy 771	N	8-Jul-13	0.0923	17.4	17.6	20	16	1
13SWE06707	AB05FA2030	Sunset Harbour Creek	At Hwy 771	N	16-Jul-13	0.0655	15.9	16.6	5	3900	1
13SWE06736	AB05FA2030	Sunset Harbour Creek	At Hwy 771	N	22-Jul-13	0.0688	18	18.3	100	120	1
13SWE06956	AB05FA2030	Sunset Harbour Creek	At Hwy 771	N	20-Aug-13	0.0431	17.6	18.2	50	60	1
13SWE02757	AB05FA2027	Tide Creek	Downstream Of The Range Road 22 Bridge	N	30-Apr-13	0.0782	18.5	18.5	100	250	1
13SWE06706	AB05FA2027	Tide Creek	Downstream Of The Range Road 22 Bridge	N	16-Jul-13	0.063	20	21.2	0	530	1
13SWE02756	AB05FA2047	Zeiner Creek	Inflow In Zeiner Campground	N	26-Apr-13	0.0521	19.2	20.2		30	0
13SWE02759	AB05FA2047	Zeiner Creek	Inflow In Zeiner Campground	N	2-May-13	0.104	22.1	21.9		L10	1
13SWE02769	AB05FA2047	Zeiner Creek	Inflow In Zeiner Campground	N	6-May-13	0.0693	25.4	24.9	0	L10	1
13SWE02777	AB05FA2047	Zeiner Creek	Inflow In Zeiner Campground	N	13-May-13	0.0235		24.1	50	40	1
13SWE02781	AB05FA2047	Zeiner Creek	Inflow In Zeiner Campground	N	27-May-13	0.0328	31.5	31.6	5	L10	1
13SWE02823	AB05FA2047	Zeiner Creek	Inflow In Zeiner Campground	N	10-Jun-13	0.0181	28.5	28.3	100	120	1
13SWE06623	AB05FA2047	Zeiner Creek	Inflow In Zeiner Campground	N	24-Jun-13	0.0648	40.3	40.7	10	73	2
13SWE06676	AB05FA2047	Zeiner Creek	Inflow In Zeiner Campground	N	8-Jul-13	0.12	29.3	29.7	20	180	2
13SWE06705	AB05FA2047	Zeiner Creek	Inflow In Zeiner Campground	N	16-Jul-13	0.0952	39.8	40	0	100	1
13SWE06734	AB05FA2047	Zeiner Creek	Inflow In Zeiner Campground	N	22-Jul-13	0.104	37.2	36.8	0	50	2
13SWE07043		Field Blank		Y (field blank)	17-Sep-13	L0.005	L0.5	L1			
13SWE07044		Trip Blank		Y (trip blank)	17-Sep-13	L0.005	L0.5	L1			

2013 Pigeon Lake Stream Chemistry Data

Sample No.	Station No.	Station Name	QC Sample?	Sample Date	Discharge Instantaneous (m3/s)	Escherichia Coli (No/100 ml)	Flow, Estimate (n/a)	Foam(Visual) At Site (n/a)	Nitrogen Dissolved Nitrate (mg/L)	Nitrogen Dissolved Nitrite (mg/L)	Nitrogen Dissolved NO3 & NO2 (mg/L)	Nitrogen Total (Calcd_) (mg/L)	Nitrogen Total Kjeldahl (TKN) (mg/L)	Odour Apparent In Sample (n/a)
13SWE02755	AB05FA2040	Grandview Heights Creek	N	26-Apr-13	0.21	L10	2	0	0.0937	0.0101	0.104	1.38	1.27	0
13SWE02751	AB05FA2025	Mitchell Beach Creek	N	25-Apr-13	0.086	82	2	1	0.241	0.0096	0.251	1.63	1.38	0
13SWE02758	AB05FA2025	Mitchell Beach Creek	N	2-May-13	0.001	L10	1	0	0.655	0.0368	0.692	1.65	0.953	0
13SWE02768	AB05FA2025	Mitchell Beach Creek	N	6-May-13	0.008	L10	2	0	0.172	0.012	0.184	1.16	0.978	0
13SWE02776	AB05FA2025	Mitchell Beach Creek	N	13-May-13	0.004	L10	2	0	0.0186	0.0025	0.0211	0.886	0.865	1
13SWE02780	AB05FA2025	Mitchell Beach Creek	N	27-May-13	0.017	L10	2	0	0.0143	0.0027	0.017	0.988	0.971	0
13SWE02822	AB05FA2025	Mitchell Beach Creek	N	10-Jun-13	0.002	10	1	0	0.0255	L0.002	0.0255	1.19	1.16	0
13SWE06622	AB05FA2025	Mitchell Beach Creek	N	24-Jun-13	0.003	L10	1	0	0.0512	0.0062	0.0574	0.919	0.861	0
13SWE06675	AB05FA2025	Mitchell Beach Creek	N	8-Jul-13	0.001	320	1	0	L0.0063	0.0037	0.0065	1.31	1.31	0
13SWE06704	AB05FA2025	Mitchell Beach Creek	N	16-Jul-13	0.002	220	1	0	0.0163	0.002	0.0183	1.02	1	0
13SWE06733	AB05FA2025	Mitchell Beach Creek	N	22-Jul-13	0.001	40	1	0	0.0108	0.0035	0.0143	1.02	1.01	0
13SWE02754	AB05FA2045	Norris Beach Creek	N	26-Apr-13	0.234	10	2	0	0.0903	0.011	0.101	1.2	1.1	0
13SWE02762	AB05FA2045	Norris Beach Creek	N	2-May-13	0.025	L10	1	0	0.024	0.0046	0.0286	0.665	0.636	0
13SWE02763	AB05FA2045	Norris Beach Creek	Y (temporal triplicate)	2-May-13					0.0226	0.0054	0.028	0.69	0.662	
13SWE02764	AB05FA2045	Norris Beach Creek	Y (temporal triplicate)	2-May-13					0.0252	0.005	0.0302	0.759	0.729	
13SWE02760	AB05FA2055	Pigeon Lake Creek	N	2-May-13	0.027	L10	1	1	0.086	0.0074	0.0934	0.711	0.618	0
13SWE02772	AB05FA2055	Pigeon Lake Creek	N	6-May-13	0.034	L10	2	0	0.984	0.0044	0.988	1.78	0.793	0
13SWE02779	AB05FA2055	Pigeon Lake Creek	N	13-May-13	0.156	10	2	0	0.0565	0.0048	0.0613	1.87	1.8	0
13SWE02784	AB05FA2055	Pigeon Lake Creek	N	27-May-13	0.34	L10	1	0	0.0357	0.0028	0.0385	0.886	0.848	0
13SWE02825	AB05FA2055	Pigeon Lake Creek	N	10-Jun-13	0.756	82	3	0	L0.006	L0.002	L0.006	1.48	1.48	0
13SWE06629	AB05FA2055	Pigeon Lake Creek	N	24-Jun-13	0.56	L10	2	0	L0.006	L0.002	L0.006	0.982	0.982	1
13SWE06682	AB05FA2055	Pigeon Lake Creek	N	8-Jul-13	0.312	L10	2	0	L0.006	L0.002	L0.006	0.71	0.71	1
13SWE06711	AB05FA2055	Pigeon Lake Creek	N	16-Jul-13	0.458	L10	3	0						1
13SWE06740	AB05FA2055	Pigeon Lake Creek	N	22-Jul-13	0.456	L10	2	0	L0.006	L0.002	L0.006	0.612	0.612	1
13SWE06792	AB05FA2055	Pigeon Lake Creek	N	6-Aug-13	0.253	18	2	0	L0.006	L0.002	L0.006	0.713	0.713	0
13SWE06960	AB05FA2055	Pigeon Lake Creek	N	20-Aug-13	0.141	80	2	0	L0.006	L0.002	L0.006	1.43	0.887	0
13SWE07009	AB05FA2055	Pigeon Lake Creek	N	3-Sep-13	0.04	L10	1	0	L0.006	L0.002	L0.006	0.834	0.834	0
13SWE07040	AB05FA2055	Pigeon Lake Creek	N	17-Sep-13	0.004	600	1	0	0.0095	0.0024	0.0119	2.3	2.28	0
13SWE07041	AB05FA2055	Pigeon Lake Creek	Y (temporal triplicate)	17-Sep-13					0.0078	0.0023	0.0101	2.07	2.06	
13SWE07042	AB05FA2055	Pigeon Lake Creek	Y (temporal triplicate)	17-Sep-13					0.006	0.0021	0.0081	1.75	1.74	
13SWE02752	AB05FA2035	Poplar Bay Creek	N	25-Apr-13	0.165	30	2	1	0.518	0.0093	0.527	1.89	1.36	0
13SWE02766	AB05FA2035	Poplar Bay Creek	N	2-May-13	0.007	10	1	0	0.187	0.0095	0.196	1.06	0.863	0
13SWE02771	AB05FA2035	Poplar Bay Creek	N	6-May-13	0.033	L10	1	0	0.0512	0.0052	0.0564	0.963	0.907	0
13SWE02783	AB05FA2035	Poplar Bay Creek	N	27-May-13	0.035	470	1	0	0.105	0.0075	0.112	1.6	1.49	0
13SWE06708	AB05FA2035	Poplar Bay Creek	N	16-Jul-13	0.036	2100	1	0						0
13SWE02753	AB05FA2030	Sunset Harbour Creek	N	25-Apr-13	0.218	73	2	2	0.813	0.0197	0.833	2.06	1.23	0
13SWE02765	AB05FA2030	Sunset Harbour Creek	N	2-May-13	0.033	L10	1	0	0.2	0.0134	0.213	0.855	0.641	0
13SWE02770	AB05FA2030	Sunset Harbour Creek	N	6-May-13	0.029	20	1	0	0.0806	0.0064	0.087	0.86	0.773	0
13SWE02778	AB05FA2030	Sunset Harbour Creek	N	13-May-13	0.008	9	1	0	L0.006	L0.002	L0.006	0.906	0.906	0
13SWE02782	AB05FA2030	Sunset Harbour Creek	N	27-May-13	0.043	8800	1	0	0.485	L0.002	0.485	1.9	1.41	0
13SWE02824	AB05FA2030	Sunset Harbour Creek	N	10-Jun-13	0.009	64	1	0	0.0063	L0.002	0.0063	1.06	1.06	0
13SWE06625	AB05FA2030	Sunset Harbour Creek	N	24-Jun-13	0.015	55	1	0	0.0162	0.0041	0.0203	0.933	0.912	0
13SWE06678	AB05FA2030	Sunset Harbour Creek	N	8-Jul-13	0.002	L10	1	1	0.0109	0.004	0.0149	1.16	1.15	0
13SWE06707	AB05FA2030	Sunset Harbour Creek	N	16-Jul-13	0.085	2400	2	0	0.194	0.0102	0.204	1.34	1.14	0
13SWE06736	AB05FA2030	Sunset Harbour Creek	N	22-Jul-13	0.008	20	1	1	0.0094	0.0039	0.0133	1.06	1.05	0
13SWE06956	AB05FA2030	Sunset Harbour Creek	N	20-Aug-13	0.002	60	1	0	L0.006	L0.002	L0.006	1.2	1.2	0
13SWE02757	AB05FA2027	Tide Creek	N	30-Apr-13	0.732	L10	2	0	0.301	0.0113	0.312	1.46	1.15	0
13SWE06706	AB05FA2027	Tide Creek	N	16-Jul-13	0.721	340	1	0	0.0244	0.0031	0.0275	1.22	1.19	0
13SWE02756	AB05FA2047	Zeiner Creek	N	26-Apr-13	0.056	10	2	1	0.254	0.0065	0.26	1.23	0.974	0
13SWE02759	AB05FA2047	Zeiner Creek	N	2-May-13	0.007	L10	1	0	0.495	0.0067	0.502	1.76	1.26	0
13SWE02769	AB05FA2047	Zeiner Creek	N	6-May-13	0.003	L10	1	0	0.61	0.0114	0.622	1.86	1.24	0
13SWE02777	AB05FA2047	Zeiner Creek	N	13-May-13	0.003	27	1	0	0.163	0.0052	0.168	1.31	1.14	0
13SWE02781	AB05FA2047	Zeiner Creek	N	27-May-13	0.006	L10	1	0	0.161	0.0089	0.17	1.8	1.63	0
13SWE02823	AB05FA2047	Zeiner Creek	N	10-Jun-13	0.004	120	1	0	0.0186	0.0022	0.0208	1.09	1.07	0
13SWE06623	AB05FA2047	Zeiner Creek	N	24-Jun-13	0.005	73	1	0	0.0197	0.0021	0.0218	1.66	1.64	0
13SWE06676	AB05FA2047	Zeiner Creek	N	8-Jul-13	0.0001	180	1	0	0.0453	0.0081	0.0534	1.88	1.83	1
13SWE06705	AB05FA2047	Zeiner Creek	N	16-Jul-13	0.004	100	1	0	0.0453	0.0071	0.0524	1.95	1.89	0
13SWE06734	AB05FA2047	Zeiner Creek	N	22-Jul-13	0.001	50	1	0	0.0686	0.0097	0.0783	1.49	1.41	0
13SWE07043		Field Blank	Y (field blank)	17-Sep-13					L0.006	L0.002	L0.006	L0.05	L0.05	
13SWE07044		Trip Blank	Y (trip blank)	17-Sep-13					L0.006	L0.002	L0.006	0.161	0.161	

2013 Pigeon Lake Stream Chemistry Data

Sample No.	Station No.	Station Name	QC Sample?	Sample Date	Oxygen Dissolved (Field Meter) (mg/L)	Oxygen Dissolved (Winkler) (mg/L)	pH (Field) (pH units)	Phosphate Dissolved Ortho (mg/L)	Phosphorus Total (P) (mg/L)	Phosphorus Total Dissolved (mg/L)	Residue Filterable (mg/L)	Residue Nonfilterable (mg/L)	Specific Conductance (Field) (uS/cm)	Temperature Air (Deg C)	Temperature Water (Deg C)	Turbidity (Visual) At Site (n/a)
13SWE02755	AB05FA2040	Grandview Heights Creek	N	26-Apr-13	4.16		7.57	0.113	0.214	0.171	157	5	195.7	16	6.5	0
13SWE02751	AB05FA2025	Mitchell Beach Creek	N	25-Apr-13	10.68		7.16	0.289	0.4	0.333	114	10	213.4	12	0.4	0
13SWE02758	AB05FA2025	Mitchell Beach Creek	N	2-May-13	7.37		6.83	0.0258	0.137	0.0728	252	L3	372		3.13	0
13SWE02768	AB05FA2025	Mitchell Beach Creek	N	6-May-13	7.12		6.68	0.0211	0.0936	0.0427	234	66	370.9	21	6.54	0
13SWE02776	AB05FA2025	Mitchell Beach Creek	N	13-May-13	6.75		7.54	0.023	0.0598	0.0371	245	L3	409	17	9.85	0
13SWE02780	AB05FA2025	Mitchell Beach Creek	N	27-May-13	6.27		7.29	0.0269	0.0637	0.0481	249	L3	420.9	15	11.26	0
13SWE02822	AB05FA2025	Mitchell Beach Creek	N	10-Jun-13	4.6		7.33	0.0318	0.0678	0.0475	348	L3	514	14	10.27	0
13SWE06622	AB05FA2025	Mitchell Beach Creek	N	24-Jun-13	4.1		7.16	0.0213	0.0811	0.0443	376	L3	567.7	17.7	12.02	0
13SWE06675	AB05FA2025	Mitchell Beach Creek	N	8-Jul-13	3.21		7.04	0.0126	0.166	0.0279	436	L3	666.7	21.3	12.42	0
13SWE06704	AB05FA2025	Mitchell Beach Creek	N	16-Jul-13	4.47		7.2	0.0334	0.102	0.0482	380	L3	589	16.7	10.99	0
13SWE06733	AB05FA2025	Mitchell Beach Creek	N	22-Jul-13	6.88		7.06	0.0184	0.143	0.0524	435	8	661	17.1	18.15	0
13SWE02754	AB05FA2045	Norris Beach Creek	N	26-Apr-13	10.74		7.5	0.0784	0.164	0.113	162	25	212.3	16	4.96	1
13SWE02762	AB05FA2045	Norris Beach Creek	N	2-May-13	10.92		7.4	0.0341	0.108	0.0745	231	5	346		8.11	1
13SWE02763	AB05FA2045	Norris Beach Creek	Y (temporal triplicate)	2-May-13				0.0404	0.107	0.0752	236	8				
13SWE02764	AB05FA2045	Norris Beach Creek	Y (temporal triplicate)	2-May-13				0.0426	0.108	0.0771	228	10				
13SWE02760	AB05FA2055	Pigeon Lake Creek	N	2-May-13	13.78		8.34	L0.001	0.031	0.0076	97	L3	144		3.1	0
13SWE02772	AB05FA2055	Pigeon Lake Creek	N	6-May-13	13.67		8.57	0.0061	0.0373	0.008	118	9	203.3	30	9.46	1
13SWE02779	AB05FA2055	Pigeon Lake Creek	N	13-May-13	10.32		7.74	0.0012	0.156	0.0115	168	109	281.6		9.49	0
13SWE02784	AB05FA2055	Pigeon Lake Creek	N	27-May-13			8.14	0.0037	0.0202	0.0053	189	4	321	23	13.75	0
13SWE02825	AB05FA2055	Pigeon Lake Creek	N	10-Jun-13	9.48		8.57	L0.001	0.26	0.0058	211	182	328.8		13.16	2
13SWE06629	AB05FA2055	Pigeon Lake Creek	N	24-Jun-13	10.11		8.56	L0.001	0.0198	0.0066	190	5	322	23.9	20.59	1
13SWE06682	AB05FA2055	Pigeon Lake Creek	N	8-Jul-13	10.12		8.72	L0.001	0.0179	0.0075	193	L3	316	26.2	19.22	0
13SWE06711	AB05FA2055	Pigeon Lake Creek	N	16-Jul-13	10.96		8.65				197	111	317		22.51	2
13SWE06740	AB05FA2055	Pigeon Lake Creek	N	22-Jul-13	9.39		8.55	0.001	0.0245	0.0069	198	L3	324	20	20.08	0
13SWE06792	AB05FA2055	Pigeon Lake Creek	N	6-Aug-13	8.82		8.57	L0.001	0.0261	0.0077	204	L3	325	21.7	20.87	0
13SWE06960	AB05FA2055	Pigeon Lake Creek	N	20-Aug-13	9.65		8.84	L0.001	0.0433	0.0071	179	4	268	19	19.37	0
13SWE07009	AB05FA2055	Pigeon Lake Creek	N	3-Sep-13	9.34		8.6	L0.001	0.0261	0.0081	204	L3	312	19.8	20.88	0
13SWE07040	AB05FA2055	Pigeon Lake Creek	N	17-Sep-13	8.77		8.38	L0.001	0.238	0.009	185	76	325	18.8	17.74	2
13SWE07041	AB05FA2055	Pigeon Lake Creek	Y (temporal triplicate)	17-Sep-13				0.0031	0.111	0.0118	185	174				
13SWE07042	AB05FA2055	Pigeon Lake Creek	Y (temporal triplicate)	17-Sep-13				L0.001	0.189	0.0085	188	212				
13SWE02752	AB05FA2035	Poplar Bay Creek	N	25-Apr-13	11.49		7.49	0.0526	0.263	0.0814	171	112	214.5	13	0.68	3
13SWE02766	AB05FA2035	Poplar Bay Creek	N	2-May-13	9.84		7.05	0.0185	0.127	0.0593	239	18	398.9		8.01	1
13SWE02771	AB05FA2035	Poplar Bay Creek	N	6-May-13	8.29		7.45	0.0197	0.124	0.0353	276	17	456.4	30	15.06	1
13SWE02783	AB05FA2035	Poplar Bay Creek	N	27-May-13	8.35		7.47	0.0421	0.132	0.068	255	16	417.1	24	12.12	0
13SWE06708	AB05FA2035	Poplar Bay Creek	N	16-Jul-13	8.09		7.66	0.0787	0.214	0.114	272	16	403	23	17.74	2
13SWE02753	AB05FA2030	Sunset Harbour Creek	N	25-Apr-13	11.58	11.1	7.55	0.0481	0.211	0.0844	157	82	197.5	13	2.11	3
13SWE02765	AB05FA2030	Sunset Harbour Creek	N	2-May-13	11.28		7.53	0.0198	0.0955	0.0526	209	11	314.7		4.86	0
13SWE02770	AB05FA2030	Sunset Harbour Creek	N	6-May-13	9.76		7.57	0.0218	0.0889	0.0445	243	12	377	30	10.01	0
13SWE02778	AB05FA2030	Sunset Harbour Creek	N	13-May-13	8.83		7.56	0.0102	0.0734	0.0301	270	4	447.5	19	11.39	0
13SWE02782	AB05FA2030	Sunset Harbour Creek	N	27-May-13	9.28		7.61	0.0324	0.102	0.0453	270	7	416.7	17.1	10.02	0
13SWE02824	AB05FA2030	Sunset Harbour Creek	N	10-Jun-13	7.99		7.91	0.0141	0.112	0.0354	298	13	448.2	14	12.58	0
13SWE06625	AB05FA2030	Sunset Harbour Creek	N	24-Jun-13	6.85		7.75	0.0293	0.108	0.0514	289	7	455.6	20.3	16.42	0
13SWE06678	AB05FA2030	Sunset Harbour Creek	N	8-Jul-13	6.74		7.68	0.0329	0.147	0.0581	338	8	519	17.5	15.3	1
13SWE06707	AB05FA2030	Sunset Harbour Creek	N	16-Jul-13	8.33		7.62	0.05	0.135	0.0762	239	10	363	21.3	15.1	2
13SWE06736	AB05FA2030	Sunset Harbour Creek	N	22-Jul-13	6.15		7.54	0.0556	0.209	0.091	294	7	440	19.1	17.21	1
13SWE06956	AB05FA2030	Sunset Harbour Creek	N	20-Aug-13	6.65		7.6	0.0388	0.213	0.0677	320	7	509	16.2	15.04	0
13SWE02757	AB05FA2027	Tide Creek	N	30-Apr-13	9.17		7.25	0.0296	0.11	0.0629	147	4	169		4.26	0
13SWE06706	AB05FA2027	Tide Creek	N	16-Jul-13	1.35		7.26	0.0593	0.153	0.101	229	3	305	22.6	14.7	2
13SWE02756	AB05FA2047	Zeiner Creek	N	26-Apr-13	9.96		7.13	0.0811	0.145	0.106	228	L3	309.5	15	0.36	0
13SWE02759	AB05FA2047	Zeiner Creek	N	2-May-13	7.74		6.82	0.045	0.148	0.0653	274	7	390.6		0.95	0
13SWE02769	AB05FA2047	Zeiner Creek	N	6-May-13	6.45		6.72	0.0709	0.107	0.0898	286	L3	405.2	20.6	4.48	0
13SWE02777	AB05FA2047	Zeiner Creek	N	13-May-13	5.92		7.03	0.0527	0.0736	0.0652	298	L3	456.2	19	7.97	0
13SWE02781	AB05FA2047	Zeiner Creek	N	27-May-13	5.91		7.29	0.092	0.144	0.134	279	L3	412.3	19	6.88	0
13SWE02823	AB05FA2047	Zeiner Creek	N	10-Jun-13	5.4		7.45	0.101	0.145	0.115	356	L3	502.5	14	8.77	0
13SWE06623	AB05FA2047	Zeiner Creek	N	24-Jun-13	4.68		7.14	0.193	0.303	0.295	315	L3	420.6	18.9	11.18	0
13SWE06676	AB05FA2047	Zeiner Creek	N	8-Jul-13	3.93		7.36	0.148	0.279	0.194	403	21	575	17.8	11.83	1
13SWE06705	AB05FA2047	Zeiner Creek	N	16-Jul-13	4.73		6.95	0.192	0.284	0.26	326	L3	424	21.3	10.22	1
13SWE06734	AB05FA2047	Zeiner Creek	N	22-Jul-13	4.25		7.25	0.275	0.326	0.313	389	L3	552	17.8	14.04	1
13SWE07043		Field Blank	Y (field blank)	17-Sep-13				L0.001	L0.001	L0.001	L10	L3				
13SWE07044		Trip Blank	Y (trip blank)	17-Sep-13				L0.001	L0.001	L0.001	L10	L3				

Appendix 4-1
2013 Pigeon Lake Stream Instant and Cumulative Nutrient Loads

2013 Pigeon Lake Instant and Cumulative Stream Nutrient Loads

Station	Date	Instantaneous loads (kg/day)										
		Ammonia	Nitrate	Nitrite	NO3+NO2	Total Kjeldahl Nitrogen	Total Nitrogen	Ortho-Phosphate	Total Phosphorus	Total Dissolved Phosphorus	Discharge (L/day)	Days to next sample date
Grandview	26-Apr-13	1.06	1.70	0.18	1.89	23.04	24.93	2.05	3.88	3.10	18,144,000	6.0
Grandview	2-May-13											4.0
Grandview	6-May-13											7.0
Grandview	13-May-13											14.0
Grandview	27-May-13											14.0
Grandview	10-Jun-13											14.0
Grandview	24-Jun-13											14.0
Grandview	8-Jul-13											8.0
Grandview	16-Jul-13											6.0
Grandview	22-Jul-13											15.0
Grandview	6-Aug-13											14.0
Grandview	20-Aug-13											14.0
Grandview	3-Sep-13											14.0
Grandview	17-Sep-13											21.0
Grandview	8-Oct-13											
Grandview Total												
Mitchell	25-Apr-13	2.76	1.79	0.07	1.87	10.25	12.12	2.15	2.97	2.47	7,430,400	6.9
Mitchell	2-May-13	0.02	0.06	0.00	0.06	0.08	0.14	0.00	0.01	0.01	86,400	4.0
Mitchell	6-May-13	0.08	0.12	0.01	0.13	0.68	0.80	0.01	0.06	0.03	691,200	7.0
Mitchell	13-May-13	0.01	0.01	0.00	0.01	0.30	0.31	0.01	0.02	0.01	345,600	14.0
Mitchell	27-May-13	0.03	0.02	0.00	0.02	1.43	1.45	0.04	0.09	0.07	1,468,800	14.0
Mitchell	10-Jun-13	0.01	0.00	0.00	0.00	0.20	0.20	0.01	0.01	0.01	172,800	14.0
Mitchell	24-Jun-13	0.01	0.01	0.00	0.01	0.22	0.24	0.01	0.02	0.01	259,200	14.0
Mitchell	8-Jul-13	0.01	0.00	0.00	0.00	0.11	0.11	0.00	0.01	0.00	86,400	8.0
Mitchell	16-Jul-13	0.01	0.00	0.00	0.00	0.17	0.18	0.01	0.02	0.01	172,800	6.0
Mitchell	22-Jul-13	0.01	0.00	0.00	0.00	0.09	0.09	0.00	0.01	0.00	86,400	15.2
Mitchell	6-Aug-13											14.0
Mitchell	20-Aug-13											14.0
Mitchell	3-Sep-13											14.0
Mitchell	17-Sep-13											21.0
Mitchell	8-Oct-13											
Mitchell Beach Total												
Norris	26-Apr-13	1.00	1.83	0.22	2.04	22.24	24.28	1.59	3.32	2.28	20,217,600	6.0
Norris	2-May-13	0.07	0.05	0.01	0.06	1.46	1.52	0.08	0.23	0.16	2,160,000	3.9
Norris	6-May-13											7.0
Norris	13-May-13											14.0
Norris	27-May-13											14.0
Norris	10-Jun-13											14.0
Norris	24-Jun-13											14.0
Norris	8-Jul-13											8.0
Norris	16-Jul-13											6.0
Norris	22-Jul-13											15.0
Norris	6-Aug-13											14.0
Norris	20-Aug-13											14.0
Norris	3-Sep-13											14.0
Norris	17-Sep-13											21.0
Norris	8-Oct-13											
Norris Beach Total												

2013 Pigeon Lake Instant and Cumulative Stream Nutrient Loads

		Cumulative loads (kg)									
Station	Date	Ammonia	Nitrate	Nitrite	NO3+NO2	Total Kjeldahl Nitrogen	Total Nitrogen	Ortho-Phosphate	Total Phosphorus	Total Dissolved Phosphorus	Cumulative discharge (L)
Grandview	26-Apr-13	6.32	10.13	1.09	11.24	137.30	148.54	12.22	23.14	18.49	108,108,000
Grandview	2-May-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Grandview	6-May-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Grandview	13-May-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Grandview	27-May-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Grandview	10-Jun-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Grandview	24-Jun-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Grandview	8-Jul-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Grandview	16-Jul-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Grandview	22-Jul-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Grandview	6-Aug-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Grandview	20-Aug-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Grandview	3-Sep-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Grandview	17-Sep-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Grandview	8-Oct-13										
Grandview Total		**6.32**	**10.13**	**1.09**	**11.24**	**137.30**	**148.54**	**12.22**	**23.14**	**18.49**	**108,108,000**
Mitchell	25-Apr-13	19.12	12.39	0.49	12.90	70.92	83.82	14.85	20.56	17.11	51,393,600
Mitchell	2-May-13	0.06	0.23	0.01	0.24	0.33	0.57	0.01	0.05	0.03	345,300
Mitchell	6-May-13	0.55	0.83	0.06	0.88	4.70	5.59	0.10	0.45	0.21	4,809,600
Mitchell	13-May-13	0.13	0.09	0.01	0.10	4.19	4.29	0.11	0.29	0.18	4,838,400
Mitchell	27-May-13	0.49	0.30	0.06	0.35	20.03	20.38	0.55	1.31	0.99	20,629,500
Mitchell	10-Jun-13	0.07	0.06	0.00	0.06	2.80	2.87	0.08	0.16	0.11	2,417,400
Mitchell	24-Jun-13	0.15	0.19	0.02	0.21	3.12	3.33	0.08	0.29	0.16	3,627,000
Mitchell	8-Jul-13	0.10	0.00	0.00	0.00	0.91	0.91	0.01	0.12	0.02	693,900
Mitchell	16-Jul-13	0.07	0.02	0.00	0.02	1.03	1.05	0.03	0.11	0.05	1,030,800
Mitchell	22-Jul-13	0.14	0.01	0.00	0.02	1.32	1.34	0.02	0.19	0.07	1,309,500
Mitchell	6-Aug-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Mitchell	20-Aug-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Mitchell	3-Sep-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Mitchell	17-Sep-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Mitchell	8-Oct-13										
Mitchell Beach Total		**20.89**	**14.10**	**0.67**	**14.79**	**109.36**	**124.15**	**15.85**	**23.52**	**18.93**	**91,095,000**
Norris	26-Apr-13	6.02	11.01	1.34	12.32	134.13	146.45	9.56	20.00	13.78	121,937,400
Norris	2-May-13	0.29	0.20	0.04	0.24	5.72	5.96	0.33	0.91	0.64	8,460,000
Norris	6-May-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Norris	13-May-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Norris	27-May-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Norris	10-Jun-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Norris	24-Jun-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Norris	8-Jul-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Norris	16-Jul-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Norris	22-Jul-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Norris	6-Aug-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Norris	20-Aug-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Norris	3-Sep-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Norris	17-Sep-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Norris	8-Oct-13										
Norris Beach Total		**6.31**	**11.21**	**1.38**	**12.56**	**139.85**	**152.41**	**9.89**	**20.91**	**14.42**	**130,397,400**

2013 Pigeon Lake Instant and Cumulative Stream Nutrient Loads

		Instantaneous loads (kg/day)										
Station	Date	Ammonia	Nitrate	Nitrite	NO3+NO2	Total Kjeldahl Nitrogen	Total Nitrogen	Ortho-Phosphate	Total Phosphorus	Total Dissolved Phosphorus	Discharge (L/day)	Days to next sample date
Outflow	2-May-13	0.66	0.20	0.02	0.22	1.44	1.66	0.00	0.07	0.02	2,332,800	3.9
Outflow	6-May-13	0.38	2.89	0.01	2.90	2.33	5.23	0.02	0.11	0.02	2,937,600	6.9
Outflow	13-May-13	2.10	0.76	0.06	0.83	24.26	25.09	0.02	2.10	0.16	13,478,400	14.0
Outflow	27-May-13	0.30	1.05	0.08	1.13	24.91	26.04	0.11	0.59	0.16	29,376,000	14.0
Outflow	10-Jun-13	1.05	0.20	0.07	0.20	96.67	96.87	0.03	16.98	0.38	65,318,400	14.1
Outflow	24-Jun-13	0.53	0.15	0.05	0.15	47.51	47.66	0.02	0.96	0.32	48,384,000	13.9
Outflow	8-Jul-13	0.57	0.08	0.03	0.08	19.14	19.22	0.01	0.48	0.20	26,956,800	8.1
Outflow (see note)	16-Jul-13	0.83	0.12	0.04	0.12	28.10	28.21	0.02	0.71	0.30	39,571,200	5.8
Outflow	22-Jul-13	1.11	0.12	0.04	0.12	24.11	24.23	0.04	0.97	0.27	39,398,400	15.0
Outflow	6-Aug-13	0.70	0.07	0.02	0.07	15.59	15.65	0.01	0.57	0.17	21,859,200	14.0
Outflow	20-Aug-13	0.34	0.04	0.01	0.04	10.81	10.84	0.01	0.53	0.09	12,182,400	14.0
Outflow	3-Sep-13	0.14	0.01	0.00	0.01	2.88	2.89	0.00	0.09	0.03	3,456,000	14.0
Outflow	17-Sep-13	0.01	0.00	0.00	0.00	0.70	0.71	0.00	0.06	0.00	345,600	21.0
Outflow	8-Oct-13											
Pigeon Outflow Total												
Poplar Bay	25-Apr-13	1.29	7.38	0.13	7.51	19.39	26.90	0.75	3.75	1.16	14,256,000	7.0
Poplar Bay	2-May-13	0.09	0.11	0.01	0.12	0.52	0.64	0.01	0.08	0.04	604,800	4.0
Poplar Bay	6-May-13	0.33	0.15	0.01	0.16	2.59	2.75	0.06	0.35	0.10	2,851,200	7.0
Poplar Bay	13-May-13											13.9
Poplar Bay	27-May-13	0.24	0.32	0.02	0.34	4.51	4.84	0.13	0.40	0.21	3,024,000	14.1
Poplar Bay	10-Jun-13											14.0
Poplar Bay	24-Jun-13											14.0
Poplar Bay	8-Jul-13											8.1
Poplar Bay (see note)	16-Jul-13	0.25	0.33	0.02	0.35	4.63	4.98	0.24	0.67	0.35	3,110,400	5.9
Poplar Bay	22-Jul-13											15.0
Poplar Bay	6-Aug-13											14.0
Poplar Bay	20-Aug-13											14.0
Poplar Bay	3-Sep-13											14.0
Poplar Bay	17-Sep-13											21.0
Poplar Bay	8-Oct-13											
Poplar Bay Total												
Sunset Harbour	25-Apr-13	2.39	15.31	0.37	15.69	23.17	38.86	0.91	3.97	1.59	18,835,200	6.9
Sunset Harbour	2-May-13	0.35	0.57	0.04	0.61	1.83	2.43	0.06	0.27	0.15	2,851,200	4.0
Sunset Harbour	6-May-13	0.22	0.20	0.02	0.22	1.94	2.15	0.05	0.22	0.11	2,505,600	6.9
Sunset Harbour	13-May-13	0.01	0.00	0.00	0.00	0.63	0.63	0.01	0.05	0.02	691,200	14.0
Sunset Harbour	27-May-13	0.20	1.80	0.00	1.80	5.24	7.04	0.12	0.38	0.17	3,715,200	14.1
Sunset Harbour	10-Jun-13	0.01	0.00	0.00	0.00	0.82	0.83	0.01	0.09	0.03	777,600	14.0
Sunset Harbour	24-Jun-13	0.06	0.02	0.01	0.03	1.18	1.21	0.04	0.14	0.07	1,296,000	14.0
Sunset Harbour	8-Jul-13	0.02	0.00	0.00	0.00	0.20	0.20	0.01	0.03	0.01	172,800	8.1
Sunset Harbour	16-Jul-13	0.48	1.42	0.07	1.50	8.37	9.87	0.37	0.99	0.56	7,344,000	5.9
Sunset Harbour	22-Jul-13	0.05	0.01	0.00	0.01	0.73	0.73	0.04	0.14	0.06	691,200	15.1
Sunset Harbour	6-Aug-13											14.0
Sunset Harbour	20-Aug-13	0.01	0.00	0.00	0.00	0.21	0.21	0.01	0.04	0.01	172,800	14.0
Sunset Harbour	3-Sep-13											14.0
Sunset Harbour	17-Sep-13											21.0
Sunset Harbour	8-Oct-13											
Sunset Harbour Total												

Note: Data from yellow highlighted cells was contaminated and not included in analysis.
For estimation purposes, highlighted cells used concentrations from previous sampling trip and flow measurements from highlighted trip to estimate instantaneous and cumulative loads.

2013 Pigeon Lake Instant and Cumulative Stream Nutrient Loads

		Cumulative loads (kg)									
Station	**Date**	**Ammonia**	**Nitrate**	**Nitrite**	**NO3+NO2**	**Total Kjeldahl Nitrogen**	**Total Nitrogen**	**Ortho-Phosphate**	**Total Phosphorus**	**Total Dissolved Phosphorus**	**Cumulative discharge (L)**
Outflow	2-May-13	2.62	0.79	0.07	0.86	5.69	6.55	0.00	0.29	0.07	9,209,700
Outflow	6-May-13	2.66	19.99	0.09	20.07	16.11	36.19	0.12	0.76	0.16	20,318,400
Outflow	13-May-13	29.39	10.65	0.90	11.55	339.15	350.70	0.23	29.39	2.17	188,416,800
Outflow	27-May-13	4.24	14.71	1.15	15.87	349.44	365.31	1.52	8.32	2.18	412,080,000
Outflow	10-Jun-13	14.69	2.75	0.92	2.75	1358.77	1361.52	0.46	238.70	5.32	918,086,400
Outflow	24-Jun-13	7.42	2.02	0.67	2.02	662.71	664.73	0.34	13.36	4.45	674,856,000
Outflow	8-Jul-13	4.62	0.66	0.22	0.66	155.57	156.23	0.11	3.92	1.64	219,117,600
Outflow (see note)	16-Jul-13	4.87	0.69	0.23	0.69	163.89	164.58	0.12	4.13	1.73	230,832,000
Outflow	22-Jul-13	16.68	1.77	0.59	1.77	362.01	363.79	0.59	14.49	4.08	591,523,200
Outflow	6-Aug-13	9.86	0.92	0.31	0.92	218.25	219.17	0.15	7.99	2.36	306,104,700
Outflow	20-Aug-13	4.75	0.51	0.17	0.51	151.02	151.53	0.09	7.37	1.21	170,257,500
Outflow	3-Sep-13	1.90	0.15	0.05	0.15	40.42	40.57	0.02	1.27	0.39	48,468,000
Outflow	17-Sep-13	0.30	0.06	0.02	0.07	14.74	14.81	0.01	1.30	0.07	7,261,200
Outflow	8-Oct-13										
Pigeon Outflow Total		**104.02**	**55.68**	**5.39**	**57.90**	**3837.78**	**3895.68**	**3.76**	**331.30**	**25.85**	**3,796,531,500**
Poplar Bay	25-Apr-13	8.94	51.33	0.92	52.23	134.77	187.00	5.21	26.06	8.07	99,099,000
Poplar Bay	2-May-13	0.37	0.45	0.02	0.47	2.09	2.56	0.04	0.31	0.14	2,417,100
Poplar Bay	6-May-13	2.28	1.02	0.10	1.13	18.13	19.26	0.39	2.48	0.71	19,988,100
Poplar Bay	13-May-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Poplar Bay	27-May-13	3.38	4.47	0.32	4.77	63.39	68.16	1.79	5.62	2.89	42,546,000
Poplar Bay	10-Jun-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Poplar Bay	24-Jun-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Poplar Bay	8-Jul-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Poplar Bay (see note)	16-Jul-13	1.46	1.93	0.14	2.06	27.45	29.52	1.45	3.94	2.10	18,424,800
Poplar Bay	22-Jul-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Poplar Bay	6-Aug-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Poplar Bay	20-Aug-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Poplar Bay	3-Sep-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Poplar Bay	17-Sep-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Poplar Bay	8-Oct-13										
Poplar Bay Total		**16.43**	**59.21**	**1.51**	**60.65**	**245.84**	**306.49**	**8.89**	**38.41**	**13.91**	**182,475,000**
Sunset Harbour	25-Apr-13	16.51	105.70	2.56	108.30	159.92	268.22	6.25	27.43	10.97	130,015,200
Sunset Harbour	2-May-13	1.42	2.31	0.15	2.46	7.39	9.85	0.23	1.10	0.61	11,533,500
Sunset Harbour	6-May-13	1.53	1.40	0.11	1.51	13.44	14.95	0.38	1.55	0.77	17,382,600
Sunset Harbour	13-May-13	0.12	0.03	0.01	0.03	8.76	8.79	0.10	0.71	0.29	9,669,600
Sunset Harbour	27-May-13	2.88	25.35	0.05	25.35	73.70	99.05	1.69	5.33	2.37	52,270,800
Sunset Harbour	10-Jun-13	0.18	0.07	0.01	0.07	11.53	11.60	0.15	1.22	0.39	10,881,000
Sunset Harbour	24-Jun-13	0.84	0.29	0.07	0.37	16.54	16.91	0.53	1.96	0.93	18,135,000
Sunset Harbour	8-Jul-13	0.13	0.02	0.01	0.02	1.61	1.63	0.05	0.21	0.08	1,397,400
Sunset Harbour	16-Jul-13	2.83	8.40	0.44	8.83	49.33	58.16	2.16	5.84	3.30	43,273,500
Sunset Harbour	22-Jul-13	0.72	0.10	0.04	0.14	10.94	11.08	0.58	2.18	0.95	10,423,200
Sunset Harbour	6-Aug-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Sunset Harbour	20-Aug-13	0.10	0.01	0.00	0.01	2.91	2.92	0.09	0.52	0.16	2,424,000
Sunset Harbour	3-Sep-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Sunset Harbour	17-Sep-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Sunset Harbour	8-Oct-13										
Sunset Harbour Total		**27.27**	**143.67**	**3.46**	**147.08**	**356.08**	**503.16**	**12.22**	**48.04**	**20.82**	**307,405,800**

Note: Data from yellow highlighted cells was contaminated and not included in analysis.
For estimation purposes, highlighted cells used concentrations from previous sampling trip and flow measurements from highlighted trip to estimate instantaneous and cumulative loads.

2013 Pigeon Lake Instant and Cumulative Stream Nutrient Loads

		Instantaneous loads (kg/day)										
Station	Date	Ammonia	Nitrate	Nitrite	NO3+NO2	Total Kjeldahl Nitrogen	Total Nitrogen	Ortho-Phosphate	Total Phosphorus	Total Dissolved Phosphorus	Discharge (L/day)	Days to next sample date
Tide	30-Apr-13	4.95	19.04	0.71	19.73	72.73	92.46	1.87	6.96	3.98	63,244,800	5.9
Tide	6-May-13											7.0
Tide	13-May-13											14.0
Tide	27-May-13											14.0
Tide	10-Jun-13											14.0
Tide	24-Jun-13											14.0
Tide	8-Jul-13											8.0
Tide	16-Jul-13	3.92	1.52	0.19	1.71	74.13	75.84	3.69	9.53	6.29	62,294,400	6.0
Tide	22-Jul-13											15.0
Tide	6-Aug-13											14.0
Tide	20-Aug-13											17.1
Tide	6-Sep-13											10.9
Tide	17-Sep-13											
Tide Total												
Zeiner	26-Apr-13	0.25	1.23	0.03	1.26	4.71	5.97	0.39	0.70	0.51	4,838,400	6.0
Zeiner	2-May-13	0.06	0.30	0.00	0.30	0.76	1.07	0.03	0.09	0.04	604,800	4.0
Zeiner	6-May-13	0.02	0.16	0.00	0.16	0.32	0.48	0.02	0.03	0.02	259,200	7.0
Zeiner	13-May-13	0.01	0.04	0.00	0.04	0.30	0.34	0.01	0.02	0.02	259,200	14.0
Zeiner	27-May-13	0.02	0.08	0.00	0.09	0.84	0.93	0.05	0.07	0.07	518,400	14.0
Zeiner	10-Jun-13	0.01	0.01	0.00	0.01	0.37	0.38	0.03	0.05	0.04	345,600	14.0
Zeiner	24-Jun-13	0.03	0.01	0.00	0.01	0.71	0.72	0.08	0.13	0.13	432,000	14.0
Zeiner	8-Jul-13	0.00	0.00	0.00	0.00	0.02	0.02	0.00	0.00	0.00	8,640	8.0
Zeiner	16-Jul-13	0.03	0.02	0.00	0.02	0.65	0.67	0.07	0.10	0.09	345,600	6.0
Zeiner	22-Jul-13	0.01	0.01	0.00	0.01	0.12	0.13	0.02	0.03	0.03	86,400	15.1
Zeiner	6-Aug-13											14.0
Zeiner	20-Aug-13											14.0
Zeiner	3-Sep-13											14.0
Zeiner	17-Sep-13											21.0
Zeiner	8-Oct-13											
Zeiner Total												

		Cumulative loads (kg)									
Station	Date	Ammonia	Nitrate	Nitrite	NO3+NO2	Total Kjeldahl Nitrogen	Total Nitrogen	Ortho-Phosphate	Total Phosphorus	Total Dissolved Phosphorus	Cumulative discharge (L)
Tide	30-Apr-13	29.11	112.04	4.21	116.13	428.06	544.19	11.02	40.94	23.41	372,222,000
Tide	6-May-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Tide	13-May-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Tide	27-May-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Tide	10-Jun-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Tide	24-Jun-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Tide	8-Jul-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Tide	16-Jul-13	23.66	9.16	1.16	10.33	446.84	457.17	22.27	57.45	37.93	375,496,800
Tide	22-Jul-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Tide	6-Aug-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Tide	20-Aug-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Tide	6-Sep-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Tide	17-Sep-13										
Tide Total		**52.76**	**121.20**	**5.37**	**126.46**	**874.90**	**1001.36**	**33.28**	**98.40**	**61.34**	**747,718,800**
Zeiner	26-Apr-13	1.50	7.32	0.19	7.50	28.08	35.57	2.34	4.18	3.06	28,828,800
Zeiner	2-May-13	0.25	1.19	0.02	1.21	3.04	4.25	0.11	0.36	0.16	2,412,900
Zeiner	6-May-13	0.12	1.10	0.02	1.12	2.24	3.36	0.13	0.19	0.16	1,803,600
Zeiner	13-May-13	0.09	0.59	0.02	0.61	4.14	4.75	0.19	0.27	0.24	3,628,800
Zeiner	27-May-13	0.24	1.17	0.06	1.24	11.87	13.11	0.67	1.05	0.98	7,282,800
Zeiner	10-Jun-13	0.09	0.09	0.01	0.10	5.18	5.28	0.49	0.70	0.56	4,839,600
Zeiner	24-Jun-13	0.39	0.12	0.01	0.13	9.91	10.04	1.17	1.83	1.78	6,040,500
Zeiner	8-Jul-13	0.01	0.00	0.00	0.00	0.13	0.13	0.01	0.02	0.01	69,360
Zeiner	16-Jul-13	0.20	0.09	0.01	0.11	3.89	4.00	0.39	0.58	0.53	2,056,800
Zeiner	22-Jul-13	0.14	0.09	0.01	0.10	1.84	1.95	0.36	0.43	0.41	1,307,400
Zeiner	6-Aug-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Zeiner	20-Aug-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Zeiner	3-Sep-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Zeiner	17-Sep-13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Zeiner	8-Oct-13										
Zeiner Total		**3.02**	**11.78**	**0.36**	**12.12**	**70.31**	**82.43**	**5.86**	**9.61**	**7.88**	**58,270,560**

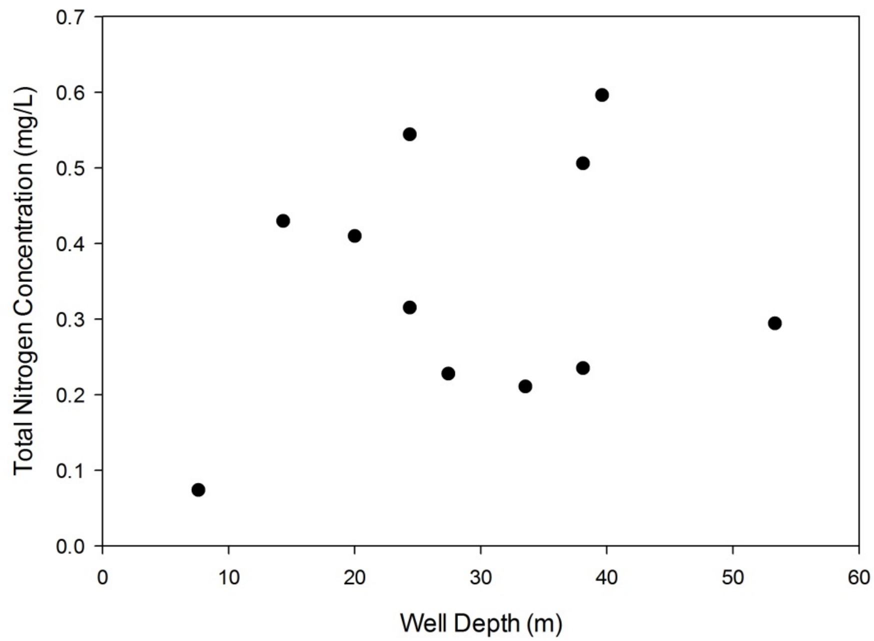
Appendix 5-1
2013 Pigeon Lake Groundwater Chemistry Data

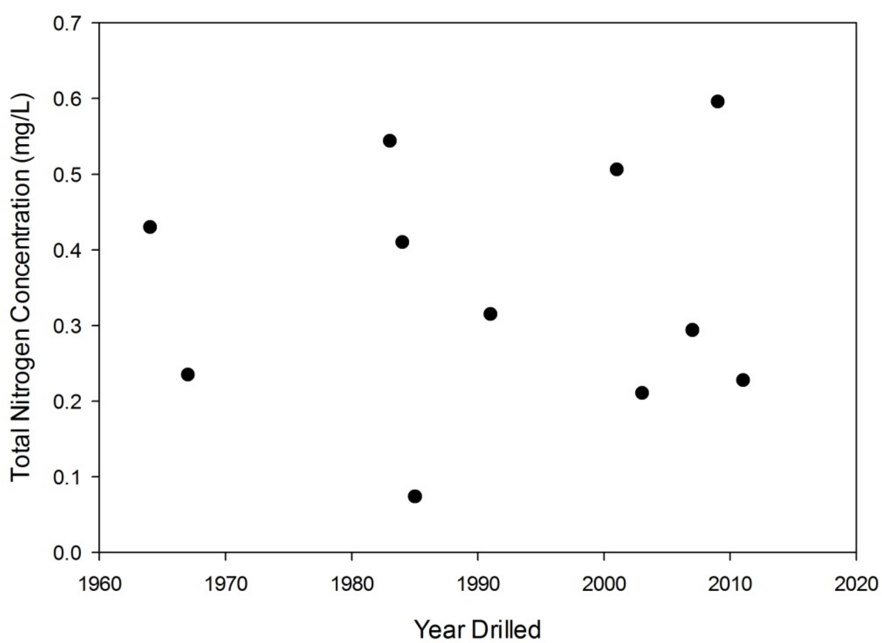
2013 Pigeon Lake Groundwater Chemistry Data

Sample ID	Location	Date	Depth of Well (m)	Year Drilled	Phosphorus (P)-Total Dissolved (mg/L)	Orthophosphate-Dissolved (as P) (mg/L)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)	Total Organic Carbon (mg/L)	Dissolved Organic Carbon (mg/L)	E.coli (No/100ml)	Fecal coliforms (No/100ml)
13GWE01506	Crystal Keys	22-Oct-13	39.62	2009	0.012	0.0087	535	<3.0	3	2.7	<10	<10
13GWE01500	Ma-Me-O	22-Oct-13	38.1	2001	0.0121	0.0138	638	<3.0	5.1	5.1	<10	<10
13GWE01501	Rundle's Mission	22-Oct-13	24.38	1983	0.0066	0.0063	367	<3.0	2.7	2.5	<10	<10
13GWE01502	Itaska Beach	22-Oct-13	38.1	1967	0.0442	0.0431	521	3	2.3	2.3	<10	<10
13GWE01503	Golden Day's Beach	22-Oct-13	7.62	1985	0.102	0.0356	841	<3.0	5.3	4.9	<10	<10
13GWE01504	Grandview Beach 1	22-Oct-13	27.43	2011	0.0393	0.0368	773	<3.0	4.8	4.6	<10	<10
13GWE01505	Crystal Springs	22-Oct-13	14.33	1964	<0.0010	<0.0010	481	<3.0	2.8	2.4	<10	<10
13GWE01510	Grandview Beach 2	23-Oct-13	24.38	1991	0.0282	0.0255	825	<3.0	4.7	4.5	<10	<10
13GWE01509	Leduc County @ Hwy 616 RR 11	23-Oct-13	33.53	2003	0.055	0.054	547	<3.0	3	2.5	<10	<10
13GWE01511	Sunset Harbour	23-Oct-13	13.72	1999	0.0019	0.0019	448	<3.0	3.4	3	<10	<10
13GWE01508	Silver Beach	23-Oct-13	20	1984	0.0313	0.0278	705	<3.0	7.5	7.2	<10	<10
13GWE01507	Johnsonia Beach	23-Oct-13	53.34	2007	0.0202	0.021	949	<3.0	6	5.6	<10	<10

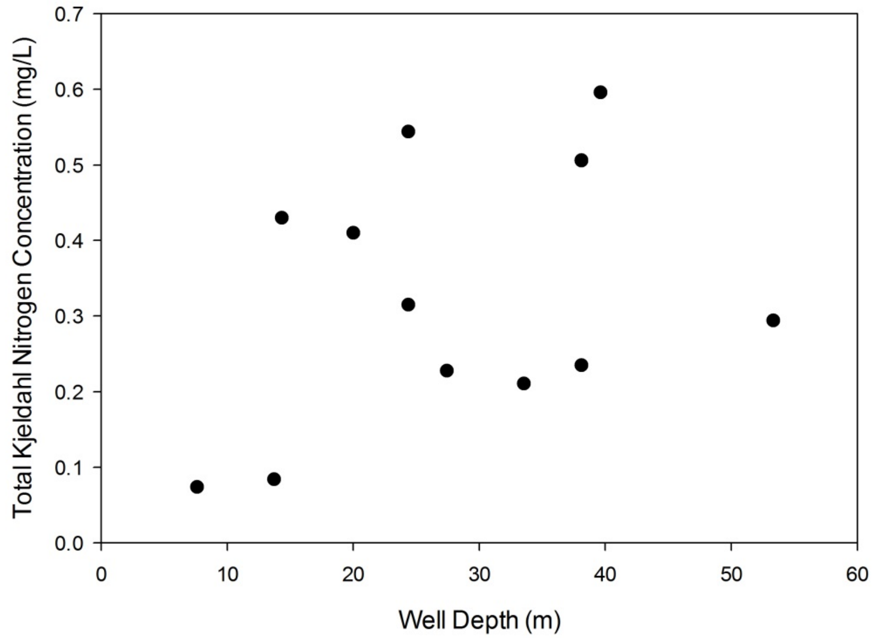
Appendix 5-2
2013 Pigeon Lake Groundwater Chemistry Plots with Well Age and Depth

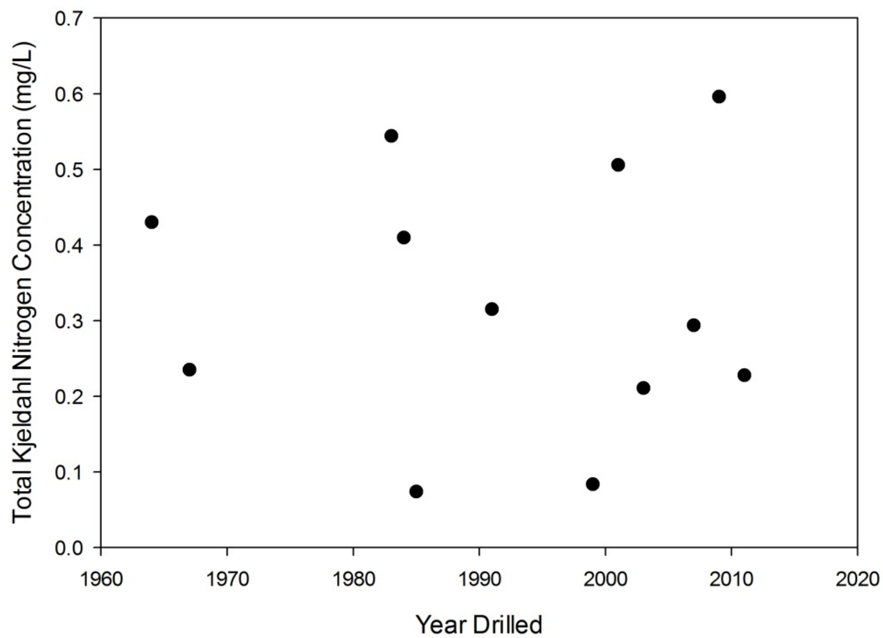
Total Nitrogen



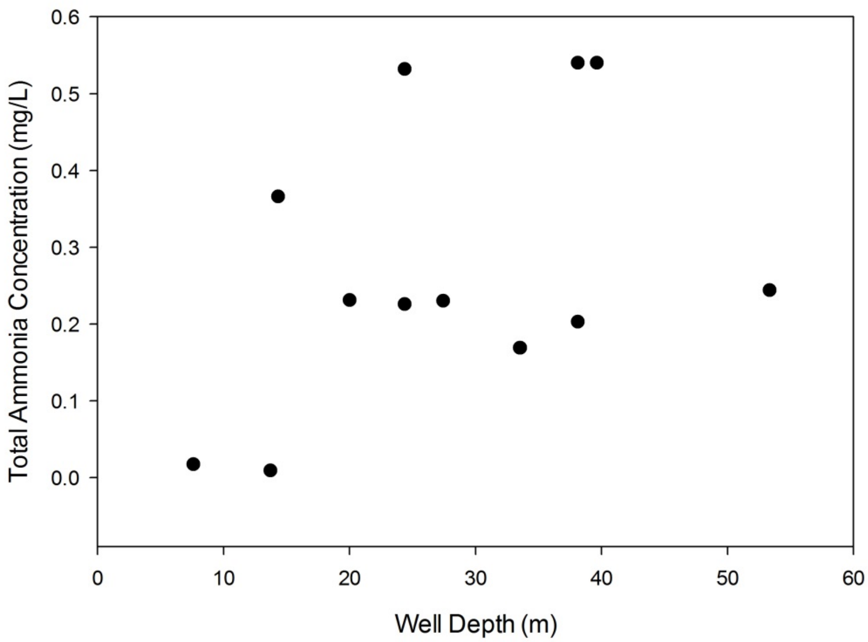


Total Kjeldahl Nitrogen

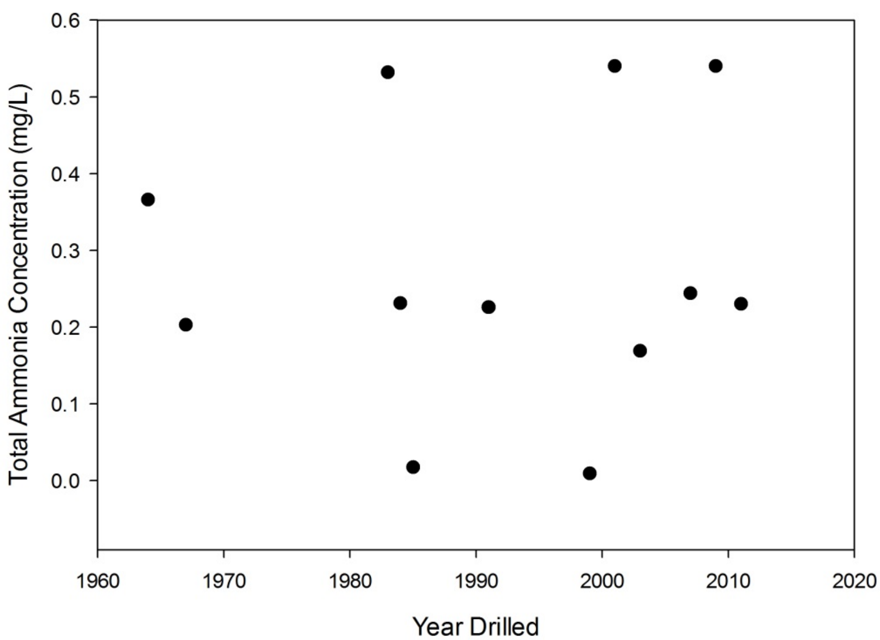




Ammonia

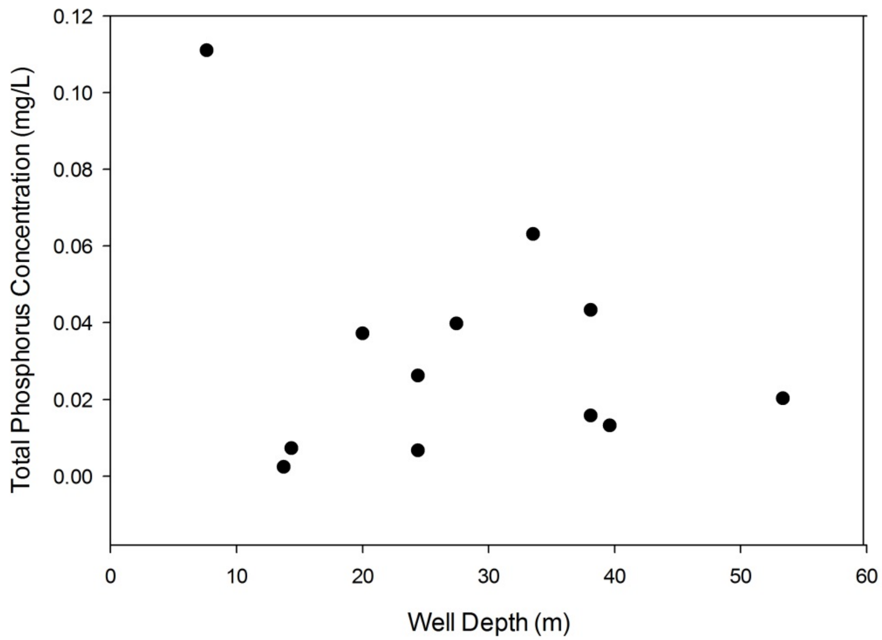


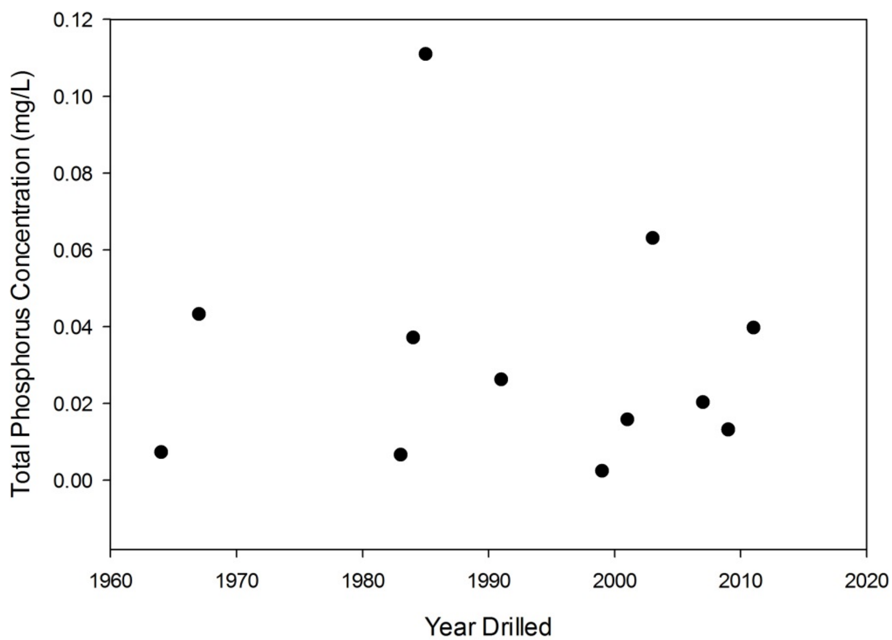
Total Ammonia Concentration (mg/L)
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0
10
20
30
40
50
60
Well Depth (m)



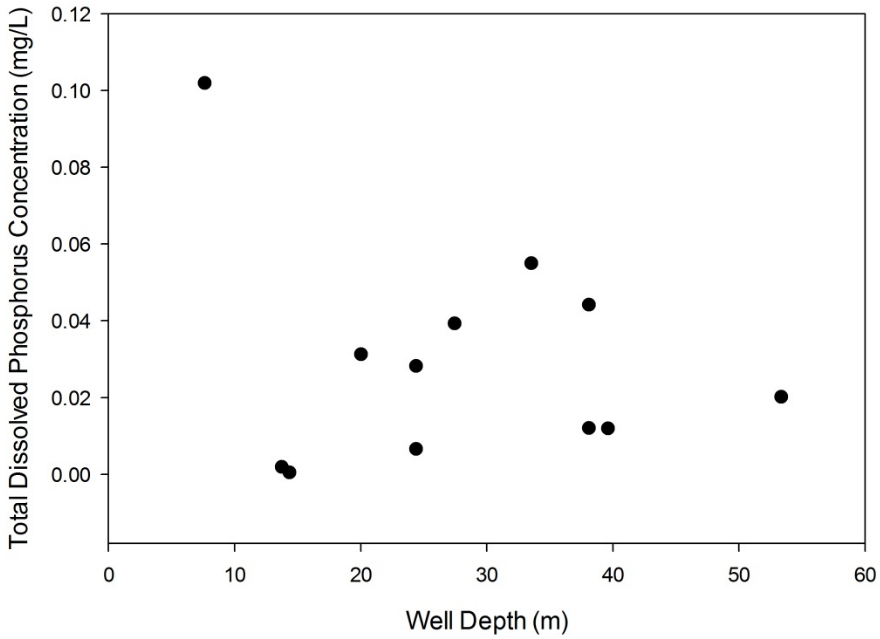
Total Ammonia Concentration (mg/L)
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1960
1970
1980
1990
2000
2010
2020
Year Drilled

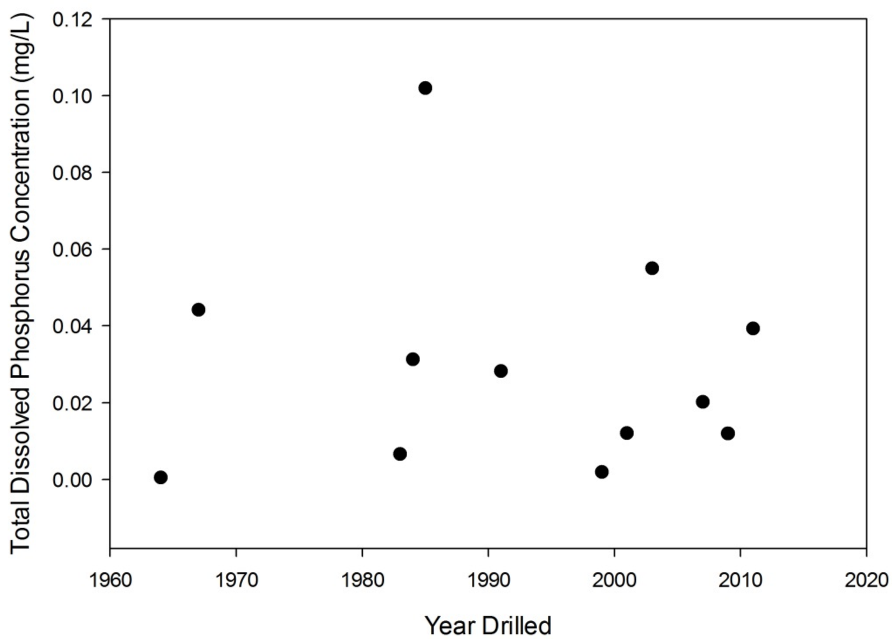
Total Phosphorus



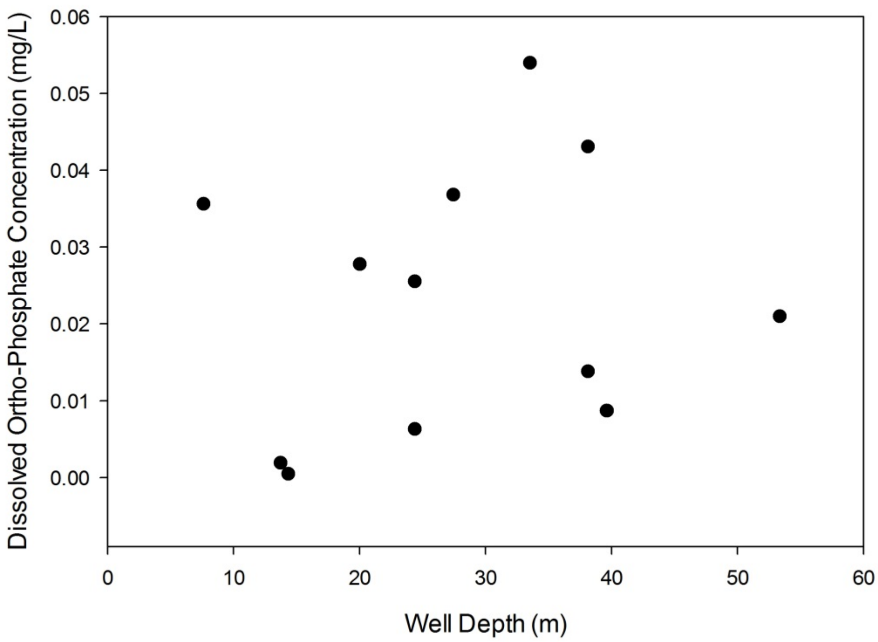


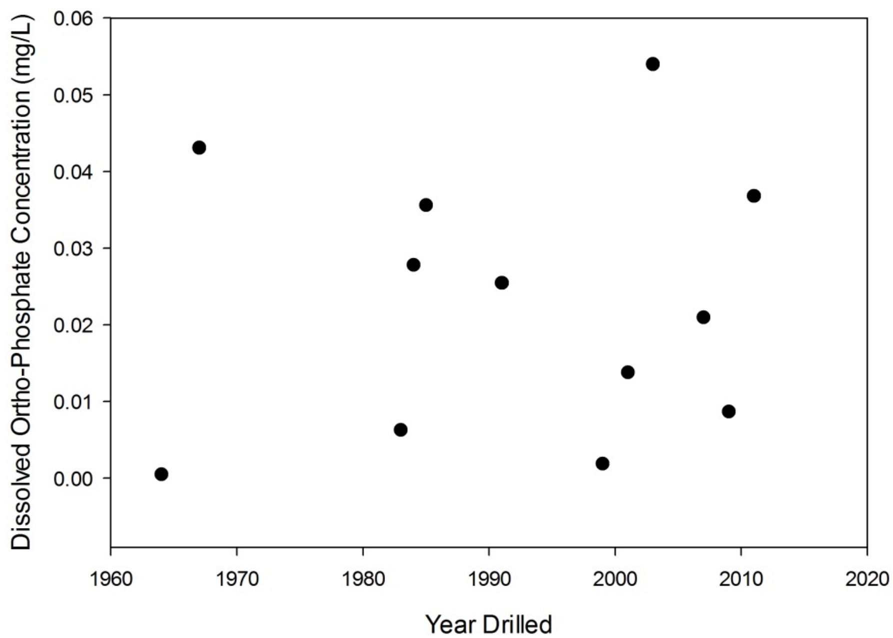
Total Dissolved Phosphorus



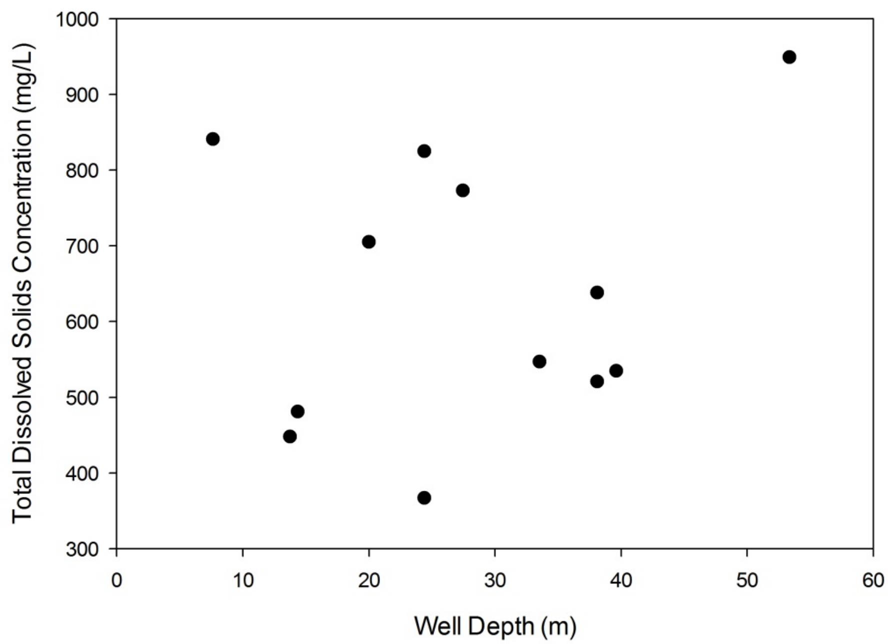


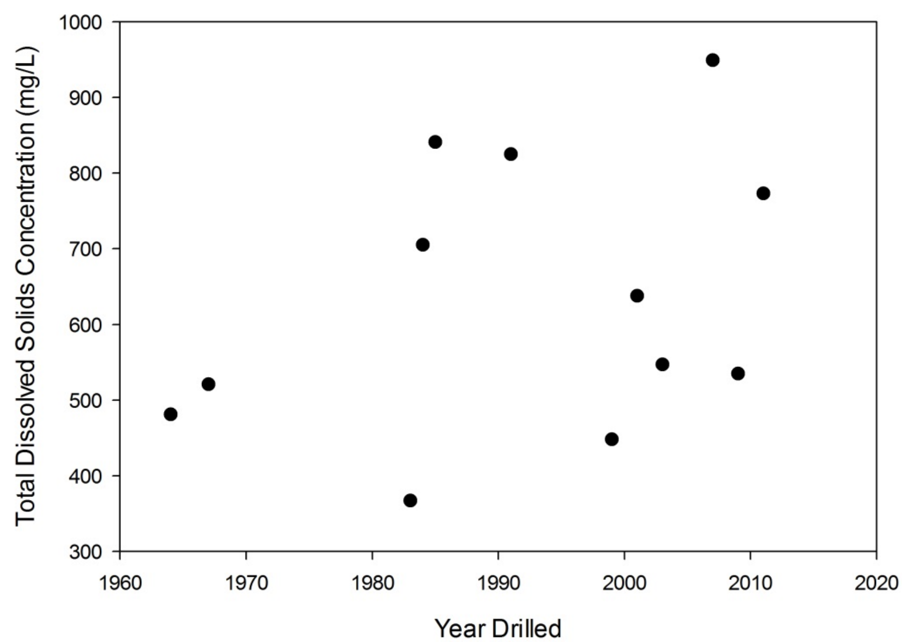
Ortho-Phosphate



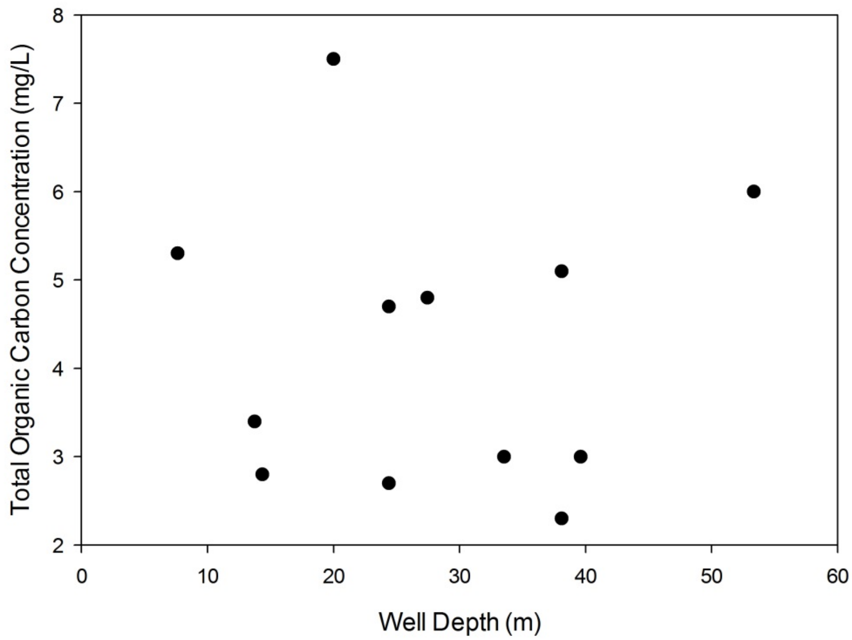


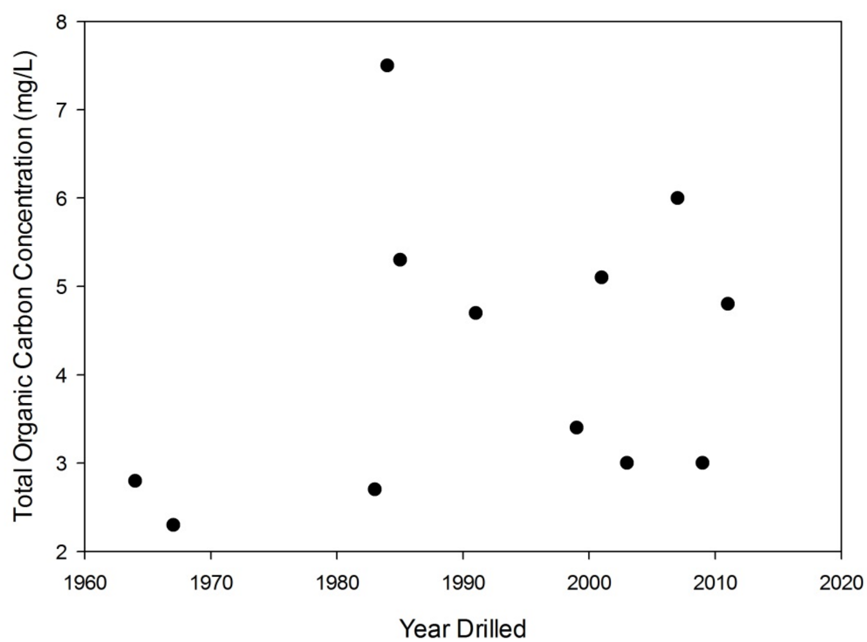
Total Dissolved Solids



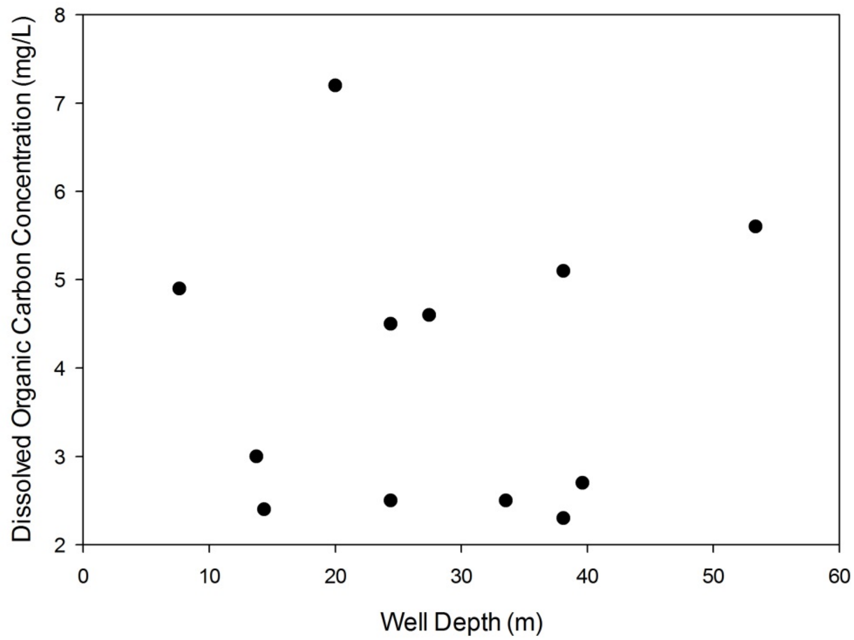


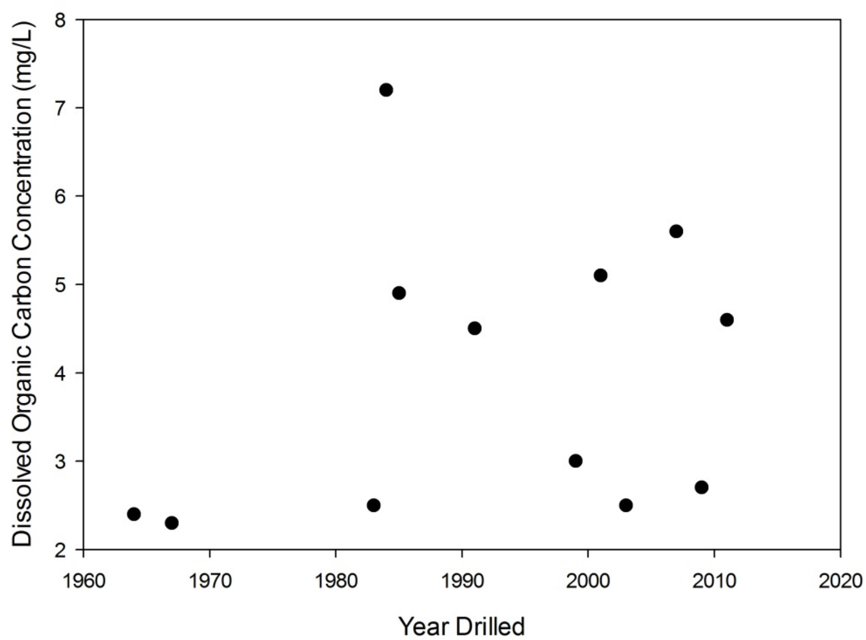
Total Organic Carbon





Dissolved Organic Carbon



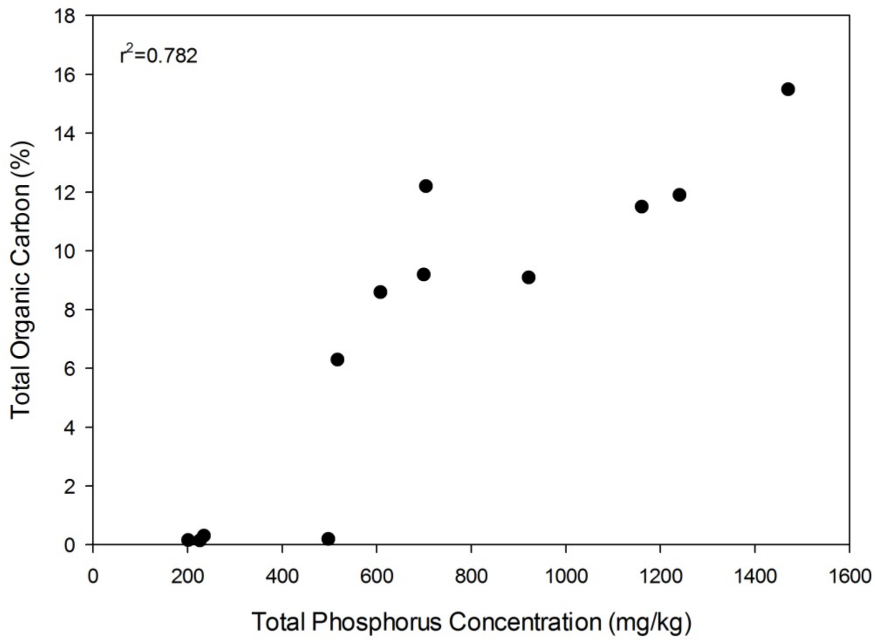


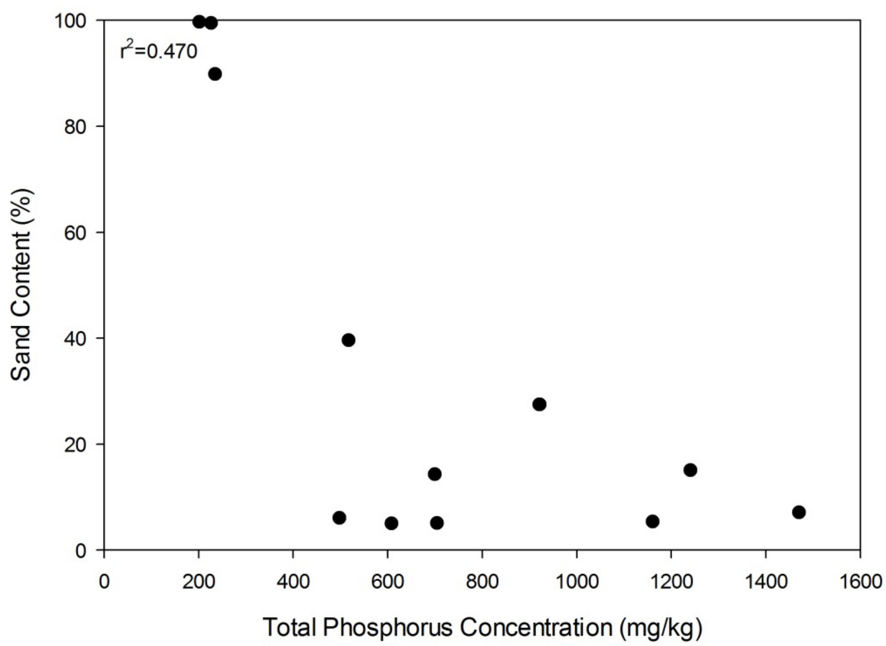
Appendix 6-1
2013 Pigeon Lake Sediment Chemistry Data

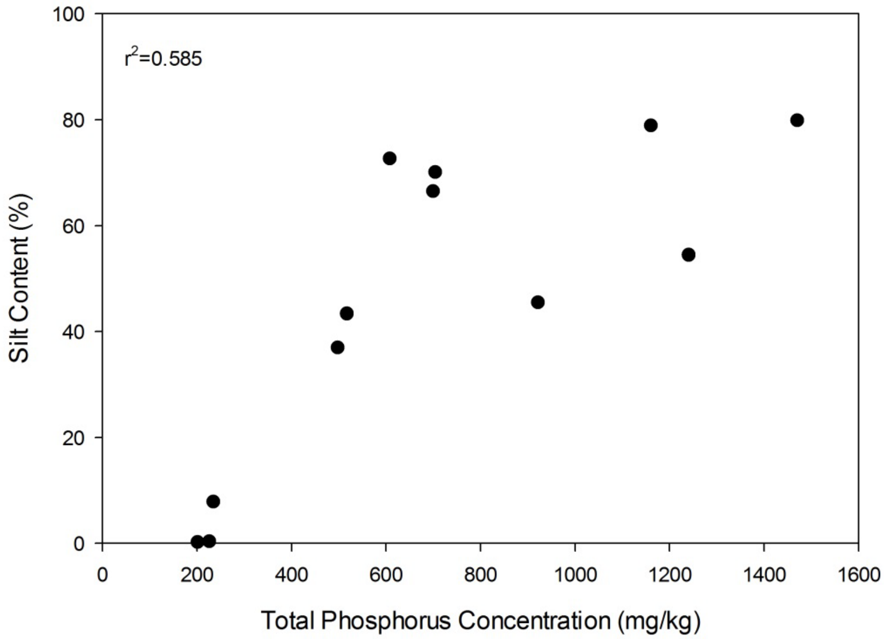
2013 Pigeon Lake Sediment Chemistry

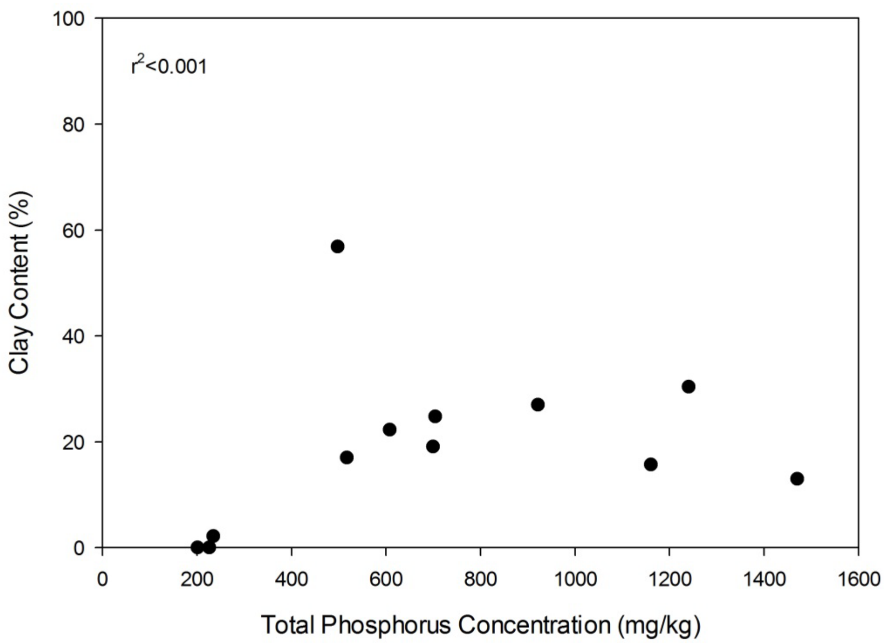
Sample ID		Total Carbon by Combustion (%)	Inorganic Carbon (%)	Total Organic Carbon (%)	CaCO3 Equivalent (%)	% Moisture	P Sorption Capacity (mg/kg)	Phosphorus Concentration (mg/kg)	Total Nitrogen (%)	% Sand (2.0mm - 0.05mm)	% Silt (0.05mm - 2um)	% Clay (<2um)	Texture
SHALLOW SPOT #1	0-10CM	0.3	0.10	0.16	0.87	26.2	101	201	0.024	99.7	0.25	<0.10	Sand
	10-25CM	0.3	0.12	0.14	0.99	21.3	123	226	0.026	99.5	0.39	<0.10	Sand
SHALLOW SPOT #2	0-10CM	10.1	0.97	9.09	8.08	88.2	1410	921	1.17	27.5	45.5	27.0	Loam / Clay loam
	10-30CM	6.5	0.17	6.30	1.38	78.1	1290	517	0.659	39.6	43.4	17.0	Loam
SHALLOW SPOT #3	0-10CM	0.5	0.24	0.30	2.03	19.1	298	234	<0.020	89.9	7.86	2.2	Sand
	10-15CM	0.5	0.32	0.20	2.69	20.5	1290	497	0.034	6.06	37	56.9	Clay
MEDIUM SPOT #1	0-10CM	12.3	0.77	11.5	6.4	92.2	1440	1160	1.46	5.36	78.9	15.7	Silt loam
	10-30CM	8.8	0.17	8.59	1.45	84.4	1430	608	0.951	5.01	72.7	22.3	Silt loam
MEDIUM SPOT #2	0-10CM	15.6	0.18	15.5	1.51	93.3	1460	1470	2.06	7.12	79.9	13.0	Silt loam
	10-30CM	12.3	0.14	12.2	1.17	90.3	1510	704	1.43	5.09	70.1	24.8	Silt loam
DEEP SPOT #1	0-10CM	12.8	0.88	11.9	7.35	91.3	1440	1240	1.53	15.1	54.5	30.4	Silty clay loam
	10-30CM	9.5	0.26	9.19	2.19	88.2	1310	699	1.09	14.3	66.5	19.1	Silt loam

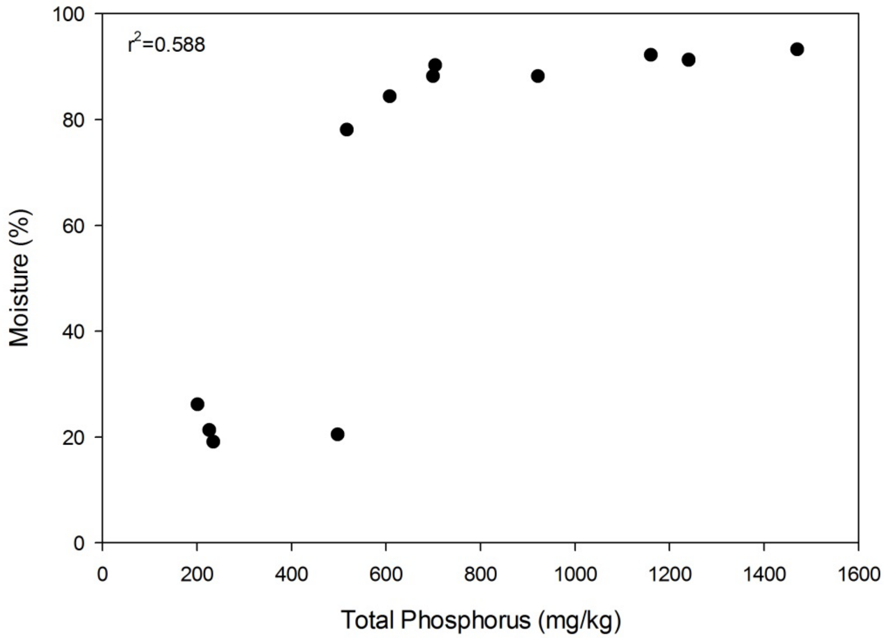
Appendix 6-2
2013 Pigeon Lake Sediment Total Phosphorus Relationship with Total Organic Carbon, Moisture, Sand, Silt, Clay and Nitrogen Content

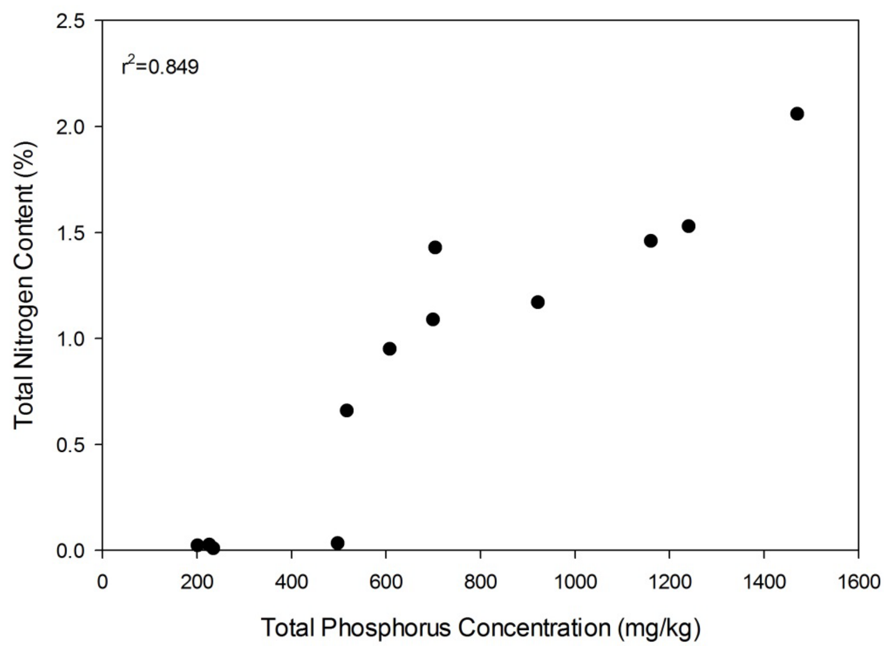

r²=0.782
Total Organic Carbon (%)
Total Phosphorus Concentration (mg/kg)
0
2
4
6
8
10
12
14
16
18
0
200
400
600
800
1000
1200
1400
1600


r²=0.470
Sand Content (%)
Total Phosphorus Concentration (mg/kg)
0
20
40
60
80
100
0
200
400
600
800
1000
1200
1400
1600


r²=0.585
Silt Content (%)
Total Phosphorus Concentration (mg/kg)
0
20
40
60
80
100
0
200
400
600
800
1000
1200
1400
1600


r²<0.001
Clay Content (%)
Total Phosphorus Concentration (mg/kg)
0
20
40
60
80
100
0
200
400
600
800
1000
1200
1400
1600


r²=0.588
Moisture (%)
Total Phosphorus (mg/kg)
0
20
40
60
80
100
0
200
400
600
800
1000
1200
1400
1600


r²=0.849
Total Nitrogen Content (%)
Total Phosphorus Concentration (mg/kg)
0.0
0.5
1.0
1.5
2.0
2.5
0
200
400
600
800
1000
1200
1400
1600

Appendix 7-1
2013 Pigeon Lake Phytoplankton Taxonomy

2013 Pigeon Lake Phytoplankton Taxonomy

SWE ID	13SWE06931		13SWE06932		13SWE06933	
Depth (m)	5.6		5		7.4	
Date sampled	5-Jun-13		16-Jun-13		18-Jun-13	
LAB ID	BIO-01	BIO-01	BIO-02	BIO-02	BIO-03	BIO-03
	Density (units/L)	Biomass (mg/m^3)	Density (units/L)	Biomass (mg/m^3)	Density (units/L)	Biomass (mg/m^3)
DIATOMS						
Achnanthes minutissima Kuetzing	0	0	0	0	0	0
Asterionella formosa Hansall	76576	16.5405	102101	170.714	17016	39.2071
Aulacoseira granulata (Ehrenberg) Simonsen	0	0	0	0	0	0
Cyclotella/Stephanodiscus sp	25525	17.3212	17016	6.68254	0	0
Diatoma tenue C. Agardh	25525	9.57204	17016	4.67966	0	0
Fragilaria capucina Desmazieres	0	0	85084	494.173	17016	118.438
Fragilaria crotonensis Kitton	25525	16.3363	85084	351.911	17016	40.8407
Gomphonema sp.	25525	66.4655	0	0	0	0
Navicula sp	0	0	0	0	0	0
Nitzschia acicularis (Kuetzing) W. Smith	0	0	34033	3.29278	0	0
Nitzschia sp	0	0	34033	1.37837	17016	2.04204
Rhoicosphenia abbreviata (Agardh) Lange-Bertalot	0	0	0	0	0	0
Stephanodiscus niagarae Ehrenberg	0	0	17016	1921.21	0	0
Synedra cyclopum Brutschy	0	0	0	0	0	0
Synedra sp (50 um long)	102101	11.4865	680678	76.5763	102101	11.4865
Synedra sp (>50 um long)	0	0	51050	12.2522	34033	4.59458
CHLOROPHYCEAE						
Ankyra judayi (G.M. Smith) Fott	0	0	0	0	0	0
Ankyra lanceolata (Kors) Fott	0	0	0	0	0	0
Chlorella spp	0	0	0	0	0	0
Chlamydomonas sagitula Skuja	0	0	0	0	0	0
Dictyosphaerium pulchellum Skuja	0	0	0	0	17016	57.7372
Elakatothrix genevensis (Reverdin) Hindak	0	0	0	0	0	0
Euastrum insulare (Wittrock) Roy	0	0	17016	27.942	0	0
Eudorina elegans Ehrenberg	0	0	0	0	0	0
Gloeocystis sp	0	0	0	0	0	0
Monoraphidium braunii Naegeli	0	0	0	0	0	0
Monoraphidium griffithii (Berkeley) Komarkova-Legenerova	0	0	0	0	0	0
Oocystis borgei Snow	0	0	0	0	0	0
Oocystis parva W. & G.S. West	0	0	0	0	17016	11.5474
Oocystis pusilla Hansgirg	0	0	0	0	0	0
Oocystis solitaria Wittrock	0	0	0	0	0	0
CHRYSOPHYCEAE						
Chromulina sp.	153152	39.2934	17016	6.84293	17016	4.80252
Desmarella moniliformis Kent	0	0	0	0	0	0
Dinobryon bavaricum Imhof	0	0	119118	80.8321	17016	4.49067
Dinobryon divergens Imhof	1021017	4095.49	170169	96.6741	153152	49.8963
Dinobryon sp (loose monad)	867864	229.024	170169	31.1852	85084	15.5926
Dinobryon sociale Ehrenberg	76576	42.1	34033	3.70659	17016	3.11852
Dinobryon sociale var. *stipitatum* (Stein) Lemmermann	51050	202.08	0	0	0	0
Unidentified naked Chrysophyte sp (*Ochromonas* /*Chromulina*)-large	587085	165.687	255254	72.0378	187186	52.8278
Unidentified naked Chrysophyte sp (*Ochromonas* /*Chromulina*)-small	306305	7.21715	306305	12.8305	68067	1.60381
Haptophyte *(Erkenia/Chrysochromulina)*	1403899	11.7613	1310305	30.8734	2637628	62.1477
Kephyrion sp	0	0	0	0	0	0
Mallomonas pseudocoronata Prescott	0	0	17016	25.661	0	0
Mallomonas sp	25525	38.4915	0	0	0	0
Monosiga varians Skuja	0	0	68067	1.60381	51050	1.20286
Ochromonas sp	0	0	0	0	0	0
Ochromonas sp	229728	92.3795	34033	9.60504	17016	4.80252
Pedinella sp	76576	29.2295	0	0	0	0
Spiniferomonas bourrellyi Takahashi	0	0	17016	8.91006	0	0
Stichogloea globosa Starmach	0	0	17016	17.8201	34033	160.381
Stylococcus sp	0	0	0	0	0	0
Uroglena sp	1174170	221.326	68067	5.13219	17016	1.42561

2013 Pigeon Lake Phytoplankton Taxonomy

SWE ID	13SWE06931		13SWE06932		13SWE06933	
Depth (m)	5.6		5		7.4	
Date sampled	5-Jun-13		16-Jun-13		18-Jun-13	
LAB ID	BIO-01	BIO-01	BIO-02	BIO-02	BIO-03	BIO-03
	Density (units/L)	Biomass (mg/m^3)	Density (units/L)	Biomass (mg/m^3)	Density (units/L)	Biomass (mg/m^3)
CRYPTOPHYCEAE						
Cryptomonas erosa Ehrenberg	76576	220.043	17016	33.3593	0	0
Cryptomonas marssonii Skuja	102101	86.6058	17016	13.7126	0	0
Cryptomonas pyrenoidifera Geitler	0	0	0	0	0	0
Cryptomonas reflexa Skuja	76576	189.731	0	0	0	0
Cryptomonas rostratiformis Skuja	0	0	0	0	0	0
Katablepharis ovalis Skuja	76576	5.77372	85084	7.12805	136135	11.4049
Rhodomonas minuta Skuja	3854341	554.985	544542	85.5366	357356	56.1334
CYANOBACTERIA						
Anabaena circinalis Rabenhorst	0	0	0	0	0	0
Anabaena flos-aquae Brebisson	0	0	0	0	0	0
Anabaena mendotae Trelease	0	0	0	0	0	0
Anabaena solitaria Klebahn	0	0	0	0	0	0
Anabaena sp.	0	0	0	0	0	0
Aphanocapsa delicatissima West & West	0	0	34033	21.3841	34033	2.85122
Aphanizomenon flos-aquae (Linne) Ralfs	0	0	17016	125.097	34033	327.445
Aphanocapsa rivularis (Carm.) Rabenhorst	0	0	0	0	0	0
Aphanocapsa sp	0	0	0	0	0	0
Aphanothece nidulans P. Richter	0	0	0	0	0	0
Aphanothece sp	0	0	0	0	0	0
Synechocystis sp (bi-cell)-spherical	0	0	0	0	0	0
Gloeotrichia echinulata (J.E. Smith) Richter	0	0	0	0	0	0
Limnothrix rosea (Utermohl) Meffert	0	0	0	0	0	0
Limnothrix sp	0	0	0	0	0	0
Merismopedia tenuissima Lemmermann	51050	0.85537	0	0	0	0
Microcystis aeruginosa Kuetzing	0	0	0	0	0	0
Microcystis ichthyoblabe Kuetzing	0	0	0	0	0	0
Phormidium sp	0	0	0	0	17016	106.921
Planktothrix agardhii Gomont	0	0	0	0	0	0
Romeria chlorina Bocher	0	0	0	0	0	0
Romeria chlorina Bocher	0	0	0	0	0	0
Romeria leopoliensis (Raciborski) Koczwara ex. Geitler	0	0	0	0	0	0
Synechococcus sp (unicell)-rod	0	0	0	0	17016	0.37422
DINOPHYCEAE						
Ceratium hirundinella (O.F. Muller) Schrank	0	0	0	0	0	0
TOTAL	**10490944**	**6369.8**	**4458418**	**3760.74**	**4135099**	**1153.31**

2013 Pigeon Lake Phytoplankton Taxonomy

SWE ID	13SWE06934		13SWE06935		13SWE06936	
Depth (m)	10.4		9		11.4	
Date sampled	26-Jun-13		4-Jul-13		10-Jul-13	
LAB ID	BIO-04	BIO-04	BIO-05	BIO-05	BIO-06	BIO-06
	Density (units/L)	Biomass (mg/m^3)	Density (units/L)	Biomass (mg/m^3)	Density (units/L)	Biomass (mg/m^3)
DIATOMS						
Achnanthes minutissima Kuetzing	0	0	0	0	0	0
Asterionella formosa Hansall	153152	323.458	0	0	34033	28.5885
Aulacoseira granulata (Ehrenberg) Simonsen	0	0	0	0	0	0
Cyclotella/Stephanodiscus sp	0	0	17016	1.44343	0	0
Diatoma tenue C. Agardh	0	0	0	0	0	0
Fragilaria capucina Desmazieres	0	0	0	0	0	0
Fragilaria crotonensis Kitton	17016	55.135	17016	15.7917	0	0
Gomphonema sp.	0	0	0	0	0	0
Navicula sp	17016	3.36936	0	0	0	0
Nitzschia acicularis (Kuetzing) W. Smith	0	0	0	0	0	0
Nitzschia sp	0	0	17016	3.40339	0	0
Rhoicosphenia abbreviata (Agardh) Lange-Bertalot	0	0	0	0	0	0
Stephanodiscus niagarae Ehrenberg	0	0	0	0	34033	3503.58
Synedra cyclopum Brutschy	0	0	0	0	0	0
Synedra sp (50 um long)	34033	3.82882	0	0	0	0
Synedra sp (>50 um long)	0	0	0	0	0	0
CHLOROPHYCEAE						
Ankyra judayi (G.M. Smith) Fott	0	0	0	0	0	0
Ankyra lanceolata (Kors) Fott	0	0	0	0	0	0
Chlorella spp	0	0	0	0	0	0
Chlamydomonas sagitula Skuja	0	0	17016	0.28512	0	0
Dictyosphaerium pulchellum Skuja	0	0	0	0	0	0
Elakatothrix genevensis (Reverdin) Hindak	0	0	17016	2.5661	0	0
Euastrum insulare (Wittrock) Roy	0	0	0	0	0	0
Eudorina elegans Ehrenberg	0	0	0	0	0	0
Gloeocystis sp	0	0	0	0	0	0
Monoraphidium braunii Naegeli	0	0	17016	0.67761	0	0
Monoraphidium griffithii (Berkeley) Komarkova-Legenerova	0	0	0	0	0	0
Oocystis borgei Snow	0	0	0	0	0	0
Oocystis parva W. & G.S. West	0	0	0	0	17016	1.60381
Oocystis pusilla Hansgirg	0	0	0	0	0	0
Oocystis solitaria Wittrock	0	0	0	0	0	0
CHRYSOPHYCEAE						
Chromulina sp.	17016	4.80252	68067	27.3717	68067	20.9565
Desmarella moniliformis Kent	17016	0.96229	0	0	0	0
Dinobryon bavaricum Imhof	34033	5.79154	0	0	0	0
Dinobryon divergens Imhof	0	0	34033	171.519	0	0
Dinobryon sp (loose monad)	34033	6.68254	0	0	0	0
Dinobryon sociale Ehrenberg	17016	1.71073	0	0	0	0
Dinobryon sociale var. *stipitatum* (Stein) Lemmermann	0	0	0	0	0	0
Unidentified naked Chrysophyte sp (*Ochromonas/Chromulina*)-large	323322	119.181	153152	56.4541	187186	52.8278
Unidentified naked Chrysophyte sp (*Ochromonas/Chromulina*)-small	187186	4.41048	306305	7.21715	187186	4.41048
Haptophyte *(Erkenia/Chrysochromulina)*	5054037	119.083	1191187	12.4741	238237	1.99585
Kephyrion sp	0	0	0	0	0	0
Mallomonas pseudocoronata Prescott	0	0	17016	20.5288	0	0
Mallomonas sp	17016	10.2644	0	0	0	0
Monosiga varians Skuja	0	0	0	0	0	0
Ochromonas sp	0	0	0	0	0	0
Ochromonas sp	34033	12.5454	34033	8.73186	17016	4.36593
Pedinella sp	0	0	0	0	0	0
Spiniferomonas bourrellyi Takahashi	17016	4.56195	0	0	0	0
Stichogloea globosa Starmach	0	0	0	0	17016	71.2805
Stylococcus sp	0	0	0	0	0	0
Uroglena sp	17016	1.28305	0	0	0	0

2013 Pigeon Lake Phytoplankton Taxonomy

SWE ID	13SWE06934		13SWE06935		13SWE06936	
Depth (m)	10.4		9		11.4	
Date sampled	26-Jun-13		4-Jul-13		10-Jul-13	
LAB ID	BIO-04	BIO-04	BIO-05	BIO-05	BIO-06	BIO-06
	Density (units/L)	Biomass (mg/m^3)	Density (units/L)	Biomass (mg/m^3)	Density (units/L)	Biomass (mg/m^3)
CRYPTOPHYCEAE						
Cryptomonas erosa Ehrenberg	0	0	0	0	0	0
Cryptomonas marssonii Skuja	0	0	17016	17.8201	17016	13.7126
Cryptomonas pyrenoidifera Geitler	0	0	0	0	0	0
Cryptomonas reflexa Skuja	17016	30.7932	17016	47.152	17016	30.7932
Cryptomonas rostratiformis Skuja	0	0	0	0	0	0
Katablepharis ovalis Skuja	136135	10.2644	34033	2.5661	68067	5.13219
Rhodomonas minuta Skuja	476474	68.6075	697695	100.461	408407	37.6361
CYANOBACTERIA						
Anabaena circinalis Rabenhorst	0	0	0	0	0	0
Anabaena flos-aquae Brebisson	0	0	0	0	51050	76.9829
Anabaena mendotae Trelease	0	0	0	0	0	0
Anabaena solitaria Klebahn	0	0	0	0	0	0
Anabaena sp.	0	0	0	0	0	0
Aphanocapsa delicatissima West & West	119118	45.6195	408407	113.336	1072068	420.198
Aphanizomenon flos-aquae (Linne) Ralfs	0	0	0	0	0	0
Aphanocapsa rivularis (Carm.) Rabenhorst	0	0	0	0	0	0
Aphanocapsa sp	0	0	0	0	0	0
Aphanothece nidulans P. Richter	0	0	0	0	0	0
Aphanothece sp	0	0	17016	9.62286	0	0
Synechocystis sp (bi-cell)-spherical	0	0	0	0	0	0
Gloeotrichia echinulata (J.E. Smith) Richter	0	0	0	0	0	0
Limnothrix rosea (Utermohl) Meffert	0	0	0	0	0	0
Limnothrix sp	0	0	0	0	17016	1.33651
Merismopedia tenuissima Lemmermann	0	0	0	0	0	0
Microcystis aeruginosa Kuetzing	0	0	0	0	0	0
Microcystis ichthyoblabe Kuetzing	0	0	0	0	0	0
Phormidium sp	0	0	0	0	0	0
Planktothrix agardhii Gomont	0	0	0	0	0	0
Romeria chlorina Bocher	0	0	0	0	17016	4.27683
Romeria chlorina Bocher	0	0	0	0	0	0
Romeria leopoliensis (Raciborski) Koczwara ex. Geitler	0	0	0	0	0	0
Synechococcus sp (unicell)-rod	0	0	34033	0.74845	17016	0.37422
DINOPHYCEAE						
Ceratium hirundinella (O.F. Muller) Schrank	0	0	5105	299.387	25525	3849.15
TOTAL	**6738700**	**832.355**	**3136210**	**919.557**	**2509987**	**8129.2**

2013 Pigeon Lake Phytoplankton Taxonomy

SWE ID	13SWE06937		13SWE06938		13SWE06939	
Depth (m)	7		8		6	
Date sampled	17-Jul-13		24-Jul-13		29-Jul-13	
LAB ID	BIO-07	BIO-07	BIO-08	BIO-08	BIO-09	BIO-09
	Density (units/L)	Biomass (mg/m^3)	Density (units/L)	Biomass (mg/m^3)	Density (units/L)	Biomass (mg/m^3)
DIATOMS						
Achnanthes minutissima Kuetzing	0	0	0	0	17016	0.23824
Asterionella formosa Hansall	0	0	0	0	0	0
Aulacoseira granulata (Ehrenberg) Simonsen	0	0	0	0	17016	177.061
Cyclotella/Stephanodiscus sp	17016	6.68254	0	0	17016	1.44343
Diatoma tenue C. Agardh	0	0	0	0	0	0
Fragilaria capucina Desmazieres	0	0	0	0	0	0
Fragilaria crotonensis Kitton	34033	422.361	51050	605.804	255254	1981.18
Gomphonema sp.	0	0	0	0	0	0
Navicula sp	0	0	0	0	0	0
Nitzschia acicularis (Kuetzing) W. Smith	0	0	0	0	0	0
Nitzschia sp	0	0	17016	0.99549	17016	0.76576
Rhoicosphenia abbreviata (Agardh) Lange-Bertalot	0	0	0	0	17016	2.21552
Stephanodiscus niagarae Ehrenberg	0	0	0	0	0	0
Synedra cyclopum Brutschy	0	0	17016	4.08407	0	0
Synedra sp (50 um long)	0	0	0	0	0	0
Synedra sp (>50 um long)	0	0	0	0	17016	4.44143
CHLOROPHYCEAE						
Ankyra judayi (G.M. Smith) Fott	578576	7.27061	340339	11.2267	102101	3.368
Ankyra lanceolata (Kors) Fott	102101	1.06921	0	0	0	0
Chlorella spp	0	0	0	0	0	0
Chlamydomonas sagitula Skuja	34033	0.42768	17016	0.1782	0	0
Dictyosphaerium pulchellum Skuja	0	0	0	0	0	0
Elakatothrix genevensis (Reverdin) Hindak	0	0	0	0	0	0
Euastrum insulare (Wittrock) Roy	0	0	0	0	0	0
Eudorina elegans Ehrenberg	0	0	0	0	0	0
Gloeocystis sp	0	0	0	0	0	0
Monoraphidium braunii Naegeli	0	0	0	0	0	0
Monoraphidium griffithii (Berkeley) Komarkova-Legenerova	0	0	0	0	0	0
Oocystis borgei Snow	0	0	0	0	0	0
Oocystis parva W. & G.S. West	0	0	17016	0.7128	68067	1.78201
Oocystis pusilla Hansgirg	0	0	0	0	0	0
Oocystis solitaria Wittrock	17016	3.84915	0	0	0	0
CHRYSOPHYCEAE						
Chromulina sp.	34033	13.6859	51050	14.4076	85084	34.2146
Desmarella moniliformis Kent	0	0	0	0	0	0
Dinobryon bavaricum Imhof	0	0	0	0	0	0
Dinobryon divergens Imhof	0	0	0	0	0	0
Dinobryon sp (loose monad)	0	0	17016	3.11852	17016	3.11852
Dinobryon sociale Ehrenberg	0	0	0	0	0	0
Dinobryon sociale var. *stipitatum* (Stein) Lemmermann	0	0	0	0	0	0
Unidentified naked Chrysophyte sp (*Ochromonas* /*Chromulina*)-large	153152	39.2934	136135	54.7434	204203	75.2722
Unidentified naked Chrysophyte sp (*Ochromonas* /*Chromulina*)-small	289288	6.8162	306305	7.21715	408407	9.62287
Haptophyte *(Erkenia/Chrysochromulina)*	289288	2.42354	153152	1.28305	340339	8.01905
Kephyrion sp	0	0	0	0	0	0
Mallomonas pseudocoronata Prescott	0	0	0	0	0	0
Mallomonas sp	0	0	0	0	0	0
Monosiga varians Skuja	0	0	0	0	0	0
Ochromonas sp	0	0	0	0	0	0
Ochromonas sp	34033	9.60504	34033	11.4049	119118	30.5615
Pedinella sp	0	0	0	0	0	0
Spiniferomonas bourrellyi Takahashi	0	0	0	0	0	0
Stichogloea globosa Starmach	0	0	0	0	0	0
Stylococcus sp	0	0	0	0	510508	29.9378
Uroglena sp	17016	1.14049	119118	14.0333	34033	2.28098

2013 Pigeon Lake Phytoplankton Taxonomy

SWE ID	13SWE06937		13SWE06938		13SWE06939	
Depth (m)	7		8		6	
Date sampled	17-Jul-13		24-Jul-13		29-Jul-13	
LAB ID	BIO-07	BIO-07	BIO-08	BIO-08	BIO-09	BIO-09
	Density (units/L)	Biomass (mg/m^3)	Density (units/L)	Biomass (mg/m^3)	Density (units/L)	Biomass (mg/m^3)
CRYPTOPHYCEAE						
Cryptomonas erosa Ehrenberg	17016	24.7967	17016	45.174	0	0
Cryptomonas marssonii Skuja	34033	43.1247	0	0	0	0
Cryptomonas pyrenoidifera Geitler	0	0	17016	30.7932	0	0
Cryptomonas reflexa Skuja	17016	72.9912	0	0	17016	37.645
Cryptomonas rostratiformis Skuja	17016	121.248	0	0	0	0
Katablepharis ovalis Skuja	17016	1.42561	68067	5.13219	34033	2.5661
Rhodomonas minuta Skuja	612610	88.2096	306305	44.1048	425424	61.2567
CYANOBACTERIA						
Anabaena circinalis Rabenhorst	0	0	0	0	17016	3.84915
Anabaena flos-aquae Brebisson	17016	8.73186	0	0	0	0
Anabaena mendotae Trelease	0	0	0	0	17016	142.561
Anabaena solitaria Klebahn	0	0	0	0	0	0
Anabaena sp.	0	0	17016	9.62286	0	0
Aphanocapsa delicatissima West & West	331830	206.357	255254	151.115	306305	250.195
Aphanizomenon flos-aquae (Linne) Ralfs	0	0	136135	344.908	119118	2626.11
Aphanocapsa rivularis (Carm.) Rabenhorst	0	0	0	0	0	0
Aphanocapsa sp	0	0	0	0	0	0
Aphanothece nidulans P. Richter	0	0	0	0	0	0
Aphanothece sp	0	0	0	0	34033	19.2457
Synechocystis sp (bi-cell)-spherical	0	0	0	0	0	0
Gloeotrichia echinulata (J.E. Smith) Richter	0	0	17016	38.4915	0	0
Limnothrix rosea (Utermohl) Meffert	0	0	0	0	0	0
Limnothrix sp	0	0	34033	4.81143	0	0
Merismopedia tenuissima Lemmermann	17016	0.14256	0	0	0	0
Microcystis aeruginosa Kuetzing	0	0	0	0	0	0
Microcystis ichthyoblabe Kuetzing	0	0	0	0	0	0
Phormidium sp	0	0	0	0	0	0
Planktothrix agardhii Gomont	0	0	0	0	17016	187.111
Romeria chlorina Bocher	0	0	0	0	0	0
Romeria chlorina Bocher	0	0	0	0	0	0
Romeria leopoliensis (Raciborski) Koczwara ex. Geitler	0	0	0	0	0	0
Synechococcus sp (unicell)-rod	391390	6.14794	68067	1.28305	51050	0.80191
DINOPHYCEAE						
Ceratium hirundinella (O.F. Muller) Schrank	5105	299.378	15315	834.984	5105	190.052
TOTAL	**3076649**	**1387.18**	**2227502**	**2239.63**	**3289358**	**5886.91**

2013 Pigeon Lake Phytoplankton Taxonomy

SWE ID	13SWE06940		13SWE06941		13SWE07071	
Depth (m)	6		4.6		4.4	
Date sampled	8-Aug-13		14-Aug-13		22-Aug-13	
LAB ID	BIO-10	BIO-10	BIO-11	BIO-11	BIO-12	BIO-12
	Density (units/L)	Biomass (mg/m^3)	Density (units/L)	Biomass (mg/m^3)	Density (units/L)	Biomass (mg/m^3)
DIATOMS						
Achnanthes minutissima Kuetzing	0	0	0	0	0	0
Asterionella formosa Hansall	0	0	0	0	0	0
Aulacoseira granulata (Ehrenberg) Simonsen	119118	2933.9	17016	1047.82	0	0
Cyclotella/Stephanodiscus sp	0	0	0	0	0	0
Diatoma tenue C. Agardh	0	0	0	0	0	0
Fragilaria capucina Desmazieres	0	0	0	0	0	0
Fragilaria crotonensis Kitton	119118	1266.06	85084	844.041	153152	1010.81
Gomphonema sp.	0	0	0	0	0	0
Navicula sp	0	0	0	0	0	0
Nitzschia acicularis (Kuetzing) W. Smith	0	0	0	0	0	0
Nitzschia sp	0	0	0	0	0	0
Rhoicosphenia abbreviata (Agardh) Lange-Bertalot	0	0	0	0	0	0
Stephanodiscus niagarae Ehrenberg	0	0	0	0	0	0
Synedra cyclopum Brutschy	0	0	0	0	0	0
Synedra sp (50 um long)	51050	5.74322	17016	1.99098	0	0
Synedra sp (>50 um long)	0	0	0	0	0	0
CHLOROPHYCEAE						
Ankyra judayi (G.M. Smith) Fott	119118	4.49067	119118	3.92934	51050	1.80429
Ankyra lanceolata (Kors) Fott	0	0	0	0	76576	2.16514
Chlorella spp	0	0	51050	3.34127	76576	8.66058
Chlamydomonas sagitula Skuja	0	0	17016	0.1782	0	0
Dictyosphaerium pulchellum Skuja	0	0	0	0	0	0
Elakatothrix genevensis (Reverdin) Hindak	0	0	0	0	0	0
Euastrum insulare (Wittrock) Roy	0	0	0	0	0	0
Eudorina elegans Ehrenberg	0	0	0	0	0	0
Gloeocystis sp	0	0	0	0	25525	54.7434
Monoraphidium braunii Naegeli	0	0	0	0	0	0
Monoraphidium griffithii (Berkeley) Komarkova-Legenerova	17016	0.89101	0	0	0	0
Oocystis borgei Snow	0	0	0	0	0	0
Oocystis parva W. & G.S. West	17016	0.21384	0	0	51050	0.96229
Oocystis pusilla Hansgirg	0	0	0	0	0	0
Oocystis solitaria Wittrock	0	0	17016	3.84915	0	0
CHRYSOPHYCEAE						
Chromulina sp.	34033	8.73186	0	0	25525	7.20378
Desmarella moniliformis Kent	0	0	0	0	0	0
Dinobryon bavaricum Imhof	0	0	0	0	0	0
Dinobryon divergens Imhof	0	0	34033	184.118	0	0
Dinobryon sp (loose monad)	0	0	0	0	0	0
Dinobryon sociale Ehrenberg	0	0	0	0	0	0
Dinobryon sociale var. *stipitatum* (Stein) Lemmermann	0	0	0	0	0	0
Unidentified naked Chrysophyte sp (*Ochromonas* /*Chromulina*)-large	374373	105.656	170169	62.7268	127627	36.0189
Unidentified naked Chrysophyte sp (*Ochromonas* /*Chromulina*)-small	153152	3.60857	51050	1.20286	51050	1.20286
Haptophyte *(Erkenia/Chrysochromulina)*	187186	4.41048	85084	0.7128	229728	5.41286
Kephyrion sp	0	0	0	0	25525	0.60143
Mallomonas pseudocoronata Prescott	0	0	0	0	0	0
Mallomonas sp	17016	9.1239	0	0	0	0
Monosiga varians Skuja	17016	0.40095	0	0	0	0
Ochromonas sp	0	0	0	0	51050	53.888
Ochromonas sp	17016	4.80252	0	0	0	0
Pedinella sp	0	0	0	0	25525	0.72171
Spiniferomonas bourrellyi Takahashi	0	0	0	0	0	0
Stichogloea globosa Starmach	0	0	0	0	0	0
Stylococcus sp	0	0	0	0	0	0
Uroglena sp	340339	25.661	136135	10.2644	51050	4.27683

2013 Pigeon Lake Phytoplankton Taxonomy

SWE ID	13SWE06940		13SWE06941		13SWE07071	
Depth (m)	6		4.6		4.4	
Date sampled	8-Aug-13		14-Aug-13		22-Aug-13	
LAB ID	BIO-10	BIO-10	BIO-11	BIO-11	BIO-12	BIO-12
	Density (units/L)	Biomass (mg/m^3)	Density (units/L)	Biomass (mg/m^3)	Density (units/L)	Biomass (mg/m^3)
CRYPTOPHYCEAE						
Cryptomonas erosa Ehrenberg	17016	30.7932	0	0	0	0
Cryptomonas marssonii Skuja	0	0	17016	13.7126	0	0
Cryptomonas pyrenoidifera Geitler	0	0	17016	21.5623	0	0
Cryptomonas reflexa Skuja	17016	37.645	0	0	0	0
Cryptomonas rostratiformis Skuja	0	0	0	0	0	0
Katablepharis ovalis Skuja	153152	12.8305	34033	2.85122	331830	27.7994
Rhodomonas minuta Skuja	204203	29.4032	323322	29.7952	229728	36.0857
CYANOBACTERIA						
Anabaena circinalis Rabenhorst	17016	18.3369	51050	947.407	0	0
Anabaena flos-aquae Brebisson	34033	1344.71	51050	1833.69	0	0
Anabaena mendotae Trelease	0	0	51050	81.9726	76576	58.1649
Anabaena solitaria Klebahn	0	0	0	0	0	0
Anabaena sp.	0	0	0	0	0	0
Aphanocapsa delicatissima West & West	187186	90.8113	85084	54.1732	0	0
Aphanizomenon flos-aquae (Linne) Ralfs	459457	12095.8	1718712	45665.4	6585563	167154
Aphanocapsa rivularis (Carm.) Rabenhorst	0	0	0	0	0	0
Aphanocapsa sp	0	0	17016	2.22752	0	0
Aphanothece nidulans P. Richter	0	0	0	0	0	0
Aphanothece sp	0	0	0	0	0	0
Synechocystis sp (bi-cell)-spherical	0	0	0	0	0	0
Gloeotrichia echinulata (J.E. Smith) Richter	0	0	0	0	0	0
Limnothrix rosea (Utermohl) Meffert	0	0	0	0	0	0
Limnothrix sp	0	0	17016	2.67302	0	0
Merismopedia tenuissima Lemmermann	0	0	0	0	0	0
Microcystis aeruginosa Kuetzing	0	0	0	0	0	0
Microcystis ichthyoblabe Kuetzing	0	0	0	0	0	0
Phormidium sp	0	0	0	0	0	0
Planktothrix agardhii Gomont	0	0	0	0	0	0
Romeria chlorina Bocher	0	0	0	0	0	0
Romeria chlorina Bocher	0	0	17016	0.80191	0	0
Romeria leopoliensis (Raciborski) Koczwara ex. Geitler	0	0	0	0	25525	0.96229
Synechococcus sp (unicell)-rod	0	0	0	0	0	0
DINOPHYCEAE						
Ceratium hirundinella (O.F. Muller) Schrank	0	0	0	0	0	0
TOTAL	**2671646**	**18034**	**3199168**	**50820.5**	**8270231**	**168465**

2013 Pigeon Lake Phytoplankton Taxonomy

SWE ID	13SWE07072		13SWE07073		13AWE07074	
Depth (m)	3		5		5	
Date sampled	28-Aug-13		5-Sep-13		19-Sep-13	
LAB ID	BIO-13	BIO-13	BIO-14	BIO-14	BIO-15	BIO-15
	Density (units/L)	Biomass (mg/m^3)	Density (units/L)	Biomass (mg/m^3)	Density (units/L)	Biomass (mg/m^3)
DIATOMS						
Achnanthes minutissima Kuetzing	0	0	0	0	0	0
Asterionella formosa Hansall	0	0	0	0	0	0
Aulacoseira granulata (Ehrenberg) Simonsen	0	0	0	0	0	0
Cyclotella/Stephanodiscus sp	0	0	0	0	0	0
Diatoma tenue C. Agardh	0	0	0	0	0	0
Fragilaria capucina Desmazieres	0	0	0	0	0	0
Fragilaria crotonensis Kitton	76576	351.332	51050	61.2611	51050	41.6575
Gomphonema sp.	0	0	0	0	0	0
Navicula sp	0	0	0	0	0	0
Nitzschia acicularis (Kuetzing) W. Smith	0	0	0	0	0	0
Nitzschia sp	0	0	0	0	0	0
Rhoicosphenia abbreviata (Agardh) Lange-Bertalot	0	0	0	0	0	0
Stephanodiscus niagarae Ehrenberg	0	0	0	0	0	0
Synedra cyclopum Brutschy	0	0	0	0	0	0
Synedra sp (50 um long)	0	0	0	0	0	0
Synedra sp (>50 um long)	0	0	0	0	0	0
CHLOROPHYCEAE						
Ankyra judayi (G.M. Smith) Fott	102101	4.81143	102101	2.88686	25525	0.90214
Ankyra lanceolata (Kors) Fott	76576	3.60857	76576	2.16514	51050	1.44343
Chlorella spp	306305	34.6423	229728	25.9817	229728	25.9817
Chlamydomonas sagitula Skuja	0	0	0	0	0	0
Dictyosphaerium pulchellum Skuja	0	0	0	0	0	0
Elakatothrix genevensis (Reverdin) Hindak	0	0	0	0	0	0
Euastrum insulare (Wittrock) Roy	0	0	0	0	0	0
Eudorina elegans Ehrenberg	0	0	25525	187.111	0	0
Gloeocystis sp	0	0	0	0	0	0
Monoraphidium braunii Naegeli	0	0	0	0	0	0
Monoraphidium griffithii (Berkeley) Komarkova-Legenerova	0	0	0	0	0	0
Oocystis borgei Snow	0	0	51050	6.84293	0	0
Oocystis parva W. & G.S. West	0	0	0	0	0	0
Oocystis pusilla Hansgirg	25525	1.44343	0	0	0	0
Oocystis solitaria Wittrock	0	0	102101	6.84293	0	0
CHRYSOPHYCEAE						
Chromulina sp.	25525	4.33029	153152	51.3219	0	0
Desmarella moniliformis Kent	0	0	0	0	0	0
Dinobryon bavaricum Imhof	0	0	0	0	0	0
Dinobryon divergens Imhof	0	0	0	0	0	0
Dinobryon sp (loose monad)	0	0	0	0	0	0
Dinobryon sociale Ehrenberg	0	0	0	0	0	0
Dinobryon sociale var. *stipitatum* (Stein) Lemmermann	0	0	0	0	0	0
Unidentified naked Chrysophyte sp (*Ochromonas/Chromulina*)-large	204203	57.6303	306305	112.908	561559	158.483
Unidentified naked Chrysophyte sp (*Ochromonas/Chromulina*)-small	102101	0.85537	229728	5.41286	102101	2.40572
Haptophyte *(Erkenia/Chrysochromulina)*	76576	0.64152	331830	2.77994	76576	0.64152
Kephyrion sp	0	0	0	0	0	0
Mallomonas pseudocoronata Prescott	0	0	0	0	0	0
Mallomonas sp	0	0	0	0	0	0
Monosiga varians Skuja	25525	0.21384	0	0	25525	0.60143
Ochromonas sp	0	0	0	0	0	0
Ochromonas sp	25525	7.20378	0	0	0	0
Pedinella sp	0	0	0	0	0	0
Spiniferomonas bourrellyi Takahashi	0	0	0	0	0	0
Stichogloea globosa Starmach	0	0	0	0	0	0
Stylococcus sp	0	0	0	0	0	0
Uroglena sp	76576	5.77372	127627	10.6921	0	0

2013 Pigeon Lake Phytoplankton Taxonomy

SWE ID	13SWE07072		13SWE07073		13AWE07074	
Depth (m)	3		5		5	
Date sampled	28-Aug-13		5-Sep-13		19-Sep-13	
LAB ID	BIO-13	BIO-13	BIO-14	BIO-14	BIO-15	BIO-15
	Density (units/L)	Biomass (mg/m^3)	Density (units/L)	Biomass (mg/m^3)	Density (units/L)	Biomass (mg/m^3)
CRYPTOPHYCEAE						
Cryptomonas erosa Ehrenberg	25525	108.15	178678	718.507	76576	251.478
Cryptomonas marssonii Skuja	25525	35.5779	127627	120.286	0	0
Cryptomonas pyrenoidifera Geitler	0	0	0	0	0	0
Cryptomonas reflexa Skuja	0	0	25525	73.3476	51050	100.078
Cryptomonas rostratiformis Skuja	0	0	0	0	25525	267.302
Katablepharis ovalis Skuja	255254	21.3841	689186	51.9635	459457	34.6423
Rhodomonas minuta Skuja	612610	56.4541	893390	140.334	433932	62.4818
CYANOBACTERIA						
Anabaena circinalis Rabenhorst	51050	403.412	76576	2108.74	0	0
Anabaena flos-aquae Brebisson	0	0	0	0	51050	3012.49
Anabaena mendotae Trelease	229728	559.409	127627	88.958	76576	164.23
Anabaena solitaria Klebahn	0	0	25525	2673.02	25525	2673.02
Anabaena sp.	0	0	0	0	0	0
Aphanocapsa delicatissima West & West	0	0	25525	53.4604	0	0
Aphanizomenon flos-aquae (Linne) Ralfs	7402377	123951	1.06E+07	301871	4135121	94598.8
Aphanocapsa rivularis (Carm.) Rabenhorst	0	0	0	0	102101	69.2846
Aphanocapsa sp	0	0	0	0	0	0
Aphanothece nidulans P. Richter	0	0	25525	24.0572	0	0
Aphanothece sp	0	0	0	0	0	0
Synechocystis sp (bi-cell)-spherical	0	0	0	0	76576	1.62386
Gloeotrichia echinulata (J.E. Smith) Richter	0	0	0	0	0	0
Limnothrix rosea (Utermohl) Meffert	76576	24.0572	331830	137.126	178678	18.0429
Limnothrix sp	25525	16.0381	51050	9.62286	51050	12.4295
Merismopedia tenuissima Lemmermann	0	0	0	0	0	0
Microcystis aeruginosa Kuetzing	0	0	0	0	25525	1732.12
Microcystis ichthyoblabe Kuetzing	0	0	0	0	25525	32.0762
Phormidium sp	0	0	0	0	0	0
Planktothrix agardhii Gomont	0	0	0	0	0	0
Romeria chlorina Bocher	0	0	0	0	0	0
Romeria chlorina Bocher	0	0	0	0	0	0
Romeria leopoliensis (Raciborski) Koczwara ex. Geitler	0	0	0	0	0	0
Synechococcus sp (unicell)-rod	25525	0.40095	0	0	0	0
DINOPHYCEAE						
Ceratium hirundinella (O.F. Muller) Schrank	0	0	5105	261.956	5105	433.029
TOTAL	**9852809**	**125648**	**14988522**	**308809**	**6922486**	**103695**

Appendix 7-2
2013 Pigeon Lake Microcystin Content

2013 Pigeon Lake Microcystin Content

Site Name/Descrip	WDS Station	Group Sample No.	Sample No.	Date	Total Microcystin (ug/L)
Pigeon Lake	AB05FA0480	13SWE02792	13SWE02793	5-Jun-13	0.07
Pigeon Lake	AB05FA0480	13SWE02832	13SWE02833	16-Jun-13	0.12
Pigeon Lake	AB05FA0480	13SWE06630	13SWE06631	26-Jun-13	0.07
Pigeon Lake	AB05FA0480	13SWE06652	13SWE06653	4-Jul-13	0.08
Pigeon Lake	AB05FA0480	13SWE06601	13SWE06602	18-Jun-13	0.05
Pigeon Lake	AB05FA0480	13SWE06683	13SWE06684	10-Jul-13	0.07
Pigeon Lake	AB05FA0480	13SWE06712	13SWE06713	17-Jul-13	0.10
Pigeon Lake	AB05FA0480	13SWE06742	13SWE06741	24-Jul-13	0.10
Pigeon Lake	AB05FA0480	13SWE06763	13SWE06764	29-Jul-13	0.07
Pigeon Lake	AB05FA0480	13SWE06793	13SWE06794	8-Aug-13	0.06
Pigeon Lake	AB05FA0480	13SWE06912	13SWE06913	14-Aug-13	0.09
Pigeon Lake	AB05FA0480	13SWE06961	13SWE06962	22-Aug-13	0.09
Pigeon Lake	AB05FA0480	13SWE06982	13SWE06983	28-Aug-13	0.11
Pigeon Lake	AB05FA0480	13SWE07011	13SWE07012	5-Sep-13	0.11
Pigeon Lake	AB05FA0480	13SWE07045	13SWE07046	19-Sep-13	0.83

Appendix 7-3
2013 Pigeon Lake Cyanobacteria Bloom Chemistry

2013 Pigeon Lake Cyanobacteria Bloom Chemistry

Lab Sample	Date	Total Nitrogen	Total Boron	Total Calcium	Total Copper	Total Iron	Total Potassium	Total Magnesium	Total Sodium	Total Phosphorus	Total Sulfur	Total Zinc	Total Manganese	Total Carbon	Moisture	Dry Weight	Wet Sample Weight
		%	mg/kg	%	mg/kg	mg/kg	%	%	mg/kg	mg/kg	%	mg/kg	mg/kg	%	%	g	g
L1353859-1	22-Aug-13	8.65	29.1	0.726	7.9	856	0.709	0.208	1620	2570	0.514	7.7	52.2	44.9	97.1	32.5	1130
L1358458-1	28-Aug-13	8.89	30.6	1.32	7.3	433	0.873	0.196	2080	3150	0.956	8.2	182	47.2	96	41.8	1050

Appendix 7-4
2013 Pigeon Lake Zooplankton Taxonomy

2013 Pigeon Lake Zooplankton Taxonomy

Lake:	Pigeon
Project No.	ABS115
Station No.	AB05FA0490
Sample No.	13SWE06942
Sample Date:	5-Jun-13
Sample Time:	10:15
Euphotic depth (m):	9
Volume of Water Sampled	93.482
# of Hauls	1
Date Counted:	23-Sep-13
Rotifer Sample	
Total Volume (mL)	10
Subsample volume (mL)	1
Crustacea	
Total Volume (mL)	10
Subsample volume (mL)	4

Species	Total # Counted in subsample	Sample Abundance	Abundance/L	Total Biomass (µg/L)	Mean Length (mm)	Mean Width (mm)	Max Length (mm)	Min Length (mm)	Mean Individual Biovolume (mm^3)	Total Biovolume (mm^3/L)	Ln (L)	Lnα	β	Source
Rotifera														
Ascomorpha sp.	18	180	1.926	5.644E-11	0.13		0.16	0.11	0.00029311	0.000564				McCauley 1984
Asplanchna sp.	2	5	0.053	6.895E-11	0.52		0.67	0.38	0.03305583	0.001768				McCauley 1984
Conochilus (Conochiloides) dossuarius	1	10	0.107	9.529E-12	0.15	0.15	0.15	0.15	0.0008908	0.000095				McCauley 1984
Conochilus sp.	14	140	1.498	2.149E-11	0.10	0.07	0.16	0.07	0.00014347	0.000215				McCauley 1984
Gastropus sp.	5	50	0.535	1.609E-11	0.11		0.13	0.09	0.0003008	0.000161				McCauley 1984
Kellikottia longispina	1	10	0.107	1.354E-12	0.16		0.16	0.16	0.00012661	0.000014				McCauley 1984
Keratella quadrata	87	870	9.307	7.219E-10	0.15		0.16	0.14	0.00077571	0.007219				McCauley 1984
Keratella hiemalis	47	470	5.028	1.987E-10	0.12		0.13	0.11	0.00039517	0.001987				McCauley 1984
Keratella cochlearis	1007	10070	107.721	1.132E-09	0.17		0.19	0.15	0.00010512	0.011324				McCauley 1984
Keratella earlinae	135	1350	14.441	2.453E-10	0.20		0.23	0.18	0.00016984	0.002453				McCauley 1984
Polyarthra sp.	43	430	4.600	2.303E-10	0.12		0.14	0.09	0.00050077	0.002303				McCauley 1984
Pompholyx complanata	13	130	1.391	1.993E-11	0.10		0.10	0.09	0.00014332	0.000199				McCauley 1984
Trichocerca multicrinis	2	20	0.214	1.976E-11	0.18	0.10	0.18	0.17	0.00092379	0.000198				McCauley 1984
Trichocerca similis	9	90	0.963	2.310E-11	0.15	0.05	0.16	0.15	0.00023993	0.000231				McCauley 1984
Trichocerca sp.	14	140	1.498	1.548E-11	0.09	0.05	0.10	0.07	0.00010338	0.000155				McCauley 1984
Cladocerans														
Chydorus sphaericus	2	5	0.053	0.03	0.27		0.31	0.24			-1.2953	4.493	3.93	Dum75
Daphnia pulex	16	40	0.428	5.35	1.45		2.32	1.00			0.3702	1.478	2.83	Bot76
Leptodora kindtii	1	1	0.011	0.11	3.28		3.28	3.28			1.1878	-0.821	2.67	Ros81
Calanoida														
Leptodiaptomus sicilis	6	15	0.160	2.99	1.50		1.57	1.38			0.4055	1.953	2.40	Bot76
Cyclopoida														
Diacyclops thomasi	52	130	1.391	11.14	1.05		1.31	0.95			0.0533	1.953	2.40	Bot76
Mesocyclops edax	5	13	0.134	1.50	1.21		1.55	0.98			0.1942	1.953	2.40	Bot76
Juvenile Copepodids/Cladocera														
Calanoid Juvenile	1070	2675	28.615	101.91	0.75		0.98	0.38			-0.2845	1.953	2.40	Bot76
Cyclopoid Juvenile	1219	3048	32.600	36.45	0.46		0.71	0.40			-0.7673	1.953	2.40	Bot76
Daphnia sp. (juvenile)	89	223	2.380	4.42	0.74		0.90	0.62			-0.3037	1.478	2.83	Bot76
Nauplii	514	1285	13.746	2.22	0.21		0.29	0.14			-1.5743	1.953	2.40	Bot76

Total Individuals Counted	4372
Total Rotifer Abundance	13965
Total Crustacea Abundance	204
Total Abundance (Rotifers+Crustacea)	14169
Total Number of Species - Rotifera	15
Total Number of Species - Crustacea	6
Richness (S)	21

2013 Pigeon Lake Zooplankton Taxonomy

Lake:	Pigeon
Project No.	ABS115
Station No.	AB05FA0490
Sample No.	13SWE06943
Sample Date:	16-Jun-13
Sample Time:	12:30
Euphotic depth (m):	8.5
Volume of Water Sampled	88.289
# of Hauls	1
Date Counted:	2-Dec-13
Rotifer Sample	
Total Volume (mL)	5
Subsample volume (mL)	4
Crustacea	
Total Volume (mL)	5
Subsample volume (mL)	5

Species	Total # Counted in subsample	Sample Abundance	Abundance/L	Total Biomass (µg/L)	Mean Length (mm)	Mean Width (mm)	Max Length (mm)	Min Length (mm)	Mean Individual Biovolume (mm^3)	Total Biovolume (mm^3/L)	Ln (L)	Lnα	β	Source
Rotifera														
Ascomorpha sp.	2	3	0.028	6.737E-13	0.13		0.13	0.12	0.00023793	0.000007				McCauley 1984
Conochilus (Conochiloides) dossuarius	1	1	0.014	4.484E-13	0.12	0.10	0.12	0.12	0.00031673	0.000004				McCauley 1984
Conochilus sp.	7	9	0.099	1.217E-12	0.08	0.07	0.10	0.07	0.00012276	0.000012				McCauley 1984
Gastropus sp.	17	21	0.241	5.186E-12	0.10		0.13	0.08	0.00021546	0.000052				McCauley 1984
Kellikottia longispina	9	11	0.127	1.160E-12	0.14		0.15	0.13	9.1025E-05	0.000012				McCauley 1984
Keratella quadrata	73	91	1.034	7.237E-11	0.14		0.16	0.12	0.00070021	0.000724				McCauley 1984
Keratella hiemalis	18	23	0.255	1.059E-11	0.12		0.13	0.10	0.00041543	0.000106				McCauley 1984
Keratella cochlearis	1456	1820	20.614	1.714E-10	0.16		0.18	0.14	8.3161E-05	0.001714				McCauley 1984
Keratella earlinae	145	181	2.053	2.996E-11	0.19		0.21	0.17	0.00014596	0.000300				McCauley 1984
Notholca foliacea	6	8	0.085	6.631E-13	0.13		0.14	0.12	7.806E-05	0.000007				McCauley 1984
Notholca squamala	4	5	0.057	3.699E-13	0.12		0.13	0.12	6.5314E-05	0.000004				McCauley 1984
Notholca sp.	1	1	0.014	1.105E-13	0.13		0.13	0.13	7.806E-05	0.000001				McCauley 1984
Polyarthra sp.	24	30	0.340	1.574E-11	0.11		0.13	0.10	0.00046323	0.000157				McCauley 1984
Pompholyx complanata	23	29	0.326	5.578E-12	0.10		0.12	0.09	0.00017129	0.000056				McCauley 1984
Synchaeta sp.	1	1	0.014	1.048E-13	0.09		0.09	0.09	7.4005E-05	0.000001				McCauley 1984
Trichocerca multicrinis	2	3	0.028	2.541E-12	0.17	0.10	0.18	0.16	0.00089739	0.000025				McCauley 1984
Trichocerca similis	19	24	0.269	8.507E-12	0.16	0.06	0.18	0.14	0.00031624	0.000085				McCauley 1984
Trichocerca sp.	5	6	0.071	5.273E-13	0.08	0.04	0.09	0.07	7.4494E-05	0.000005				McCauley 1984
Cladocerans														
Ceriodaphnia sp.	1	1	0.011	0.01	0.38		0.38	0.38			-0.9555	2.562	3.34	Bot76
Daphnia pulex	3	3	0.034	0.69	1.72		1.88	1.48			0.5423	1.478	2.83	Bot76
Cyclopoida														
Diacyclops thomasi	11	11	0.125	0.87	1.00		1.24	0.86			-0.0048	1.953	2.40	Bot76
Mesocyclops edax	2	2	0.023	0.25	1.20		1.43	0.98			0.1843	1.953	2.40	Bot76
Juvenile Copepodids/Cladocera														
Calanoid Juvenile	103	103	1.167	4.05	0.74		1.02	0.46			-0.2955	1.953	2.40	Bot76
Cyclopoid Juvenile	188	188	2.129	5.24	0.64		1.02	0.36			-0.4388	1.953	2.40	Bot76
Daphnia sp. (juvenile)	2	2	0.023	0.06	0.84		0.92	0.76			-0.1744	1.478	2.83	Bot76
Nauplii	111	111	1.257	0.07	0.13		0.17	0.11			-2.0352	1.953	2.40	Bot76

Total Individuals Counted	2234
Total Rotifer Abundance	2266
Total Crustacea Abundance	17
Total Abundance (Rotifers+Crustacea)	2283
Total Number of Species - Rotifera	18
Total Number of Species - Crustacea	4
Richness (S)	22

2013 Pigeon Lake Zooplankton Taxonomy

Lake:	Pigeon
Project No.	ABS115
Station No.	AB05FA0490
Sample No.	13SWE06944
Sample Date:	18-Jun-13
Sample Time:	8:10
Euphotic depth (m):	7.5
Volume of Water Sampled	77.902
# of Hauls	1
Date Counted:	30-Nov-13
Rotifer Sample	
Total Volume (mL)	10
Subsample volume (mL)	1
Crustacea	
Total Volume (mL)	10
Subsample volume (mL)	5

Species	**Total # Counted in subsample**	**Sample Abundance**	**Abundance/L**	**Total Biomass (µg/L)**	**Mean Length (mm)**	**Mean Width (mm)**	**Max Length (mm)**	**Min Length (mm)**	**Mean Individual Biovolume (mm^3)**	**Total Biovolume (mm^3/L)**	**Ln (L)**	**Lnα**	**β**	**Source**
Rotifera														
Ascomorpha sp.	1	10	0.128	7.683E-12	0.17		0.17	0.17	0.00059849	0.000077				McCauley 1984
Asplanchna sp.	3	6	0.077	4.834E-11	0.41		0.49	0.37	0.01609201	0.001239				McCauley 1984
Conochilus sp.	47	470	6.033	1.225E-10	0.16	0.07	0.27	0.11	0.00020305	0.001225				McCauley 1984
Gastropus sp.	45	450	5.777	1.038E-10	0.10		0.12	0.07	0.00017963	0.001038				McCauley 1984
Keratella quadrata	87	870	11.168	8.150E-10	0.15		0.16	0.12	0.0007298	0.008150				McCauley 1984
Keratella hiemalis	6	60	0.770	3.253E-11	0.12		0.13	0.11	0.00042234	0.000325				McCauley 1984
Keratella cochlearis	3007	30070	385.999	2.918E-09	0.16		0.17	0.13	7.5606E-05	0.029184				McCauley 1984
Keratella earlinae	301	3010	38.638	5.381E-10	0.19		0.21	0.18	0.00013926	0.005381				McCauley 1984
Notholca foliacea	4	40	0.513	3.354E-12	0.12		0.13	0.12	6.5314E-05	0.000034				McCauley 1984
Notholca squamala	20	200	2.567	1.656E-11	0.12		0.14	0.11	6.4518E-05	0.000166				McCauley 1984
Notholca sp.	1	10	0.128	7.881E-13	0.12		0.12	0.12	6.1396E-05	0.000008				McCauley 1984
Polyarthra sp.	39	390	5.006	2.319E-10	0.11		0.16	0.10	0.00046323	0.002319				McCauley 1984
Pompholyx complanata	31	310	3.979	5.880E-11	0.10		0.10	0.09	0.00014775	0.000588				McCauley 1984
Trichocerca multicrinis	2	20	0.257	2.764E-11	0.19	0.11	0.20	0.17	0.00107667	0.000276				McCauley 1984
Trichocerca similis	32	320	4.108	1.241E-10	0.16	0.06	0.18	0.14	0.00030216	0.001241				McCauley 1984
Trichocerca sp.	14	140	1.797	1.292E-11	0.08	0.04	0.10	0.07	7.1876E-05	0.000129				McCauley 1984
Cladocerans														
Ceriodaphnia sp.	3	6	0.077	0.06	0.43		0.55	0.36			-0.8473	2.562	3.34	Bot76
Chydorus sphaericus	6	12	0.154	0.05	0.24		0.31	0.21			-1.4229	4.493	3.93	Dum75
Daphnia pulex	32	64	0.822	8.74	1.37		2.04	1.00			0.3133	1.478	2.83	Bot76
Leptodora kindtii	1	1	0.013	0.07	2.56		2.56	2.56			0.94	-0.821	2.67	Ros81
Calanoida														
Leptodiaptomus sicilis	1	2	0.026	0.35	1.31		1.31	1.31			0.2697	1.953	2.40	Bot76
Cyclopoida														
Acanthocyclops vernalis	3	6	0.077	0.35	0.83		0.86	0.81			-0.1823	1.953	2.40	Bot76
Diacyclops thomasi	236	472	6.059	36.86	0.94		1.17	0.83			-0.0614	1.953	2.40	Bot76
Mesocyclops edax	8	16	0.205	2.60	1.28		1.43	1.10			0.2443	1.953	2.40	Bot76
Juvenile Copepodids/Cladocera														
Calanoid Juvenile	1228	2456	31.527	119.23	0.77		0.95	0.62			-0.2595	1.953	2.40	Bot76
Cyclopoid Juvenile	1522	3044	39.075	89.57	0.63		1.02	0.40			-0.4681	1.953	2.40	Bot76
Daphnia sp. (juvenile)	39	78	1.001	2.27	0.79		0.92	0.72			-0.2332	1.478	2.83	Bot76
Nauplii	522	1044	13.402	1.07	0.15		0.21	0.12			-1.8659	1.953	2.40	Bot76

Total Individuals Counted	7241
Total Rotifer Abundance	36376

2013 Pigeon Lake Zooplankton Taxonomy

Lake:	Pigeon
Project No.	ABS115
Station No.	AB05FA0490
Sample No.	13SWE06945
Sample Date:	26-Jun-13
Sample Time:	9:10
Euphotic depth (m):	8.5
Volume of Water Sampled	88.289
# of Hauls	1
Date Counted:	9-Dec-13
Rotifer Sample	
Total Volume (mL)	10
Subsample volume (mL)	1
Crustacea	
Total Volume (mL)	10
Subsample volume (mL)	2

Species	Total # Counted in subsample	Sample Abundance	Abundance/L	Total Biomass (μg/L)	Mean Length (mm)	Mean Width (mm)	Max Length (mm)	Min Length (mm)	Mean Individual Biovolume (mm^3)	Total Biovolume (mm^3/L)	Ln (L)	Lnα	β	Source
Rotifera														
Ascomorpha sp.	3	30	0.340	5.024E-12	0.11		0.11	0.10	0.00014784	0.000050				McCauley 1984
Asplanchna sp.	3	15	0.170	7.416E-11	0.37		0.45	0.31	0.01119154	0.001901				McCauley 1984
Conochilus sp.	649	6490	73.509	1.902E-09	0.18	0.07	0.31	0.12	0.00025871	0.019018				McCauley 1984
Gastropus sp.	87	870	9.854	2.001E-10	0.10		0.12	0.09	0.00020303	0.002001				McCauley 1984
Keratella quadrata	68	680	7.702	4.154E-10	0.13		0.15	0.12	0.00053934	0.004154				McCauley 1984
Keratella hiemalis	15	150	1.699	6.885E-11	0.12		0.13	0.11	0.00040522	0.000688				McCauley 1984
Keratella cochlearis	3591	71820	813.469	5.686E-09	0.15		0.16	0.13	6.9902E-05	0.056863				McCauley 1984
Keratella earlinae	367	3670	41.568	4.840E-10	0.18		0.20	0.16	0.00011644	0.004840				McCauley 1984
Notholca michiganensis	10	100	1.133	7.673E-12	0.12		0.13	0.11	6.7743E-05	0.000077				McCauley 1984
Polyarthra sp.	16	160	1.812	9.310E-11	0.12		0.14	0.10	0.00051372	0.000931				McCauley 1984
Pompholyx complanata	71	710	8.042	1.153E-10	0.10		0.11	0.08	0.00014332	0.001153				McCauley 1984
Trichocerca multicrinis	7	70	0.793	7.354E-11	0.18	0.10	0.19	0.16	0.00092756	0.000735				McCauley 1984
Trichocerca similis	13	130	1.472	5.029E-11	0.16	0.06	0.18	0.14	0.00034151	0.000503				McCauley 1984
Trichocerca sp.	7	70	0.793	5.070E-12	0.08	0.04	0.09	0.07	6.3949E-05	0.000051				McCauley 1984
Cladocerans														
Ceriodaphnia sp.	2	10	0.113	0.13	0.49		0.50	0.48			-0.7172	2.562	3.34	Bot76
Chydorus sphaericus	3	15	0.170	0.10	0.28		0.31	0.26			-1.2809	4.493	3.93	Dum75
Daphnia pulex	17	85	0.963	17.00	1.64		2.16	1.24			0.4923	1.478	2.83	Bot76
Leptodora kindtii	2	2	0.023	1.59	6.68		10.71	2.64			1.8989	-0.821	2.67	Ros81
Cyclopoida														
Diacyclops thomasi	160	800	9.061	59.24	0.97		1.12	0.81			-0.0314	1.953	2.40	Bot76
Mesocyclops edax	4	20	0.227	2.64	1.23		1.38	0.90			0.2088	1.953	2.40	Bot76
Juvenile Copepodids/Cladocera														
Calanoid Juvenile	731	3655	41.398	216.70	0.88		1.05	0.64			-0.1241	1.953	2.40	Bot76
Cyclopoid Juvenile	557	2785	31.544	71.00	0.62		0.93	0.36			-0.4757	1.953	2.40	Bot76
Daphnia sp. (juvenile)	57	285	3.228	5.33	0.71		0.88	0.60			-0.3453	1.478	2.83	Bot76
Nauplii	455	2275	25.768	1.44	0.13		0.19	0.10			-2.0149	1.953	2.40	Bot76

Total Individuals Counted	6895
Total Rotifer Abundance	84965
Total Crustacea Abundance	932
Total Abundance (Rotifers+Crustacea)	85897
Total Number of Species - Rotifera	14
Total Number of Species - Crustacea	6
Richness (S)	20

Note:
K. cochlearis estimated after 0.5mls

2013 Pigeon Lake Zooplankton Taxonomy

Lake:	Pigeon
Project No.	ABS115
Station No.	AB05FA0490
Sample No.	13SWE06946
Sample Date:	4-Jul-13
Sample Time:	11:15
Euphotic depth (m):	9
Volume of Water Sampled	93.482
# of Hauls	1
Date Counted:	27-Nov-13
Rotifer Sample	
Total Volume (mL)	10
Subsample volume (mL)	1
Crustacea	
Total Volume (mL)	10
Subsample volume (mL)	2

Species	Total # Counted in subsample	Sample Abundance	Abundance/L	Total Biomass (µg/L)	Mean Length (mm)	Mean Width (mm)	Max Length (mm)	Min Length (mm)	Mean Individual Biovolume (mm^3)	Total Biovolume (mm^3/L)	Ln (L)	Lnα	β	Source
Rotifera														
Ascomorpha sp.	2	20	0.214	3.469E-12	0.11		0.11	0.11	0.00016214	0.000035				McCauley 1984
Asplanchna sp.	1	5	0.053	1.119E-11	0.29		0.29	0.29	0.00536443	0.000287				McCauley 1984
Conochilus sp.	1518	15180	162.384	3.096E-09	0.18	0.06	0.29	0.14	0.00019066	0.030960				McCauley 1984
Gastropus sp.	88	880	9.414	1.691E-10	0.10		0.11	0.08	0.00017963	0.001691				McCauley 1984
Keratella quadrata	34	340	3.637	1.706E-10	0.13		0.14	0.10	0.00046909	0.001706				McCauley 1984
Keratella cochlearis	2884	28840	308.509	2.288E-09	0.15		0.19	0.13	7.4152E-05	0.022877				McCauley 1984
Keratella earlinae	175	1750	18.720	1.968E-10	0.17		0.19	0.14	0.00010512	0.001968				McCauley 1984
Notholca squamala	5	50	0.535	3.122E-12	0.12		0.12	0.11	5.8377E-05	0.000031				McCauley 1984
Polyarthra sp.	29	290	3.102	1.155E-10	0.11		0.17	0.08	0.00037239	0.001155				McCauley 1984
Pompholyx complanata	235	2350	25.139	3.079E-10	0.09		0.10	0.07	0.00012248	0.003079				McCauley 1984
Synchaeta sp.	2	20	0.214	2.891E-12	0.11		0.12	0.10	0.00013512	0.000029				McCauley 1984
Trichocerca multicrinis	28	280	2.995	2.703E-10	0.18	0.10	0.20	0.16	0.00090241	0.002703				McCauley 1984
Trichocerca similis	7	70	0.749	1.909E-11	0.17	0.05	0.20	0.15	0.00025493	0.000191				McCauley 1984
Trichocerca sp.	1	10	0.107	6.324E-13	0.07	0.04	0.07	0.07	5.9122E-05	0.000006				McCauley 1984
Cladocerans														
Chydorus sphaericus	2	10	0.107	0.04	0.25		0.29	0.21			-1.3863	4.493	3.93	Dum75
Daphnia pulex	64	320	3.423	44.82	1.47		2.20	1.00			0.3866	1.478	2.83	Bot76
Diaphanosoma sp.	5	25	0.267	1.17	0.95		1.32	0.56			-0.0492	1.624	3.05	Bot76
Leptodora kindtii	3	3	0.032	3.05	7.49		9.54	6.15			2.0132	-0.821	2.67	Ros81
Cyclopoida														
Acanthocyclops vernalis	1	5	0.053	0.63	1.24		1.24	1.24			0.2136	1.953	2.40	Bot76
Diacyclops thomasi	176	880	9.414	55.55	0.93		1.19	0.81			-0.0741	1.953	2.40	Bot76
Mesocyclops edax	5	25	0.267	2.78	1.18		1.36	0.95			0.1623	1.953	2.40	Bot76
Juvenile Copepodids/Cladocera														
Calanoid Juvenile	728	3640	38.938	187.10	0.85		1.19	0.60			-0.1597	1.953	2.40	Bot76
Cyclopoid Juvenile	516	2580	27.599	90.99	0.73		0.93	0.52			-0.3167	1.953	2.40	Bot76
Daphnia sp. (juvenile)	21	105	1.123	2.97	0.84		0.96	0.60			-0.1791	1.478	2.83	Bot76
Nauplii	1193	5965	63.809	6.56	0.17		0.26	0.10			-1.7615	1.953	2.40	Bot76

Total Individuals Counted	7723
Total Rotifer Abundance	50085
Total Crustacea Abundance	1268
Total Abundance (Rotifers+Crustacea)	51353
Total Number of Species - Rotifera	14
Total Number of Species - Crustacea	7
Richness (S)	21

2013 Pigeon Lake Zooplankton Taxonomy

Lake:	Pigeon
Project No.	ABS115
Station No.	AB05FA0490
Sample No.	13SWE06947
Sample Date:	10-Jul-13
Sample Time:	8:30
Euphotic depth (m):	8
Volume of Water Sampled	83.095
# of Hauls	1
Date Counted:	9-Dec-13
Rotifer Sample	
Total Volume (mL)	10
Subsample volume (mL)	4
Crustacea	
Total Volume (mL)	10
Subsample volume (mL)	4

Species	Total # Counted in subsample	Sample Abundance	Abundance/L	Total Biomass (µg/L)	Mean Length (mm)	Mean Width (mm)	Max Length (mm)	Min Length (mm)	Mean Individual Biovolume (mm^3)	Total Biovolume (mm^3/L)	Ln (L)	Lnα	β	Source
Rotifera														
Ascomorpha sp.	8	20	0.241	3.771E-12	0.11		0.12	0.10	0.00015668	0.000038				McCauley 1984
Conochilus sp.	437	1093	13.148	2.032E-10	0.12	0.07	0.17	0.09	0.00015456	0.002032				McCauley 1984
Gastropus sp.	33	83	0.993	2.203E-11	0.10		0.11	0.09	0.00022186	0.000220				McCauley 1984
Keratella quadrata	16	40	0.481	2.656E-11	0.13		0.16	0.12	0.00055169	0.000266				McCauley 1984
Keratella hiemalis	1	3	0.030	1.219E-12	0.12		0.12	0.12	0.00040522	0.000012				McCauley 1984
Keratella cochlearis	1085	2713	32.643	1.979E-10	0.14		0.17	0.13	6.0625E-05	0.001979				McCauley 1984
Keratella earlinae	36	90	1.083	1.392E-11	0.19		0.20	0.16	0.00012855	0.000139				McCauley 1984
Polyarthra sp.	12	30	0.361	9.678E-12	0.10		0.10	0.09	0.00026807	0.000097				McCauley 1984
Pompholyx complanata	153	383	4.603	7.009E-11	0.10		0.11	0.09	0.00015227	0.000701				McCauley 1984
Trichocerca multicrinis	6	15	0.181	1.469E-11	0.17	0.10	0.19	0.14	0.0008139	0.000147				McCauley 1984
Trichocerca similis	19	48	0.572	1.497E-11	0.16	0.06	0.18	0.15	0.00026188	0.000150				McCauley 1984
Cladocerans														
Daphnia pulex	39	98	1.173	29.43	1.85		2.76	1.00			0.6163	1.478	2.83	Bot76
Diaphanosoma sp.	3	8	0.090	0.10	0.61		0.68	0.56			-0.4888	1.624	3.05	Bot76
Leptodora kindtii	1	1	0.012	0.34	4.77		4.77	4.77			1.5622	-0.821	2.67	Ros81
Calanoida														
Leptodiaptomus sicilis	1	3	0.030	0.48	1.40		1.40	1.40			0.3399	1.953	2.40	Bot76
Cyclopoida														
Acanthocyclops vernalis	10	25	0.301	1.62	0.89		1.17	0.71			-0.1133	1.953	2.40	Bot76
Diacyclops thomasi	135	338	4.062	21.26	0.88		1.12	0.69			-0.1241	1.953	2.40	Bot76
Mesocyclops edax	2	5	0.060	0.92	1.38		1.38	1.38			0.3228	1.953	2.40	Bot76
Juvenile Copepodids/Cladocera														
Calanoid Juvenile	583	1458	17.540	74.47	0.81		1.12	0.67			-0.2113	1.953	2.40	Bot76
Cyclopoid Juvenile	474	1185	14.261	42.36	0.70		0.86	0.57			-0.3601	1.953	2.40	Bot76
Daphnia sp. (juvenile)	26	65	0.782	2.15	0.85		0.96	0.80			-0.1649	1.478	2.83	Bot76
Nauplii	220	550	6.619	0.30	0.12		0.17	0.10			-2.1084	1.953	2.40	Bot76

Total Individuals Counted	3300
Total Rotifer Abundance	4515
Total Crustacea Abundance	476
Total Abundance (Rotifers+Crustacea)	4991
Total Number of Species - Rotifera	11
Total Number of Species - Crustacea	7
Richness (S)	18

2013 Pigeon Lake Zooplankton Taxonomy

Lake:	Pigeon
Project No.	ABS115
Station No.	AB05FA0490
Sample No.	13SWE06948
Sample Date:	17-Jul-13
Sample Time:	9:00
Euphotic depth (m):	8.5
Volume of Water Sampled	88.289
# of Hauls	1
Date Counted:	24-Sep-13
Rotifer Sample	
Total Volume (mL)	5
Subsample volume (mL)	2
Crustacea	
Total Volume (mL)	10
Subsample volume (mL)	4

Species	Total # Counted in subsample	Sample Abundance	Abundance/L	Total Biomass (µg/L)	Mean Length (mm)	Mean Width (mm)	Max Length (mm)	Min Length (mm)	Mean Individual Biovolume (mm^3)	Total Biovolume (mm^3/L)	Ln (L)	Lnα	β	Source
Rotifera														
Ascomorpha sp.	11	28	0.311	5.923E-12	0.12		0.13	0.10	0.00019015	0.000059				McCauley 1984
Conochilus sp.	333	833	9.429	1.151E-10	0.10	0.07	0.14	0.08	0.00012204	0.001151				McCauley 1984
Gastropus sp.	7	18	0.198	5.150E-12	0.11		0.12	0.09	0.00025984	0.000052				McCauley 1984
Keratella quadrata	6	15	0.170	1.215E-11	0.15		0.16	0.13	0.0007149	0.000121				McCauley 1984
Keratella hiemalis	1	3	0.028	1.147E-12	0.12		0.12	0.12	0.00040522	0.000011				McCauley 1984
Keratella cochlearis	258	645	7.306	4.712E-11	0.15		0.17	0.11	6.4493E-05	0.000471				McCauley 1984
Keratella earlinae	8	20	0.227	2.796E-12	0.18		0.20	0.17	0.00012341	0.000028				McCauley 1984
Polyarthra sp.	87	218	2.464	6.815E-11	0.10		0.10	0.09	0.00027663	0.000681				McCauley 1984
Pompholyx complanata	63	158	1.784	2.479E-11	0.10		0.10	0.09	0.00013898	0.000248				McCauley 1984
Trichocerca multicrinis	16	40	0.453	3.626E-11	0.17	0.10	0.19	0.15	0.00080037	0.000363				McCauley 1984
Trichocerca similis	17	43	0.481	1.104E-11	0.17	0.05	0.18	0.14	0.00022929	0.000110				McCauley 1984
Cladocerans														
Chydorus sphaericus	1	3	0.028	0.01	0.21		0.21	0.21			-1.5404	4.493	3.93	Dum75
Daphnia mendotae	1	3	0.028	0.70	1.84		1.84	1.84			0.6098	1.478	2.83	Bot76
Daphnia pulex	45	113	1.274	33.34	1.88		3.00	1.04			0.6313	1.478	2.83	Bot76
Diaphanosoma sp.	6	15	0.170	0.48	0.83		1.28	0.52			-0.1904	1.624	3.05	Bot76
Cyclopoida														
Diacyclops thomasi	99	248	2.803	12.85	0.84		1.00	0.76			-0.1795	1.953	2.40	Bot76
Mesocyclops edax	2	5	0.057	0.56	1.15		1.43	0.88			0.1439	1.953	2.40	Bot76
Juvenile Copepodids/Cladocera														
Calanoid Juvenile	452	1130	12.799	77.87	0.94		1.19	0.76			-0.0614	1.953	2.40	Bot76
Cyclopoid Juvenile	163	408	4.616	15.46	0.73		0.86	0.48			-0.3102	1.953	2.40	Bot76
Daphnia sp. (juvenile)	32	80	0.906	2.52	0.85		0.96	0.72			-0.1602	1.478	2.83	Bot76
Nauplii	147	368	4.162	0.29	0.15		0.19	0.10			-1.9294	1.953	2.40	Bot76

Total Individuals Counted	1755
Total Rotifer Abundance	2018
Total Crustacea Abundance	385
Total Abundance (Rotifers+Crustacea)	2403
Total Number of Species - Rotifera	11
Total Number of Species - Crustacea	6
Richness (S)	17

2013 Pigeon Lake Zooplankton Taxonomy

Lake:	Pigeon
Project No.	ABS115
Station No.	AB05FA0490
Sample No.	13SWE06949
Sample Date:	24-Jul-13
Sample Time:	8:50
Euphotic depth (m):	8
Volume of Water Sampled	83.095
# of Hauls	1
Date Counted:	13-Dec-13
Rotifer Sample	
Total Volume (mL)	5
Subsample volume (mL)	5
Crustacea	
Total Volume (mL)	5
Subsample volume (mL)	3

Species	Total # Counted in subsample	Sample Abundance	Abundance/L	Total Biomass (µg/L)	Mean Length (mm)	Mean Width (mm)	Max Length (mm)	Min Length (mm)	Mean Individual Biovolume (mm^3)	Total Biovolume (mm^3/L)	Ln (L)	Lnα	β	Source
Rotifera														
Ascomorpha sp.	29	29	0.349	5.659E-12	0.11		0.12	0.10	0.00016214	0.000057				McCauley 1984
Asplanchna sp.	1	2	0.020	9.947E-12	0.38		0.38	0.38	0.01271569	0.000255				McCauley 1984
Conochilus sp.	384	384	4.621	7.378E-11	0.12	0.07	0.15	0.09	0.00015966	0.000738				McCauley 1984
Euchlanis dilatata	2	2	0.024	1.051E-12	0.16		0.19	0.13	0.0004366	0.000011				McCauley 1984
Keratella quadrata	4	4	0.048	4.204E-12	0.16		0.17	0.15	0.00087325	0.000042				McCauley 1984
Keratella hiemalis	1	1	0.012	4.877E-13	0.12		0.12	0.12	0.00040522	0.000005				McCauley 1984
Keratella cochlearis	72	72	0.866	6.425E-12	0.15		0.19	0.14	7.4152E-05	0.000064				McCauley 1984
Keratella earlinae	7	7	0.084	1.070E-12	0.19		0.20	0.16	0.00012707	0.000011				McCauley 1984
Lepadella sp.	1	1	0.012	1.283E-13	0.10		0.10	0.10	0.00010659	0.000001				McCauley 1984
Polyarthra sp.	11	11	0.132	4.523E-12	0.10		0.12	0.09	0.00034166	0.000045				McCauley 1984
Pompholyx complanata	138	138	1.661	2.100E-11	0.09		0.10	0.07	0.00012648	0.000210				McCauley 1984
Trichocerca multicrinis	4	4	0.048	4.227E-12	0.18	0.10	0.18	0.16	0.00087818	0.000042				McCauley 1984
Trichocerca similis	54	54	0.650	1.661E-11	0.17	0.05	0.18	0.14	0.00025552	0.000166				McCauley 1984
Cladocerans														
Daphnia pulex	126	210	2.527	37.05	1.53		2.64	0.88			0.4266	1.478	2.83	Bot76
Diaphanosoma sp.	2	3	0.040	0.05	0.62		0.64	0.60			-0.478	1.624	3.05	Bot76
Cyclopoida														
Acanthocyclops vernalis	3	5	0.060	0.30	0.87		1.00	0.69			-0.1449	1.953	2.40	Bot76
Diacyclops thomasi	43	72	0.862	4.01	0.84		0.98	0.74			-0.1738	1.953	2.40	Bot76
Mesocyclops edax	1	2	0.020	0.09	0.83		0.83	0.83			-0.1823	1.953	2.40	Bot76
Juvenile Copepodids/Cladocera														
Calanoid Juvenile	506	843	10.149	63.26	0.95		1.17	0.83			-0.0513	1.953	2.40	Bot76
Cyclopoid Juvenile	60	100	1.203	4.69	0.78		0.93	0.62			-0.2472	1.953	2.40	Bot76
Daphnia sp. (juvenile)	60	100	1.203	3.63	0.88		0.96	0.72			-0.1324	1.478	2.83	Bot76
Nauplii	165	275	3.309	0.17	0.13		0.14	0.10			-2.0513	1.953	2.40	Bot76

Total Individuals Counted	1674
Total Rotifer Abundance	709
Total Crustacea Abundance	292
Total Abundance (Rotifers+Crustacea)	1000
Total Number of Species - Rotifera	13
Total Number of Species - Crustacea	5
Richness (S)	18

2013 Pigeon Lake Zooplankton Taxonomy

Lake:	Pigeon
Project No.	ABS115
Station No.	AB05FA0490
Sample No.	13SWE06950
Sample Date:	29-Jul-13
Sample Time:	8:40
Euphotic depth (m):	8
Volume of Water Sampled	83.095
# of Hauls	1
Date Counted:	15-Dec-13
Rotifer Sample	
Total Volume (mL)	10
Subsample volume (mL)	2.5
Crustacea	
Total Volume (mL)	10
Subsample volume (mL)	3

Species	Total # Counted in subsample	Sample Abundance	Abundance/L	Total Biomass (µg/L)	Mean Length (mm)	Mean Width (mm)	Max Length (mm)	Min Length (mm)	Mean Individual Biovolume (mm^3)	Total Biovolume (mm^3/L)	Ln (L)	Lnα	β	Source
Rotifera														
Ascomorpha sp.	58	232	2.792	5.447E-11	0.12		0.13	0.10	0.00019511	0.000545				McCauley 1984
Asplanchna sp.	6	20	0.241	1.157E-10	0.38		0.43	0.31	0.01232245	0.002966				McCauley 1984
Conochilus sp.	98	392	4.717	5.217E-11	0.11	0.06	0.15	0.06	0.00011059	0.000522				McCauley 1984
Keratella cochlearis	21	84	1.011	7.496E-12	0.15		0.17	0.14	7.4152E-05	0.000075				McCauley 1984
Keratella earlinae	1	4	0.048	7.819E-13	0.20		0.20	0.20	0.00016242	0.000008				McCauley 1984
Polyarthra sp.	63	252	3.033	1.162E-10	0.11		0.14	0.09	0.00038303	0.001162				McCauley 1984
Pompholyx complanata	69	276	3.321	4.068E-11	0.09		0.10	0.08	0.00012248	0.000407				McCauley 1984
Synchaeta sp.	4	16	0.193	2.783E-12	0.11		0.14	0.09	0.00014454	0.000028				McCauley 1984
Trichocerca multicrinis	6	24	0.289	2.276E-11	0.16	0.10	0.17	0.14	0.00078812	0.000228				McCauley 1984
Trichocerca similis	23	92	1.107	2.863E-11	0.17	0.05	0.18	0.15	0.0002586	0.000286				McCauley 1984
Trichotria sp.	1	4	0.048	1.743E-12	0.14	0.07	0.14	0.14	0.00036212	0.000017				McCauley 1984
Cladocerans														
Daphnia pulex	142	473	5.696	68.45	1.43		2.40	1.08			0.3563	1.478	2.83	Bot76
Diaphanosoma sp.	17	57	0.682	1.73	0.80		1.32	0.48			-0.2282	1.624	3.05	Bot76
Cyclopoida														
Diacyclops thomasi	40	133	1.605	6.76	0.81		0.95	0.71			-0.2143	1.953	2.40	Bot76
Mesocyclops edax	1	3	0.040	0.14	0.74		0.74	0.74			-0.3037	1.953	2.40	Bot76
Juvenile Copepodids/Cladocera														
Calanoid Juvenile	641	2137	25.714	132.00	0.88		1.19	0.71			-0.1322	1.953	2.40	Bot76
Cyclopoid Juvenile	54	180	2.166	3.20	0.52		0.76	0.29			-0.6512	1.953	2.40	Bot76
Daphnia sp. (juvenile)	38	127	1.524	4.59	0.88		0.96	0.76			-0.1324	1.478	2.83	Bot76
Nauplii	255	850	10.229	0.57	0.13		0.21	0.10			-2.0149	1.953	2.40	Bot76

Total Individuals Counted	1538
Total Rotifer Abundance	1396
Total Crustacea Abundance	667
Total Abundance (Rotifers+Crustacea)	2063
Total Number of Species - Rotifera	11
Total Number of Species - Crustacea	4
Richness (S)	15

2013 Pigeon Lake Zooplankton Taxonomy

Lake:	Pigeon
Project No.	ABS115
Station No.	AB05FA0490
Sample No.	13SWE06951
Sample Date:	8-Aug-13
Sample Time:	7:40
Euphotic depth (m):	8.5
Volume of Water Sampled	88.289
# of Hauls	1
Date Counted:	25-Sep-13
Rotifer Sample	
Total Volume (mL)	
Subsample volume (mL)	
Crustacea	
Total Volume (mL)	
Subsample volume (mL)	

Species	Total # Counted in subsample	Sample Abundance	Abundance/L	Total Biomass (µg/L)	Mean Length (mm)	Mean Width (mm)	Max Length (mm)	Min Length (mm)	Mean Individual Biovolume (mm^3)	Total Biovolume (mm^3/L)	Ln (L)	Lnα	β	Source
Rotifera														
Cladocerans														
Calanoida														
Cyclopoida														
Juvenile Copepodids/Cladocera														

Note:
Sample was degraded could not analyze

2013 Pigeon Lake Zooplankton Taxonomy

Lake:	Pigeon
Project No.	ABS115
Station No.	AB05FA0490
Sample No.	13SWE06952
Sample Date:	14-Aug-13
Sample Time:	9:05
Euphotic depth (m):	9
Volume of Water Sampled	93.482
# of Hauls	1
Date Counted:	17-Dec-13
Rotifer Sample	
Total Volume (mL)	10
Subsample volume (mL)	1
Crustacea	
Total Volume (mL)	10
Subsample volume (mL)	2

Species	Total # Counted in subsample	Sample Abundance	Abundance/L	Total Biomass (µg/L)	Mean Length (mm)	Mean Width (mm)	Max Length (mm)	Min Length (mm)	Mean Individual Biovolume (mm^3)	Total Biovolume (mm^3/L)	Ln (L)	Lnα	β	Source
Rotifera														
Ascomorpha sp.	133	1330	14.227	2.568E-10	0.11		0.15	0.10	0.00018048	0.002568				McCauley 1984
Asplanchna sp.	7	35	0.374	1.958E-10	0.39		0.55	0.31	0.01340912	0.005020				McCauley 1984
Conochilus sp.	482	4820	51.561	6.102E-10	0.14	0.06	0.21	0.11	0.00011834	0.006102				McCauley 1984
Euchlanis dilatata	1	10	0.107	1.576E-11	0.24		0.24	0.24	0.00147351	0.000158				McCauley 1984
Gastropus sp.	12	120	1.284	2.029E-11	0.09		0.10	0.07	0.0001581	0.000203				McCauley 1984
Keratella quadrata	3	30	0.321	2.065E-11	0.14		0.16	0.13	0.00064347	0.000206				McCauley 1984
Keratella hiemalis	1	10	0.107	3.339E-12	0.11		0.11	0.11	0.00031212	0.000033				McCauley 1984
Keratella cochlearis	89	890	9.521	8.371E-11	0.16		0.18	0.14	8.7927E-05	0.000837				McCauley 1984
Keratella earlinae	6	60	0.642	1.042E-11	0.20		0.22	0.18	0.00016242	0.000104				McCauley 1984
Ploesoma hudsoni	2	20	0.214	2.851E-10	0.39	0.21	0.41	0.36	0.01332419	0.002851				McCauley 1984
Polyarthra sp.	228	2280	24.390	1.221E-09	0.12		0.17	0.10	0.00050077	0.012214				McCauley 1984
Pompholyx complanata	173	1730	18.506	3.079E-10	0.10		0.11	0.10	0.00016639	0.003079				McCauley 1984
Synchaeta sp.	1	10	0.107	1.321E-11	0.23		0.23	0.23	0.00123513	0.000132				McCauley 1984
Trichocerca multicrinis	10	100	1.070	8.173E-11	0.17	0.09	0.19	0.15	0.00076402	0.000817				McCauley 1984
Trichocerca similis	172	1720	18.399	4.774E-10	0.18	0.05	0.19	0.13	0.00025949	0.004774				McCauley 1984
Cladocerans														
Bosmina sp.	4	20	0.214	0.05	0.23		0.24	0.21			-1.4864	3.09	3.04	Bot76
Ceriodaphnia sp.	1	5	0.053	0.02	0.33		0.33	0.33			-1.0986	2.562	3.34	Bot76
Chydorus sphaericus	6	30	0.321	0.06	0.21		0.26	0.17			-1.5782	4.493	3.93	Dum75
Daphnia pulex	68	340	3.637	41.32	1.40		1.72	1.20			0.3365	1.478	2.83	Bot76
Diaphanosoma sp.	118	590	6.311	19.09	0.84		1.24	0.52			-0.1696	1.624	3.05	Bot76
Leptodora kindtii	2	2	0.021	1.60	6.85		8.62	5.08			1.9237	-0.821	2.67	Ros81
Calanoida														
Leptodiaptomus sicilis	11	55	0.588	7.18	1.26		1.36	1.07			0.2288	1.953	2.40	Bot76
Cyclopoida														
Diacyclops thomasi	12	60	0.642	3.38	0.89		1.02	0.69			-0.1214	1.953	2.40	Bot76
Mesocyclops edax	1	5	0.053	0.24	0.83		0.83	0.83			-0.1823	1.953	2.40	Bot76
Juvenile Copepodids/Cladocera														
Calanoid Juvenile	174	870	9.307	60.13	0.96		1.10	0.88			-0.0364	1.953	2.40	Bot76
Cyclopoid Juvenile	215	1075	11.500	7.18	0.36		0.48	0.29			-1.0098	1.953	2.40	Bot76
Daphnia sp. (juvenile)	14	70	0.749	0.52	0.52		0.57	0.45			-0.6512	1.478	2.83	Bot76
Nauplii	454	2270	24.283	1.09	0.12		0.17	0.10			-2.1084	1.953	2.40	Bot76

Total Individuals Counted	2400
Total Rotifer Abundance	13165
Total Crustacea Abundance	1107
Total Abundance (Rotifers+Crustacea)	14272
Total Number of Species - Rotifera	15
Total Number of Species - Crustacea	9
Richness (S)	24

2013 Pigeon Lake Zooplankton Taxonomy

Lake:	Pigeon
Project No.	ABS115
Station No.	AB05FA0490
Sample No.	13SWE07067
Sample Date:	22-Aug-13
Sample Time:	9:15
Euphotic depth (m):	8
Volume of Water Sampled	83.095
# of Hauls	1
Date Counted:	20-Dec-13
Rotifer Sample	
Total Volume (mL)	10
Subsample volume (mL)	1
Crustacea	
Total Volume (mL)	10
Subsample volume (mL)	4

Species	Total # Counted in subsample	Sample Abundance	Abundance/L	Total Biomass (µg/L)	Mean Length (mm)	Mean Width (mm)	Max Length (mm)	Min Length (mm)	Mean Individual Biovolume (mm^3)	Total Biovolume (mm^3/L)	Ln (L)	Lnα	β	Source
Rotifera														
Ascomorpha sp.	6	60	0.722	2.871E-11	0.15		0.19	0.11	0.00039758	0.000287				McCauley 1984
Conochilus sp.	17	170	2.046	2.391E-11	0.12	0.06	0.15	0.08	0.00011687	0.000239				McCauley 1984
Euchlanis dilatata	20	200	2.407	2.807E-10	0.22		0.30	0.15	0.00116622	0.002807				McCauley 1984
Gastropus sp.	11	110	1.324	3.023E-11	0.10		0.13	0.07	0.00022838	0.000302				McCauley 1984
Keratella quadrata	3	30	0.361	2.161E-11	0.14		0.15	0.13	0.00059859	0.000216				McCauley 1984
Keratella cochlearis	56	560	6.739	4.346E-11	0.15		0.17	0.10	6.4493E-05	0.000435				McCauley 1984
Polyarthra sp.	54	540	6.499	2.220E-10	0.10		0.12	0.08	0.00034166	0.002220				McCauley 1984
Pompholyx complanata	49	490	5.897	6.992E-11	0.09		0.10	0.08	0.00011857	0.000699				McCauley 1984
Synchaeta sp.	3	30	0.361	2.788E-11	0.20		0.21	0.18	0.00077219	0.000279				McCauley 1984
Trichocerca multicrinis	12	120	1.444	1.063E-10	0.18	0.09	0.20	0.16	0.00073591	0.001063				McCauley 1984
Trichocerca similis	63	630	7.582	1.765E-10	0.16	0.05	0.17	0.14	0.0002328	0.001765				McCauley 1984
Trichocerca sp.	2	20	0.241	1.423E-12	0.07	0.04	0.07	0.07	5.9122E-05	0.000014				McCauley 1984
Cladocerans														
Ceriodaphnia sp.	17	43	0.511	0.47	0.45		0.71	0.33			-0.7932	2.562	3.34	Bot76
Chydorus sphaericus	4	10	0.120	0.04	0.24		0.29	0.21			-1.4104	4.493	3.93	Dum75
Daphnia mendotae	2	5	0.060	0.29	1.04		1.08	1.00			0.0392	1.478	2.83	Bot76
Daphnia pulex	31	78	0.933	12.03	1.46		2.08	1.00			0.3812	1.478	2.83	Bot76
Diaphanosoma sp.	101	253	3.039	6.36	0.75		1.00	0.60			-0.2904	1.624	3.05	Bot76
Calanoida														
Leptodiaptomus sicilis	19	48	0.572	8.11	1.34		1.50	1.17			0.2912	1.953	2.40	Bot76
Cyclopoida														
Acanthocyclops vernalis	2	5	0.060	0.15	0.64		0.71	0.57			-0.4418	1.953	2.40	Bot76
Diacyclops thomasi	5	13	0.150	0.72	0.85		1.02	0.76			-0.1597	1.953	2.40	Bot76
Mesocyclops edax	1	3	0.030	0.15	0.86		0.86	0.86			-0.1542	1.953	2.40	Bot76
Juvenile Copepodids/Cladocera														
Calanoid Juvenile	151	378	4.543	30.76	0.98		1.19	0.86			-0.0168	1.953	2.40	Bot76
Cyclopoid Juvenile	141	353	4.242	5.54	0.50		0.71	0.33			-0.7027	1.953	2.40	Bot76
Daphnia sp. (juvenile)	7	18	0.211	0.52	0.82		0.96	0.68			-0.2019	1.478	2.83	Bot76
Nauplii	85	213	2.557	0.27	0.17		0.21	0.10			-1.7498	1.953	2.40	Bot76

Total Individuals Counted	862
Total Rotifer Abundance	2960
Total Crustacea Abundance	455
Total Abundance (Rotifers+Crustacea)	3415
Total Number of Species - Rotifera	12
Total Number of Species - Crustacea	9
Richness (S)	21

2013 Pigeon Lake Zooplankton Taxonomy

Lake:	Pigeon
Project No.	ABS115
Station No.	AB05FA0490
Sample No.	13SWE07068
Sample Date:	28-Aug-13
Sample Time:	9:00
Euphotic depth (m):	8.5
Volume of Water Sampled	88.289
# of Hauls	1
Date Counted:	20-Dec-13
Rotifer Sample	
Total Volume (mL)	10
Subsample volume (mL)	1.5
Crustacea	
Total Volume (mL)	10
Subsample volume (mL)	4

Species	Total # Counted in subsample	Sample Abundance	Abundance/L	Total Biomass (μg/L)	Mean Length (mm)	Mean Width (mm)	Max Length (mm)	Min Length (mm)	Mean Individual Biovolume (mm^3)	Total Biovolume (mm^3/L)	Ln (L)	Lnα	β	Source
Rotifera														
Asplanchna sp.	1	3	0.028	1.157E-11	0.36		0.36	0.36	0.01047741	0.000297				McCauley 1984
Conochilus sp.	60	400	4.531	4.901E-11	0.10	0.07	0.18	0.05	0.00010817	0.000490				McCauley 1984
Euchlanis dilatata	7	47	0.529	1.163E-10	0.28		0.31	0.23	0.00219953	0.001163				McCauley 1984
Gastropus sp.	14	93	1.057	2.485E-11	0.11		0.12	0.09	0.00023503	0.000248				McCauley 1984
Keratella quadrata	2	13	0.151	7.780E-12	0.13		0.13	0.13	0.0005152	0.000078				McCauley 1984
Keratella cochlearis	168	1120	12.686	1.178E-10	0.17		0.19	0.15	9.2872E-05	0.001178				McCauley 1984
Keratella earlinae	3	20	0.227	2.834E-12	0.18		0.20	0.16	0.00012511	0.000028				McCauley 1984
Polyarthra sp.	44	293	3.322	1.499E-10	0.11		0.13	0.10	0.00045115	0.001499				McCauley 1984
Pompholyx complanata	97	647	7.324	9.868E-11	0.10		0.10	0.08	0.00013472	0.000987				McCauley 1984
Trichocerca multicrinis	3	20	0.227	1.632E-11	0.16	0.09	0.17	0.14	0.00072042	0.000163				McCauley 1984
Trichocerca similis	30	200	2.265	5.896E-11	0.16	0.06	0.18	0.14	0.00026028	0.000590				McCauley 1984
Trichocerca sp.	1	7	0.076	4.464E-13	0.07	0.04	0.07	0.07	5.9122E-05	0.000004				McCauley 1984
Cladocerans														
Chydorus sphaericus	11	28	0.311	0.10	0.24		0.36	0.17			-1.4251	4.493	3.93	Dum75
Daphnia pulex	21	53	0.595	9.72	1.59		2.08	1.04			0.465	1.478	2.83	Bot76
Diaphanosoma sp.	50	125	1.416	3.42	0.78		1.08	0.48			-0.2433	1.624	3.05	Bot76
Calanoida														
Leptodiaptomus sicilis	66	165	1.869	22.00	1.24		1.40	1.10			0.2136	1.953	2.40	Bot76
Cyclopoida														
Acanthocyclops vernalis	19	48	0.538	2.00	0.77		0.98	0.69			-0.2657	1.953	2.40	Bot76
Diacyclops thomasi	23	58	0.651	2.32	0.75		0.95	0.67			-0.2845	1.953	2.40	Bot76
Juvenile Copepodids/Cladocera														
Calanoid Juvenile	495	1238	14.017	76.25	0.90		1.00	0.79			-0.108	1.953	2.40	Bot76
Cyclopoid Juvenile	115	288	3.256	6.11	0.58		0.71	0.48			-0.5513	1.953	2.40	Bot76
Daphnia sp. (juvenile)	30	75	0.849	1.64	0.75		0.88	0.68			-0.2904	1.478	2.83	Bot76
Nauplii	78	195	2.209	0.08	0.11		0.17	0.07			-2.1901	1.953	2.40	Bot76

Total Individuals Counted	1338
Total Rotifer Abundance	2863
Total Crustacea Abundance	475
Total Abundance (Rotifers+Crustacea)	3338
Total Number of Species - Rotifera	12
Total Number of Species - Crustacea	6
Richness (S)	18

2013 Pigeon Lake Zooplankton Taxonomy

Lake:	Pigeon
Project No.	ABS115
Station No.	AB05FA0490
Sample No.	13SWE07069
Sample Date:	5-Sep-13
Sample Time:	8:45
Euphotic depth (m):	9
Volume of Water Sampled	93.482
# of Hauls	1
Date Counted:	17-Dec-13
Rotifer Sample	
Total Volume (mL)	10
Subsample volume (mL)	1
Crustacea	
Total Volume (mL)	10
Subsample volume (mL)	1

Species	Total # Counted in subsample	Sample Abundance	Abundance/L	Total Biomass (μg/L)	Mean Length (mm)	Mean Width (mm)	Max Length (mm)	Min Length (mm)	Mean Individual Biovolume (mm^3)	Total Biovolume (mm^3/L)	Ln (L)	Lnα	β	Source
Rotifera														
Ascomorpha sp.	3	30	0.321	3.531E-12	0.10		0.10	0.09	0.00011004	0.000035				McCauley 1984
Conochilus sp.	902	9020	96.489	2.624E-09	0.16	0.08	0.25	0.14	0.00027196	0.026241				McCauley 1984
Euchlanis dilatata	20	200	2.139	3.737E-10	0.26		0.28	0.20	0.00174671	0.003737				McCauley 1984
Gastropus sp.	6	60	0.642	1.369E-11	0.10		0.11	0.09	0.00021335	0.000137				McCauley 1984
Kellikottia longispina	4	40	0.428	3.827E-12	0.14		0.15	0.14	8.9446E-05	0.000038				McCauley 1984
Keratella quadrata	8	80	0.856	4.537E-11	0.13		0.14	0.12	0.0005302	0.000454				McCauley 1984
Keratella cochlearis	1827	18270	195.439	1.595E-09	0.16		0.18	0.13	8.1612E-05	0.015950				McCauley 1984
Keratella crassa	20	200	2.139	2.662E-11	0.18		0.19	0.17	0.00012443	0.000266				McCauley 1984
Keratella earlinae	26	260	2.781	3.935E-11	0.19		0.20	0.17	0.00014147	0.000393				McCauley 1984
Polyarthra sp.	50	500	5.349	2.890E-10	0.12		0.17	0.10	0.00054029	0.002890				McCauley 1984
Pompholyx complanata	231	2310	24.711	2.930E-10	0.09		0.10	0.08	0.00011857	0.002930				McCauley 1984
Synchaeta sp.	1	10	0.107	1.445E-12	0.11		0.11	0.11	0.00013512	0.000014				McCauley 1984
Trichocerca multicrinis	39	390	4.172	3.210E-10	0.18	0.09	0.20	0.14	0.00076936	0.003210				McCauley 1984
Trichocerca similis	5	50	0.535	1.313E-11	0.17	0.05	0.19	0.14	0.00024551	0.000131				McCauley 1984
Cladocerans														
Ceriodaphnia sp.	1	10	0.107	0.04	0.33		0.33	0.33			-1.0986	2.562	3.34	Bot76
Chydorus sphaericus	31	310	3.316	1.01	0.24		0.29	0.19			-1.4451	4.493	3.93	Dum75
Daphnia mendotae	1	10	0.107	2.48	1.80		1.80	1.80			0.5878	1.478	2.83	Bot76
Daphnia pulex	20	200	2.139	48.27	1.78		2.12	1.52			0.5789	1.478	2.83	Bot76
Diaphanosoma sp.	95	950	10.162	43.81	0.95		1.36	0.68			-0.0534	1.624	3.05	Bot76
Calanoida														
Leptodiaptomus sicilis	82	820	8.772	100.88	1.23		1.31	1.12			0.2039	1.953	2.40	Bot76
Cyclopoida														
Acanthocyclops vernalis	9	90	0.963	3.99	0.80		1.02	0.69			-0.2212	1.953	2.40	Bot76
Diacyclops thomasi	21	210	2.246	11.16	0.86		1.02	0.76			-0.1459	1.953	2.40	Bot76
Juvenile Copepodids/Cladocera														
Calanoid Juvenile	167	1670	17.864	125.94	1.00		1.12	0.88			0	1.953	2.40	Bot76
Cyclopoid Juvenile	128	1280	13.692	22.05	0.54		0.76	0.33			-0.6153	1.953	2.40	Bot76
Daphnia sp. (juvenile)	26	260	2.781	7.75	0.85		0.96	0.72			-0.1602	1.478	2.83	Bot76
Nauplii	255	2550	27.278	2.52	0.16		0.24	0.10			-1.8061	1.953	2.40	Bot76

Total Individuals Counted	3978
Total Rotifer Abundance	31420
Total Crustacea Abundance	2600
Total Abundance (Rotifers+Crustacea)	34020
Total Number of Species - Rotifera	14
Total Number of Species - Crustacea	8
Richness (S)	22

2013 Pigeon Lake Zooplankton Taxonomy

Lake:	Pigeon
Project No.	ABS115
Station No.	AB05FA0490
Sample No.	13SWE07070
Sample Date:	19-Sep-13
Sample Time:	11:50
Euphotic depth (m):	8.5
Volume of Water Sampled	88.289
# of Hauls	1
Date Counted:	18-Dec-13
Rotifer Sample	
Total Volume (mL)	10
Subsample volume (mL)	2
Crustacea	
Total Volume (mL)	10
Subsample volume (mL)	2

Species	Total # Counted in subsample	Sample Abundance	Abundance/L	Total Biomass (µg/L)	Mean Length (mm)	Mean Width (mm)	Max Length (mm)	Min Length (mm)	Mean Individual Biovolume (mm^3)	Total Biovolume (mm^3/L)	Ln (L)	Lnα	β	Source
Rotifera														
Conochilus sp.	572	2860	32.394	5.258E-10	0.14	0.07	0.16	0.11	0.00016232	0.005258				McCauley 1984
Euchlanis dilatata	7	35	0.396	6.160E-11	0.25		0.30	0.16	0.00155387	0.000616				McCauley 1984
Keratella quadrata	31	155	1.756	9.906E-11	0.13		0.15	0.12	0.00056423	0.000991				McCauley 1984
Keratella hiemalis	2	10	0.113	5.835E-12	0.13		0.13	0.13	0.0005152	0.000058				McCauley 1984
Keratella cochlearis	449	2245	25.428	1.777E-10	0.15		0.18	0.14	6.9902E-05	0.001777				McCauley 1984
Keratella earlinae	10	50	0.566	7.887E-12	0.19		0.21	0.18	0.00013926	0.000079				McCauley 1984
Polyarthra sp.	73	365	4.134	1.412E-10	0.10		0.12	0.09	0.00034166	0.001412				McCauley 1984
Pompholyx complanata	112	560	6.343	7.521E-11	0.09		0.11	0.08	0.00011857	0.000752				McCauley 1984
Trichocerca multicrinis	21	105	1.189	1.010E-10	0.17	0.10	0.19	0.15	0.00084932	0.001010				McCauley 1984
Trichocerca similis	29	145	1.642	4.237E-11	0.17	0.05	0.19	0.13	0.00025801	0.000424				McCauley 1984
Cladocerans														
Ceriodaphnia sp.	1	5	0.057	0.03	0.38		0.38	0.38			-0.9651	2.562	3.34	Bot76
Chydorus sphaericus	17	85	0.963	0.34	0.25		0.29	0.19			-1.4055	4.493	3.93	Dum75
Daphnia mendotae	1	5	0.057	0.54	1.32		1.32	1.32			0.2776	1.478	2.83	Bot76
Daphnia pulex	89	445	5.040	69.61	1.50		2.24	1.08			0.4055	1.478	2.83	Bot76
Diaphanosoma sp.	37	185	2.095	16.72	1.16		1.36	0.84			0.1484	1.624	3.05	Bot76
Leptodora kindtii	1	1	0.011	0.65	6.21		6.21	6.21			1.8269	-0.821	2.67	Ros81
Calanoida														
Leptodiaptomus sicilis	102	510	5.777	50.92	1.10		1.33	0.95			0.0931	1.953	2.40	Bot76
Cyclopoida														
Acanthocyclops vernalis	16	80	0.906	3.48	0.78		0.83	0.71			-0.2534	1.953	2.40	Bot76
Diacyclops thomasi	16	80	0.906	3.85	0.81		0.86	0.71			-0.2113	1.953	2.40	Bot76
Juvenile Copepodids/Cladocera														
Calanoid Juvenile	21	105	1.189	6.39	0.89		0.98	0.79			-0.1133	1.953	2.40	Bot76
Cyclopoid Juvenile	136	680	7.702	17.18	0.62		0.83	0.31			-0.4796	1.953	2.40	Bot76
Daphnia sp. (juvenile)	8	40	0.453	1.19	0.84		0.92	0.68			-0.1803	1.478	2.83	Bot76
Nauplii	205	1025	11.610	0.65	0.13		0.17	0.12			-2.0149	1.953	2.40	Bot76

Total Individuals Counted	1956
Total Rotifer Abundance	6530
Total Crustacea Abundance	1396
Total Abundance (Rotifers+Crustacea)	7926
Total Number of Species - Rotifera	10
Total Number of Species - Crustacea	9
Richness (S)	19