

# Okanagan Lake Collaborative Monitoring Agreement 2013 Summary Report

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**BC Ministry of Environment  
Environmental Protection Division  
Penticton**

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## Executive Summary

Shared stewardship of water resources has been identified as a priority by local governments and the province of BC. To incrementally further this ambition, a Memorandum of Understanding (MOU) between BC Ministry of Environment, the City of Kelowna, Regional District of Central Okanagan and the District of Summerland, established a framework in 2010, for implementing a cost-shared monitoring program of Okanagan Lake. 2011 was the inaugural year for the Collaborative Monitoring Program for Okanagan Lake. A subsequent MOU was signed for 3 years of monitoring (2012-2014). Sampling of Okanagan Lake in 2013 was carried out on 7 dates, 5 through a contract, and 2 as part of the ongoing BC Ministry of Environment spring-fall sampling program on the large Okanagan basin lakes. The data demonstrates that the main body of Okanagan Lake in 2013 met most water quality objectives set for the lake in 2005, with the exception of seasonal secchi in the south basin and spring total nitrogen in the three main lake basins. The data provide important information to a long-term database necessary for guiding Liquid Waste Management Planning within the Okanagan Basin. Contracted sample collection services and laboratory services for 2013, totalled \$20178.99. Since 2014 is the final year of the 3-year MOU, it is recommended that MoE meet with the partner municipalities to discuss the renewal of the sampling program for another 3-year term (2015-2017). Furthermore, it is also recommended to have a synthesis report written of the data collected to date (2011-2014), which will include recommendations for future sampling and the direction of the collaborative sampling program going forward.

## Introduction

### Background and Context:

Living Water Smart, the provinces vision and commitment to ensuring that our water stays healthy and secure for future generations, closely aligns with the guiding principles of the Okanagan Basin Water Boards Okanagan Sustainable Water Strategy. In both, share stewardship is promoted as key to the sustainability of significant BC freshwater resources. Okanagan Lake is arguably the single most important freshwater body to the Okanagan economy. Sustainable long-term management of this common resource requires investment in science-based information to support and inform decisions made by local and provincial governments. In particular, timely and integrated water quality information is fundamental to liquid waste management, as well as drinking water management within the Okanagan basin. Municipal liquid waste management within the Okanagan has benefited from a long history of investment in advanced waste water treatment. Indeed, utilization of the best available control technology to manage municipal effluents places the Okanagan in a leadership position, within BC and Canada. Water science information supports and confirms the success of these investments. Nevertheless, approximately 18 Mm<sup>3</sup>/yr of tertiary effluent is discharged annually to Okanagan Lake, from which approximately 100,000 people obtain some portion of their drinking water. In 2010, the municipal effluent volume was approximately 5% of inflow to Okanagan Lake in a low flow year, and is expected to become a larger proportion as the population grows and climate change potentially provides less effective inflow to the lake. Waste management in the basin has primarily focused on phosphorus removal from municipal effluents in order to prevent eutrophication of the lakes. As the population continues to increase, phosphorus loading is again increasing in some lakes. As the volume of

effluent grows, there is a responsibility for ensuring sufficient information is gathered to understand how and why Okanagan Lake changes over time. To understand the condition of Okanagan Lake in relation to conventional and emerging contaminants, proactive, collaborative and integrated monitoring at the basin level is desirable to ensure sustainability.

Local and provincial agencies have monitored Okanagan Lake quality intermittently over many decades. While this information has been useful, this information was not well integrated and could not specifically address the Okanagan Lake water quality objectives prepared in 2005

([http://www.env.gov.bc.ca/wat/wq/objectives/oklakes\\_update\\_over/index.html](http://www.env.gov.bc.ca/wat/wq/objectives/oklakes_update_over/index.html); Nordin, 2005).

Furthermore, testing of sediments for changes near wastewater outfalls, as an early indicator of impact, has not been carried out to date. Similarly, testing for various emerging contaminants of concern is not possible with the existing resourcing. Without local government collaboration, a comprehensive water quality monitoring and reporting program cannot be accomplished by the Ministry of Environment. To address these issues, a collaborative monitoring and reporting program was established with the City of Kelowna, Regional District of Central Okanagan and the District of Summerland in late-2010.

### **Purpose of Collaborative Monitoring of Okanagan Lake**

The collaborative monitoring program on Okanagan Lake combines resources from three local governments and the province, to provide high quality, integrated, and timely water quality information to guide Liquid Waste Management Planning and manage Okanagan Lake into the future. A primary function of the monitoring is to determine attainment of Okanagan Lake water quality objectives (Appendix A). This function has been made possible through this partnership. Over time, and with the support of other local governments, this program may be expanded to address similar issues on other lakes in the basin, or address emerging issues of common concern.

### **Okanagan Lake Collaborative Monitoring Agreement**

The initial 2010 Memorandum of Understanding (MOU) provided a framework for cost shared collaborative monitoring of Okanagan Lake as developed and signed on October 26, 2010 by the BC Ministry of Environment (MOE), City of Kelowna, Regional District of Central Okanagan and the District of Summerland (Appendix B). The MOU set a 1-year term to the agreement, ending December 31, 2011. The MOU required that a Technical Advisory Group meet to review the results, determine monitoring priorities, disperse any remaining funds, and if mutually agreed, re-negotiate the MOU for a subsequent term. The MOU established an approximate flow proportionate, cost shared budget (\$22,000) for the collection of samples and lab charges associated with the monitoring program necessary to check attainment of the water quality objectives for Okanagan Lake. In early-2012, a 3-year MOU (2012-2014) was signed by all three participating municipalities and the province. This MOU outlined a multi-year monitoring program, following the same protocols as the initial 2011 agreement.

## **Collaborative Monitoring Agreement Implementation - 2012**

### **Sample Collection Contract**

An invitation to quote (ITQ) for sample collection services, was issued on November 28, 2011, to the following suitably qualified local contractors:

1. Larratt Aquatic Consulting, West Kelowna.
2. Okanagan Nation Alliance, West Kelowna.

The contractors submitted comprehensive and competitively priced bids. Larratt Aquatic Consulting provided the lowest priced bid at \$8,315.00. A contract (general service agreement - GS12PNE300) was awarded to Larratt Aquatic Consulting on February 02, 2012 (Appendix C).

### **Sampling Program Implementation**

Ministry of Environment (MOE) staff collected the first (March) and last (September) samples at 4 sites on Okanagan Lake (Figure 1). Larratt Aquatic Consulting collected five monthly samples at the same four sites on Okanagan Lake, as per the contract. A MOE employee observed sample collection on the first date and at the first site, to ensure methods and quality assurance procedures were implemented as per the contract. Samples were shipped on the day of collection to Maxxam Analytics in Burnaby, and data returned to MOE staff in Penticton for collation and quality control checks. All data is stored in the BC MOE database and files, and are available upon request.

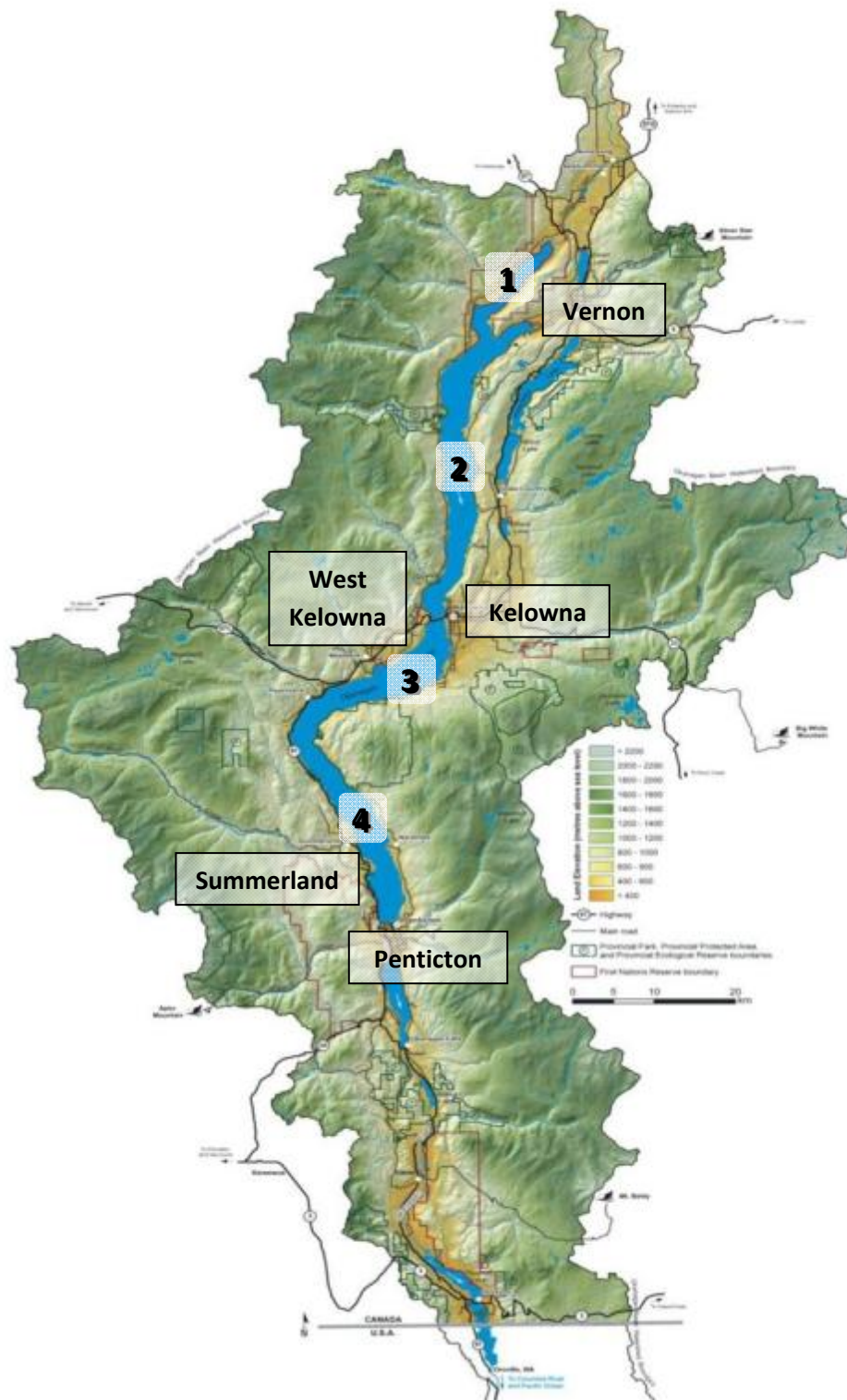


Figure 1. Map of the Okanagan basin watershed, indicating sampling sites in four Okanagan Lake basins. 1 = Armstrong Arm, 2 = Ok Centre (north basin), 3 = Kelowna (central basin), and 4 = Summerland (south basin).  
 Map modified from: Turner, RJW et al., 2006. *Okanagan Basin Waterscape*; Geological Survey of Canada, Miscellaneous report 93.

## Water Quality Objectives Attainment and Seasonal Trends

Water quality samples for nutrients and general ions, phytoplankton chlorophyll-*a*, water clarity, temperature and dissolved oxygen profiles were collected at all 4 sites. This data is summarized in Table 1, and compared against the water quality objectives for Okanagan Lake. All water chemistry data is provided in Appendix D.

Briefly, the water chemistry data demonstrated that Okanagan Lake water quality was good and most water quality objectives were met in 2013. Values were similar to those measured in 2012, except seasonal secchi for the Summerland site, which was below the objective value. On the basis of concentrations of nitrogen, phosphorus, phytoplankton chlorophyll-*a*, and Secchi depth, the main body of Okanagan Lake would be considered oligotrophic, while Armstrong Arm would be considered mesotrophic.

Table 1. Water quality objectives and 2013 attainment for four sites in Okanagan Lake.

<b>Water Quality Objectives</b>					
Lake Site	Seasonal (April-Sept) Secchi (m)	Seasonal (April-Sept) Chl- <i>a</i> (µg/L)	Spring TP (mg/L)	Spring TN (mg/L)	DO @ bottom (mg/L)
Summerland	≥ 7	≤ 4.0	≤ 0.007	≤ 0.230	-
Kelowna	≥ 6	≤ 4.5	≤ 0.008	≤ 0.230	-
Ok Centre	≥ 6	≤ 4.5	≤ 0.008	≤ 0.230	-
Armstrong Arm	≥ 5	≤ 5.0	≤ 0.010	≤ 0.250	≥ 5

<b>2013 Objectives Attainment</b>					
Lake Site	Seasonal (April-Sept) Secchi (m)	Seasonal (April-Sept) Chl- <i>a</i> (µg/L)	Spring TP (mg/L)	Spring TN (mg/L)	DO @ bottom (mg/L)
Summerland	6.55	1.93	0.0041	0.246	-
Kelowna	6.47	2.00	0.0041	0.244	-
Ok Centre	6.82	1.85	0.0063	0.249	-
Armstrong Arm	2.93	2.46	0.0078	0.185	2.78 (Aug) & 1.41 (Sept)

Key: Objective Not Met Objective Met

Seasonal changes in water clarity in Okanagan Lake corresponded in part to changes in algal abundance. Generally, over the growing season, as phytoplankton chlorophyll-*a* increased, Secchi depth decreased (Figure 2). Water clarity was high in the early spring and decreased as algal production increased. Following the spring algae bloom, water clarity became progressively clearer into the fall. Continued collection of chlorophyll-*a* samples and Secchi depth measurements is recommended.



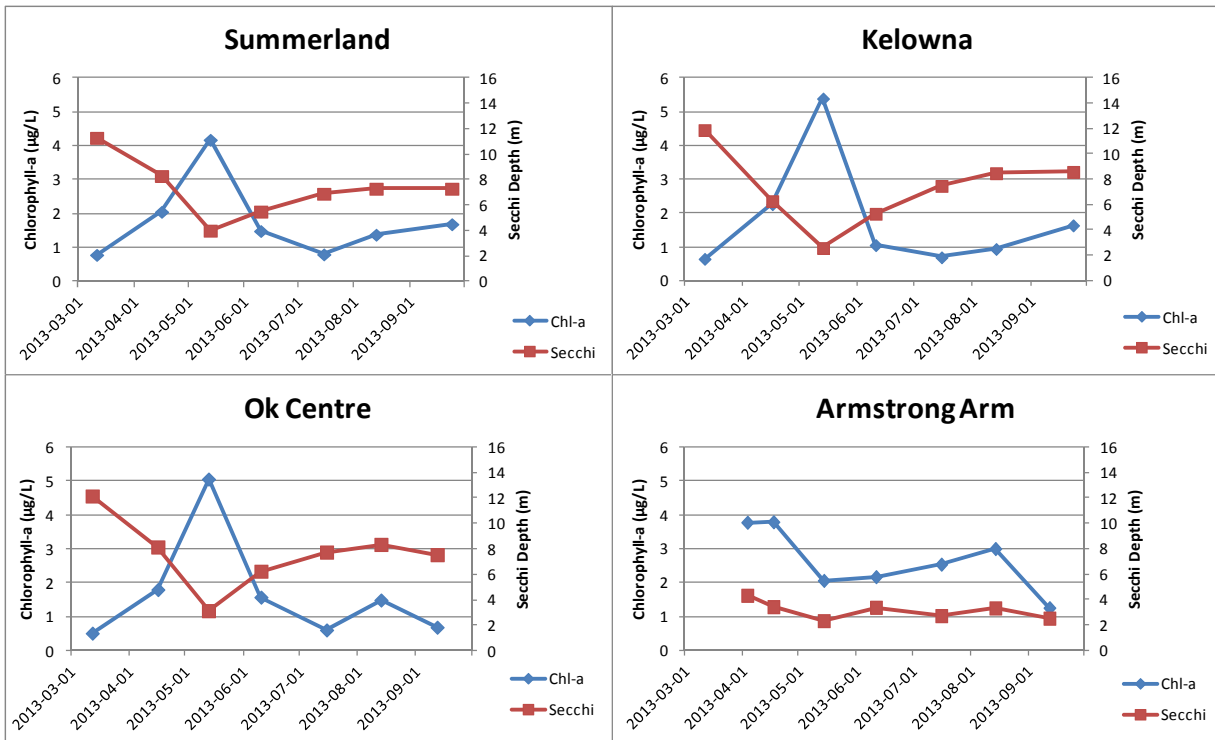


Figure 2. 2013 Secchi Depth and chlorophyll-*a* concentrations at four sites in Okanagan Lake.

Silica concentrations did not vary widely between sites (mean range = 5.7 – 7.2 mg/L), but exhibited seasonal patterns that were most likely related to diatom algae production. Following algal blooms, concentrations of silica were highest in the early spring, then decreased throughout the summer and increased slightly again in September (Appendix E). Continued collection of silica samples is of lower priority, however, financial savings would be minimal.

Phosphorus is a key nutrient in freshwater ecosystems, and concentrations were generally quite low in Okanagan Lake. The three main lake basins exhibited some seasonal variation, with low phosphorus concentrations in March and September, and generally higher levels in April-June (Appendix F). These three basins were similarly low, whereas Armstrong Arm phosphorus concentrations were higher, especially in late-summer/early-fall hypolimnetic waters. Total dissolved phosphorus concentrations and variation were similar to total phosphorus (Appendix D). Ortho-phosphate was generally quite low, with the exception of July to September samples in Armstrong Arm. Continued collection of total phosphorus, total dissolved phosphorus, and ortho-phosphate is recommended.

Like phosphorus, 2013 nitrogen levels in Okanagan Lake were relatively low. Ammonia and NO<sub>2</sub>+NO<sub>3</sub> were low throughout the year, but decreased in the epilimnion following thermal stratification (Appendix G). In the three main basins, total nitrogen was similar to concentrations in 2012, while Armstrong Arm was lower. There was little variation throughout the year, and no discernible trends were observed. Continued collection of all nitrogen species is recommended.

Temperature profiles were similar at all four sites and the seasonal progression exhibited is typical of north temperate lakes. In the spring, the lake was cold and well mixed, and temperatures did not vary much with depth. As the season progressed and air temperatures rose, the lake became thermally stratified with warm water in the epilimnion (upper ~10 m) and relatively cold water in the hypolimnion (below ~20m). Armstrong arm was often slightly warmer than the main lake basins, due to the shallower nature of this part of the lake.

Dissolved oxygen (DO) profiles followed similar seasonal patterns in the south, central and north basins. These basins exhibited orthograde profiles, with high DO concentrations in the spring and decreasing concentrations in the epilimnion as temperatures gradually increased throughout the summer (Figure 3). Conversely, Armstrong Arm is more eutrophic than the other basins and exhibited a clinograde profile. During spring turnover, Armstrong Arm had high DO concentrations and a subsequent depletion of oxygen in the hypolimnion occurred in the summer with increased biological oxidation of organic matter (Figure 3). Continued collection of temperature and dissolved oxygen profiles is recommended.

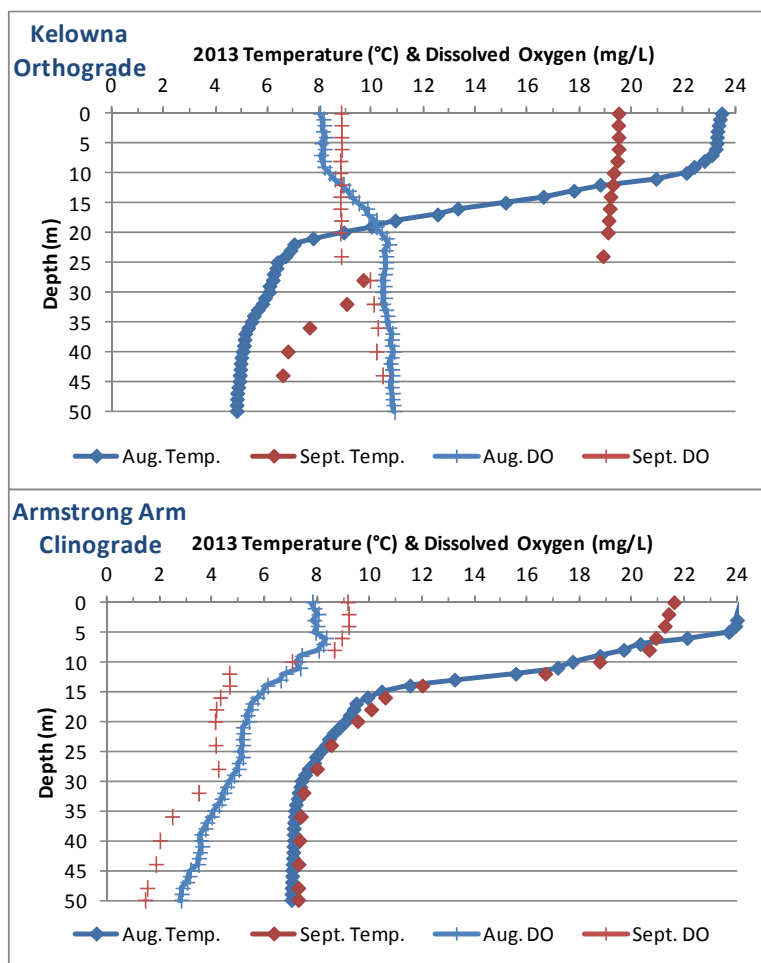


Figure 3. 2013 water column temperature and dissolved oxygen in two Okanagan Lake basins exhibiting orthograde (Kelowna) and clinograde (Armstrong Arm) profiles.

Samples for phytoplankton and zooplankton abundance and taxonomic composition were collected at the central and southern sites (Appendix H). Phytoplankton communities were very diverse with many species present, however, there were only a few species that were most dominant. These communities were quite similar at both sites, with minor seasonal differences in various species abundances. Generally, a successional pattern began with a spring peak of diatoms and flagellates followed by a summer assemblage dominated by cyanophytes which persisted into the fall when diatoms and flagellates typically regained dominance. Total phytoplankton abundance increased steadily from April to June. This was followed by a large reduction in July and August, and a subsequent increase to peak levels in September. This seasonal cycle of algae blooms is consistent with other years. Phytoplankton objectives for Okanagan Lake indicate that less than 5% of the phytoplankton biomass, as growing season (April to September) mean, should be composed of nitrogen-fixing cyanobacteria species (i.e., species with heterocysts). In 2013, both the central and south sites were below this at 3.8% and 3.4%, respectively. In 2011, percentages were almost double (6.4% and 6.6%), however in 2012 the percentages were approximately half (1.5% and 1.4%).

Zooplankton diversity was much lower than phytoplankton, but is comparable to other large lakes in BC. Overall, average total zooplankton abundance was higher in 2013, compared to previous years. Similar zooplankton species were found at both the central and south sites, and were dominated by copepods throughout the year, with cladocerans emerging in late summer and fall. There were differences in abundances throughout the year, as the central site had higher zooplankton abundances in the spring to early-summer, while the south site had higher populations in the late-summer and fall. Another difference between sites is that on average, there were more cladocerans in the central site compared to the south site (a reversal from previous years). Zooplankton objectives for Okanagan Lake indicate that there should be a minimum of 5% by numbers of cladocerans (averaged over the growing season) in the zooplankton community. Both sites were similar in percentage of cladocerans, but neither site achieved the objective with the central site having a value of 4.8%, and the south site with a value of 4.9% (both down from 2012 values of 7.3% and 12%, respectively). The objectives also note that there should be no significant change in dominant species. The dominant species that were present in Okanagan Lake (and have been over the past 30 years) are used as indicators of biological change; these include the calanoid copepod *Leptodiapomus ashlandi*, the cyclopoid copepod *Diacyclops bicuspidatus thomasi* and the cladocerans *Daphnia galeata mendotae*, *Diaphanasoma* and *Bosmina*. These dominant species were found at both sampling sites in 2011 and 2012, and there appears to be no significant changes in 2013.

Along with taxonomy, phytoplankton and zooplankton biomass measurements were also examined in 2012 (Table 2). Average zooplankton biomass in the central basin was more than twice that of the south basin, and both were higher than values in 2012. The zooplankton objective for Okanagan Lake is for a minimum seasonal average biomass of 50 µg/L for the main basin of the lake measured for the top 50 m of the water column. Values in 2013 are well above the objective minimum. Average phytoplankton biomass was quite low and very similar in both basins. The biomass objective for phytoplankton for Okanagan Lake is a maximum of 0.75mm<sup>3</sup>/L (0.75 g/m<sup>3</sup>). This biomass is to be

evaluated as a growing season (April to September) mean for all main basin stations (monthly samples, epilimnetic volume). Values in 2013 are well below the objective maximum.

Table 2. Ash-free dry-mass (g) of 2013 seasonal zooplankton and phytoplankton samples.

AFDM (g)							
Zooplankton	April	May	June	July	August	September	Avg.
<b>Kelowna</b>	0.1932	0.3386	0.0111	0.0340	0.0040	0.0166	<b>0.0996</b>
<b>Summerland</b>	0.0744	0.1167	0.0119	0.0336	0.0050	0.0085	<b>0.0417</b>
Phytoplankton	April	May	June	July	August	September	Avg.
<b>Kelowna</b>	<0.002	<0.002	0.002	0.0163	0.0050	0.0049	<b>0.0071</b>
<b>Summerland</b>	<0.002	<0.002	0.003	0.0122	0.0083	0.0058	<b>0.0073</b>

## Summary of Program Costs

### Sample Collection Contract

Larratt Aquatic Consulting Ltd. sample collection charges were delivered on budget at: \$8,730.75. Refer to Appendix I for copies of individual invoices.

### Laboratory Analysis Costs

- Maxxam analytical costs for water chemistry and chlorophyll-*a* analyses totalled: \$3687.60. A final Year End statement is attached in Appendix J.
- Fraser Environmental costs for phytoplankton and zooplankton analytical costs totalled: \$7,760.64. Refer to Appendix K for copies of individual invoices.

### Summary of Program Costs 2013

A balance of \$1,821.01 remains from the 2013 budget. Refer to Table 3 for a statement of accounts summary. Costs were slightly lower than in 2012, since only GST was charged this year, while costs in 2012 included HST for sample collection and data analyses. The remaining balance can be carried over to future sampling, or could be used towards contracting a summary report. This will be discussed further at the program review meeting while discussing the future MOU.

Table 3. Statement of accounts summary for Okanagan collaborative monitoring agreement, 2013.

Parameter	Supplier	March	April	May	June	July	August	September	Totals
<b>Sample Collection</b>	Larratt Aquatic Consulting	MOE	\$1,746.15	\$1,746.15	\$1,746.15	\$1,746.15	\$1,746.15	MOE	\$8,730.75
<b>Water Chemistry</b>	Maxxam Analytics	MOE	\$672.00	\$835.80	\$672.00	\$835.80	\$672.00	MOE	\$3,687.60
<b>Plankton Analyses</b>	Fraser Environmental	-	\$1,257.44	\$1,257.44	\$1,311.44	\$1,311.44	\$1,311.44	\$1,311.44	\$7,760.64
Grand Total									<b>\$20,178.99</b>
Budget									\$22,000.00
Balance									\$1,821.01

### **MOE In-kind and direct costs**

In 2013, the MOE contributed approximately 95 hours for contract and data management, report writing, and sample collection in spring and fall. Approximately \$1300 was spent on laboratory costs.

### **Recommendations**

- Partners to the MOU are encouraged to post the final version of this report on their web sites and refer to the web site address in their respective annual reports required under appropriate Environmental Management Act authorizations.
- Renewal of the original agreement for a 3-year term was agreed upon in early 2012. This addressed the Ministry's need to ensure continuity and effective program management, and accommodated local governments budgetary time lines. Sampling in 2014 will be the final year of this agreement, and is recommended to remain the same as 2013.
- Since 2014 is the final year of the 3-year MOU, it is recommended to meet and discuss the renewal of the sampling program for another 3-year term (2015-2017) in late-2014 or early-2015.
- It is also recommended to have a synthesis report written of the data collected to date (2011-2014), which should include recommendations for future sampling and the direction of the collaborative sampling program going forward. Since a small surplus remains from the budgets of the past 2 years, this money could be used to help finance a contract to write up this report.

## Appendix A: Okanagan Lake Water Quality Objectives (Nordin, 2005)

	North Basin	Central Basin	South Basin	Armstrong Arm
Secchi disc Transparency (m) (growing season average)	6	6	7	5
Dissolved Oxygen	-	-	-	5 mg/L min in bottom waters
Total Phosphorus (µg/L) (at spring overturn)	8	8	7	10
Chlorophyll-a (µg/L) (growing season average)	4.5	4.5	4	5
Total Nitrogen (µg/L) (maximum)	230	230	230	250
N:P ratio (spring .weight ratio)	>25:1	>25:1	>25:1	>25:1
Phytoplankton Structure (heterocystous cyanobacteria by numbers)	<5%	<5%	<5%	<5%
Phytoplankton growing season average biomass	<0.75 g/m <sup>3</sup>	<0.75 g/ m <sup>3</sup>	<0.75 g/ m <sup>3</sup>	<0.75 g/ m <sup>3</sup>
Zooplankton designated species mix minimum biomass	50 ug/ m <sup>3</sup>	50 ug/ m <sup>3</sup>	50 ug/ m <sup>3</sup>	50 ug/ m <sup>3</sup>
Zooplankton Structure (minimum of cladoceran by numbers)	5%	5%	5%	5%
Contaminants in fish tissue and <i>Mysis</i> tissue	Below human consumption and wildlife protection guidelines	Below human consumption and wildlife protection guidelines	Below human consumption and wildlife protection guidelines	Below human consumption and wildlife protection guidelines

Nordin, R.N. 2005. Water quality objectives for Okanagan Lake, a first update. Prepared for the BC Ministry of Water Land and Air Protection, Penticton, BC. 44p.

## **Appendix B: Memorandum of Understanding 2012-2014**

### **MEMORANDUM OF UNDERSTANDING**

**BETWEEN**

**MINISTRY OF ENVIRONMENT  
GOVERNMENT OF THE PROVINCE OF  
BRITISH COLUMBIA**

**AND**

**THE CITY OF KELOWNA**

**AND**

**THE REGIONAL DISTRICT OF CENTRAL OKANAGAN**

**AND**

**THE DISTRICT OF SUMMERLAND**

***RESPECTING***

***THE Okanagan Lake Collaborative Monitoring Agreement for  
2012-2014***

## MEMORANDUM OF UNDERSTANDING

### *RESPECTING*

### *Okanagan Lake Collaborative Monitoring Agreement* for years **2012 to 2014**

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**BETWEEN:**

Government of the Province of British Columbia  
As Represented by  
Michael Sokal, Impact Assessment Biologist of the  
Environmental Protection Division  
Ministry of Environment

(hereinafter referred to as the “MOE”)

**AND**

City of Kelowna  
As Represented by  
Mike Gosselin, Supervisor Wastewater Treatment Operations

Regional District of Central Okanagan  
As Represented by  
Angela Lambrecht, Water and Wastewater Process Technologist

District of Summerland  
As Represented by  
Kevin McLuskey, Supervisor Wastewater Treatment Operation

(hereinafter referred to as the “local governments”)

**WHEREAS:**

- A. This Memorandum of Understanding (MOU) serves to enable collaboration of the MOE and the local governments to provide high quality, integrated and timely water quality information to enable sustainable environmental management of Okanagan Lake, and inform Liquid Waste Management Planning at the basin level.
- B. The local governments will reimburse the Ministry for costs incurred as described in Section 3 and Appendix 1.

## THE PARTIES AGREE AS FOLLOWS:

### SECTION 1.0

### INTERPRETATION

- 1.1 In this Memorandum of Understanding (MOU) each of the following terms will, unless the context otherwise requires, have the meaning set beside it:
- (a) **"Costs,"** means all costs incurred by the Ministry of Environment to deliver the Collaborative Monitoring and Reporting Program set out in Appendix 1.
  - (b) **"Memorandum of Understanding,"** or **"MOU,"** means this agreement describing the delivery of a collaborative monitoring program on Okanagan Lake.
  - (c) **"MOE"** means Ministry of Environment, for the Province of British Columbia.
  - (d) **"local government"** means the City of Kelowna, Regional District of Central Okanagan, and District of Summerland and designates who are signatories to this MOU.
  - (e) **"Participants"** means representatives of each organization, either MOE or local governments, who are signatories to this MOU.

### SECTION 2.0

### AGREEMENT AUTHORITY

- 2.1 This MOU is entered into by the Ministry of Environment under the authority of the *Environment Management Act, Part 2 Section 14 Permits (1)(c)* allowing MOE to require the permittee (here the local governments) to monitor the effects of the introduction of waste into the environment. Where authorizations, permits or operational certificates under the *Environmental Management Act* enable a discharge to surface water, there is an expectation the discharger will provide monitoring information to demonstrate environmental condition.

## SECTION 3.0

## SUBJECT MATTER

### 3.1 Three Year Collaborative Monitoring and Reporting Program

- 3.1.1 A collaborative monitoring and reporting program is to replace receiving environment monitoring and environmental impact assessment programs required under existing Municipal Sewage Regulation Operational Certificates.
- 3.1.2 Monthly sample and associated field measurement collection from March through September, and analysis of water chemistry for 4 sites and plankton taxonomy for 2 sites on Okanagan Lake as per Appendix 1.
- 3.1.3 Annual reporting of Okanagan Lake trophic status, trends, and attainment of water quality objectives through the MOE or other suitable web sites.

### 3.2 Operational Certificates and Lake Monitoring

- 3.2.1 Lake monitoring requirements under the Operational Certificates ME 12211, PE 11652 and ME 13627 for the City of Kelowna, Regional District of Central Okanagan, and District of Summerland respectively, are waived while the named local governments participate in this Collaborative Monitoring MOU. The MOE will provide written confirmation following MOU sign-off. Other local governments with effluent discharges to Okanagan Lake may become participants under the terms of this MOU.
- 3.2.2 Effluent monitoring requirements and compliance with all other terms and conditions of the Operational Certificates will remain in effect.

### 3.3 Cost Estimates of Program:

- 3.3.1 Costs of this program include laboratory and sample collection costs.
- 3.3.2 Laboratory expenses are as per Appendix 1: \$11,000 (full program 2 sites + 2 sites chemistry only: Okanagan Centre, Armstrong Arm)
- 3.3.3 Sample collection contract: \$11,000
- 3.3.4 Total projected annual costs: \$22,000 (costs based on 18M m3 effluent discharged per year = \$0.0013/m3).

### 3.4 Roles and Responsibilities

- 3.4.1 The Ministry will contribute in-kind costs of program coordination and contract management for sample collection and reporting of results. For 2011, these costs included staff time of approximately 70 hours

(sampling 30, contract prep/monitoring 15, MOU prep 20, meetings 5), and \$500 for laboratory costs.

- 3.4.2 The local governments agree to provide the Ministry with funds sufficient to cover costs as described in Section 5.0 and detailed in Appendix 1.
- 3.4.3 Representatives of MOE and local governments will form a Technical Advisory Group and will meet annually to review actions carried out under this MOU, and adjust the program from year to year as agreed.
- 3.4.4 The Technical Advisory Group may invite input from other agencies or institutions to further the intent of this MOU.

#### **SECTION 4.0                      SECURITY AND CONFIDENTIALITY**

- 4.1 All information and documentation provided to, collected by, delivered to or compiled by ministry employees, in the performance of their duties and responsibilities will be dealt with subject to and in accordance with all applicable provisions of Federal, Provincial and Municipal Statutes, particularly the *Privacy Act*, R.S.C. 1985, c, P-21, and the *Access to Information Act*, R.S.C. 1985, c. A-1, and the *Freedom of Information and Protection of Privacy Act*, R.S.B.C. 2004, c.165.

#### **SECTION 5.0                      BASIS OF PAYMENT**

- 5.1 The local governments will provide the MOE start-up costs for contract services and laboratory services.
- 5.2 Local government share of costs and maximum estimated annual costs are as follows:

City of Kelowna 50% or \$11,000  
Regional District of Central Okanagan 32% or \$7000  
District of Summerland 18% or \$4000

- 5.3 When another municipal effluent discharge routinely occurs to Okanagan Lake, the monitoring requirements and costs will be re-evaluated and re-apportioned.

#### **SECTION 6.0                      METHOD OF PAYMENT**

- 6.1 The local governments are responsible for providing funding in full, as per Section 5, before January 31 of years 2012 to 2014, by way of cheque to the Minister of Finance for British Columbia c/o Senior Financial Officer of Corporate Services Division, Ministry of Environment, 102 Industrial Place, Penticton, BC, V2A 7C8.
- 6.2 The MOE agrees to provide the local governments with a financial statement and an Annual Report.
- 6.3 Surplus funds at the end of the sampling season will be reviewed by the Technical Advisory Group and will be returned to local governments or reallocated through renewal of this MOU for the following year.

#### **SECTION 7.0 LIABILITY**

- 7.1 Each participant and personnel by association, waives all claims against the other participants in respect of damage caused to its personnel and/or its property by personnel or agents (excluding contractors) of that other participant arising out of, or in connection with the implementation of this MOU.
- 7.2 The provisions of sections 7.1 will survive the termination of this MOU for any reason whatsoever.

#### **SECTION 8.0 DISPUTE RESOLUTION**

- 8.1 Any new issue, matter of general concern or dispute arising from this MOU will be dealt with by Technical Advisory Group or their delegates.
- 8.2 The dispute or disagreement will not be submitted to a third party for resolution.

#### **SECTION 9.0 TERM OF AGREEMENT**

- 9.1 This MOU will begin January 31, 2012 and end December 31, 2014.
- 9.2 This MOU may be reviewed annually and amended by mutual written agreement by the Participants to this MOU.
- 9.3 Prior to the termination of this MOU, it may be renewed for an additional period on terms agreed to by participants to this MOU.

- 9.4 Any of the participants to this MOU may terminate participation in this agreement upon provision of sixty (60) days written notice to the other participants of their intention to terminate participation in this MOU.
- 9.5 On the date of termination of this MOU or termination of participation in this agreement, the lake monitoring requirements under local government operational certificates or permits as noted above, are reinstated. Regardless of the reason for termination or the participant who gives notice of termination, the MOE will not have any obligation to the local governments beyond the reimbursement of funds surplus to costs incurred by MOE to the effective date of termination.

## **SECTION 10.0**

## **NOTICE**

- 10.1 All official notices and communications pertinent to implementation of this MOU will be in writing and will be mailed or delivered. For the purposes of delivery of Notice, the addresses for delivery are:

**For MOE**

Ministry of Environment  
Attention: Manager, Environmental Protection Division  
Suite 401, 333 Victoria Street, Nelson B.C. V1L 4K3

**For local governments**

City of Kelowna  
Attention: Mike Gosselin, Supervisor Wastewater Treatment Operations  
951 Raymer Avenue, Kelowna, BC V1Y 4Z7

Regional District of Central Okanagan  
Attention: Angela Lambrecht, Water and Wastewater Technologist  
1450 K.L.O. Road, Kelowna, BC, V1W 3Z4

District of Summerland  
Attention: Kevin McLuskey, Supervisor Wastewater Treatment Operation  
13211 Henry Avenue Box 159 Summerland, BC, V0H 1Z0

- 9 -

**SECTION 11.0**

**SAVING PROVISION**

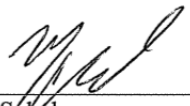
- 11.1 Nothing in this Memorandum of Understanding is in any way intended to replace or amend any obligation that participants are bound to, or required to perform by operation of law, unless otherwise noted in this MOU.

**SECTION 12.0**

**GENERAL**


- 13.1 This MOU reflects the good faith and spirit of cooperation of the participants but is not legally binding on any of the participants.

**Signed on behalf of the MOE:**

  
\_\_\_\_\_  
Michael Sokal  
Ministry of Environment  
Province of British Columbia

Jan. 31/12  
Date

**Signed on behalf of local governments:**

  
\_\_\_\_\_  
Mike Gosselin  
City of Kelowna

JAN 31 2012  
Date

  
\_\_\_\_\_  
Angela Lambrecht  
Regional District of Central Okanagan

Feb 3, 2012  
Date

  
\_\_\_\_\_  
Kevin McLuskey  
District of Summerland

Feb 6 2012  
Date

## Appendix C: General Service Agreement (GS12PNE300) 2012-2014

### GENERAL SERVICE AGREEMENT



<i>For Administrative Purposes Only</i>	
<i>Ministry Contract No.:</i> GS12PNE300	<i>Client:</i> 048
<i>Requisition No.:</i> _____	<i>Responsibility Centre:</i> 294KD
<i>Solicitation No.(if applicable):</i> N/A	<i>Service Line:</i> 30595
<i>Commodity Code:</i>	<i>STOB:</i> 6001
	<i>Project:</i> 2930563
<b><i>Contractor Information</i></b>	
<i>Supplier Name:</i> Larratt Aquatic Consulting Ltd.	
<i>Supplier No.:</i>	
<i>Telephone No.:</i> 250-769-5444	
<i>E-mail Address:</i> heather@larratt.net	
<i>Website:</i>	



## 13 MISCELLANEOUS (Cont.)

## Governing law

- 13.21 This Agreement is governed by, and is to be interpreted and construed in accordance with, the laws applicable in British Columbia.

## 14 INTERPRETATION

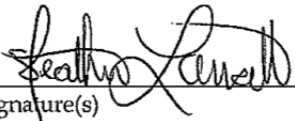

## 14.1 In this Agreement:

- (a) "includes" and "including" are not intended to be limiting;
- (b) unless the context otherwise requires, references to sections by number are to sections of this Agreement;
- (c) the Contractor and the Province are referred to as "the parties" and each of them as a "party";
- (d) "attached" means attached to this Agreement when used in relation to a schedule;
- (e) unless otherwise specified, a reference to a statute by name means the statute of British Columbia by that name, as amended or replaced from time to time;
- (f) the headings have been inserted for convenience of reference only and are not intended to describe, enlarge or restrict the scope or meaning of this Agreement or any provision of it;
- (g) "person" includes an individual, partnership, corporation or legal entity of any nature; and
- (h) unless the context otherwise requires, words expressed in the singular include the plural and *vice versa*.

## 15 EXECUTION AND DELIVERY OF AGREEMENT

- 15.1 This Agreement may be entered into by a separate copy of this Agreement being executed by, or on behalf of, each party and that executed copy being delivered to the other party by a method provided for in section 13.1 or any other method agreed to by the parties.

The parties have executed this Agreement as follows:

<p>SIGNED on the <u>22</u> day of <u>February</u>, 20<u>12</u> by the Contractor (or, if not an individual, on its behalf by its authorized signatory or signatories):</p> <p></p> <p>Signature(s)</p> <p><u>HEATHER LARRATT</u></p> <p>Print Name(s)</p> <p><u>PRESIDENT</u></p> <p>Print Title(s)</p>	<p>SIGNED on the <u>22</u> day of <u>February</u>, 20<u>12</u> on behalf of the Province by its duly authorized representative:</p> <p></p> <p>Signature</p> <p><u>Robyn Roome, Manager</u></p> <p>Print Name(s)</p> <p><u>Environmental Protection Division</u></p> <p><u>Penticton</u></p> <p>Print Title(s)</p>
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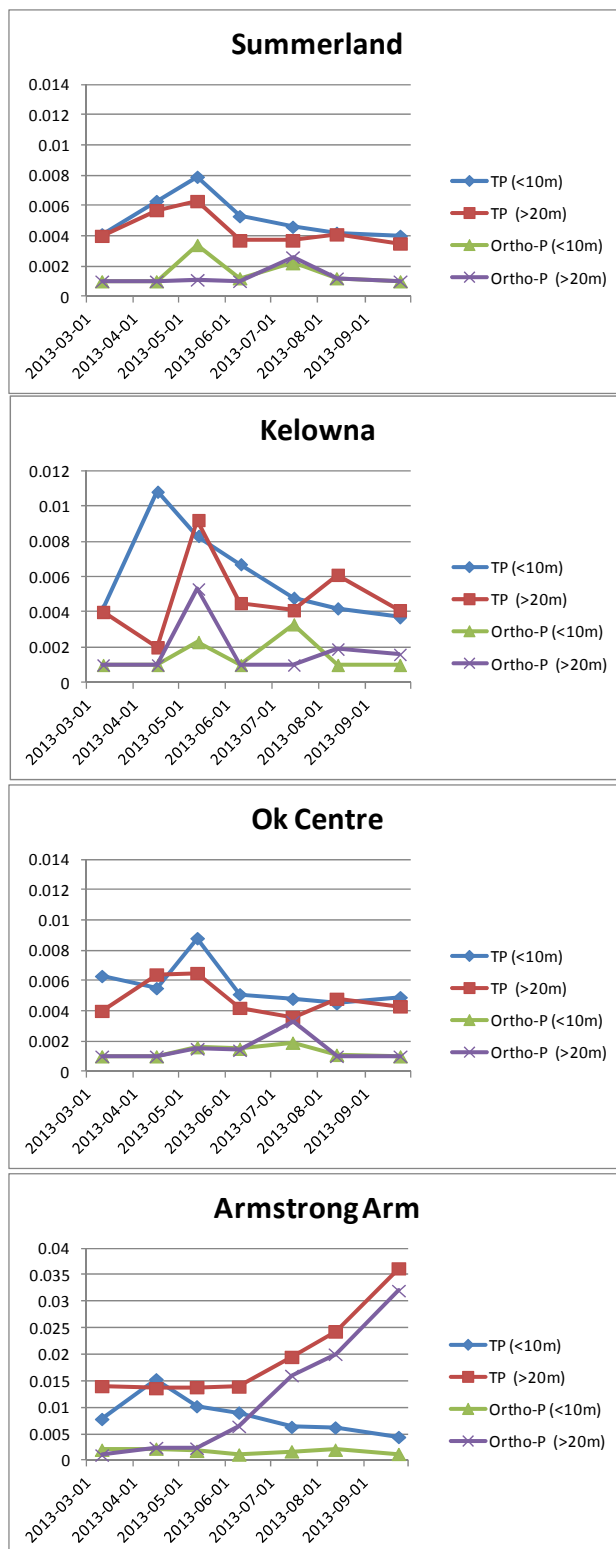
## Appendix D: Physical and chemical parameters for Okanagan Lake, 2013

			µg/L	mg/L	°C	m	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Site	EMS #	Sampling Date	Chl-a	DO	Temp	Secchi	Silica (<10m)	Silica (>20m)	Ortho-P (<10m)	Ortho-P (>20m)	Ammonia (<10m)	Ammonia (>20m)	TKN (<10m)	TKN (>20m)	Total Org N (<10m)	Total Org N (>20m)	DP (<10m)	DP (>20m)	NO2+NO3 (<10m)	NO2+NO3 (>20m)	TN (<10m)	TN (>20m)	TP (<10m)	TP (>20m)
Summerland	0500454	2013-03-11	0.785	12.60	4.05	11.3	6.90	6.92	0.0010	0.0010			0.178	0.203			0.0035	0.0030	0.0682	0.0690	0.246	0.272	0.0041	0.0040
Summerland	0500454	2013-04-16	2.055	11.40	5.50	8.3	6.36	6.41	0.0010	0.0010	0.0250	0.0140	0.535	0.173	0.51	0.159	0.0062	0.0071	0.0530	0.0570	0.588	0.230	0.0063	0.0057
Summerland	0500454	2013-05-13	4.180	9.40	14.90	4.0	6.73	6.70	0.0034	0.0011	0.0150	0.0190	0.206	0.174	0.191	0.154	0.0040	0.0031	0.0217	0.0561	0.228	0.230	0.0079	0.0063
Summerland	0500454	2013-06-10	1.490	9.30	16.40	5.5	6.36	6.62	0.0012	0.0010	0.0073	0.0140	0.237	0.272	0.23	0.258	0.0024	0.0023	0.0064	0.0598	0.244	0.331	0.0053	0.0037
Summerland	0500454	2013-07-15	0.800	8.29	20.20	6.9	6.31	6.58	0.0022	0.0026	0.0082	0.0110	0.242	0.209	0.234	0.198	0.0026	0.0023	0.0020	0.0426	0.242	0.251	0.0046	0.0037
Summerland	0500454	2013-08-13	1.380	7.70	23.60	7.3	6.22	6.60	0.0012	0.0012	0.0100	0.0058	0.176	0.152	0.166	0.146	0.0030	0.0024	0.0120	0.0678	0.188	0.220	0.0042	0.0041
Summerland	0500454	2013-09-24	1.690	9.12	16.28	7.3	6.49	6.45	0.0010	0.0010			0.194	0.160			0.0053	0.0028	0.0039	0.0686	0.198	0.229	0.0040	0.0035
Kelowna	0500236	2013-03-11	0.655	12.50	4.72	11.9	6.79	6.82	0.0010	0.0010			0.172	0.166			0.0023	0.0030	0.0713	0.0740	0.244	0.240	0.0041	0.0040
Kelowna	0500236	2013-04-16	2.270	10.90	7.00	6.3	6.43	6.57	0.0010	0.0010	0.027	0.0300	0.182	0.910	0.154	0.879	0.0090	0.0030	0.0361	0.0580	0.218	0.968	0.0108	0.0020
Kelowna	0500236	2013-05-13	5.395	10.40	14.20	2.6	6.69	9.79	0.0023	0.0053	0.014	0.0250	0.212	0.198	0.199	0.173	0.0040	0.0053	0.0231	0.0334	0.236	0.231	0.0083	0.0092
Kelowna	0500236	2013-06-10	1.060	9.40	15.50	5.3	6.33	6.72	0.0010	0.0010	0.011	0.0110	0.230	0.191	0.219	0.180	0.0027	0.0036	0.0020	0.0475	0.230	0.238	0.0067	0.0045
Kelowna	0500236	2013-07-15	0.700	8.70	20.1	7.5	6.10	6.71	0.0033	0.0010	0.018	0.0130	0.237	0.203	0.219	0.190	0.0024	0.0028	0.0020	0.0564	0.237	0.260	0.0048	0.0041
Kelowna	0500236	2013-08-13	0.945	7.20	23.4	8.5	6.13	7.30	0.0010	0.0019	0.005	0.0050	0.188	0.153	0.188	0.148	0.0034	0.0023	0.0020	0.0568	0.188	0.210	0.0042	0.0061
Kelowna	0500236	2013-09-23	1.645	8.80	19.48	8.6	6.18	6.58	0.0010	0.0016			0.197	0.166			0.0029	0.0027	0.0020	0.0408	0.197	0.207	0.0037	0.0041
Ok Centre	0500730	2013-03-12	0.500	12.10	4.52	12.1	6.89	6.94	0.001	0.0010			0.185	0.185			0.0047	0.0030	0.0633	0.0680	0.249	0.253	0.0063	0.0040
Ok Centre	0500730	2013-04-16	1.785	12.03	6.50	8.1	6.47	6.65	0.001	0.0010	0.017	0.0150	0.206	0.198	0.189	0.183	0.0063	0.0069	0.0240	0.0559	0.230	0.254	0.0055	0.0064
Ok Centre	0500730	2013-05-13	5.035	10.50	15.30	3.1	6.22	6.62	0.0016	0.0015	0.017	0.0200	0.207	0.186	0.190	0.165	0.0043	0.0041	0.0020	0.0315	0.207	0.217	0.0088	0.0065
Ok Centre	0500730	2013-06-10	1.560	9.50	16.30	6.2	6.07	6.62	0.0015	0.0014	0.011	0.0120	0.213	0.206	0.202	0.194	0.0026	0.0022	0.0020	0.0315	0.213	0.238	0.0051	0.0042
Ok Centre	0500730	2013-07-15	0.595	8.73	20.40	7.7	6.01	6.65	0.0019	0.0033	0.018	0.0230	0.225	0.187	0.207	0.164	0.0028	0.0033	0.0020	0.0471	0.225	0.234	0.0048	0.0036
Ok Centre	0500730	2013-08-13	1.475	8.20	24.20	8.3	6.10	6.58	0.0011	0.0010	0.014	0.0120	0.199	0.158	0.184	0.146	0.0030	0.0046	0.0020	0.0433	0.199	0.201	0.0045	0.0048
Ok Centre	0500730	2013-09-12	0.675	8.91	21.46	7.5	6.09	6.59	0.0010	0.0010			0.274	0.293			0.0036	0.0023	0.0020	0.0491	0.274	0.342	0.0049	0.0043
Armstrong Arm	0500239	2013-04-03	3.765	11.95	11.01	4.30	5.37	5.45	0.0020	0.0010			0.183	0.242			0.0029	0.0040	0.0022	0.0020	0.185	0.242	0.0078	0.0140
Armstrong Arm	0500239	2013-04-17	3.780	10.63	8.40	3.40	5.39	5.50	0.0022	0.0024	0.0310	0.0160	0.204	0.454	0.173	0.438	0.0109	0.0139	0.0020	0.0020	0.204	0.454	0.0153	0.0136
Armstrong Arm	0500239	2013-05-14	2.050	9.60	12.70	2.30	6.41	6.27	0.0018	0.0023	0.0059	0.0210	0.235	0.234	0.229	0.212	0.0044	0.0070	0.0020	0.0074	0.235	0.241	0.0102	0.0138
Armstrong Arm	0500239	2013-06-11	2.160	9.06	18.74	3.35	6.69	6.75	0.0011	0.0064	0.0120	0.0120	0.251	0.191	0.239	0.179	0.0053	0.0107	0.0020	0.0375	0.251	0.228	0.0090	0.0139
Armstrong Arm	0500239	2013-07-16	2.530	8.37	21.55	2.70	6.64	7.48	0.0017	0.0160	0.0140	0.0120	0.240	0.186	0.227	0.174	0.0031	0.0171	0.0024	0.0996	0.243	0.286	0.0063	0.0195
Armstrong Arm	0500239	2013-08-14	2.990	7.82	24.12	3.30	2.99	3.04	0.0020	0.0200	0.0120	0.0098	0.211	0.181	0.199	0.171	0.0031	0.0219	0.0020	0.1230	0.211	0.304	0.0062	0.0243
Armstrong Arm	0500239	2013-09-12	1.245	9.13	21.58	2.50	6.54	8.73	0.0012	0.0320			0.391	0.309			0.0031	0.0338	0.0020	0.1640	0.391	0.474	0.0044	0.0362

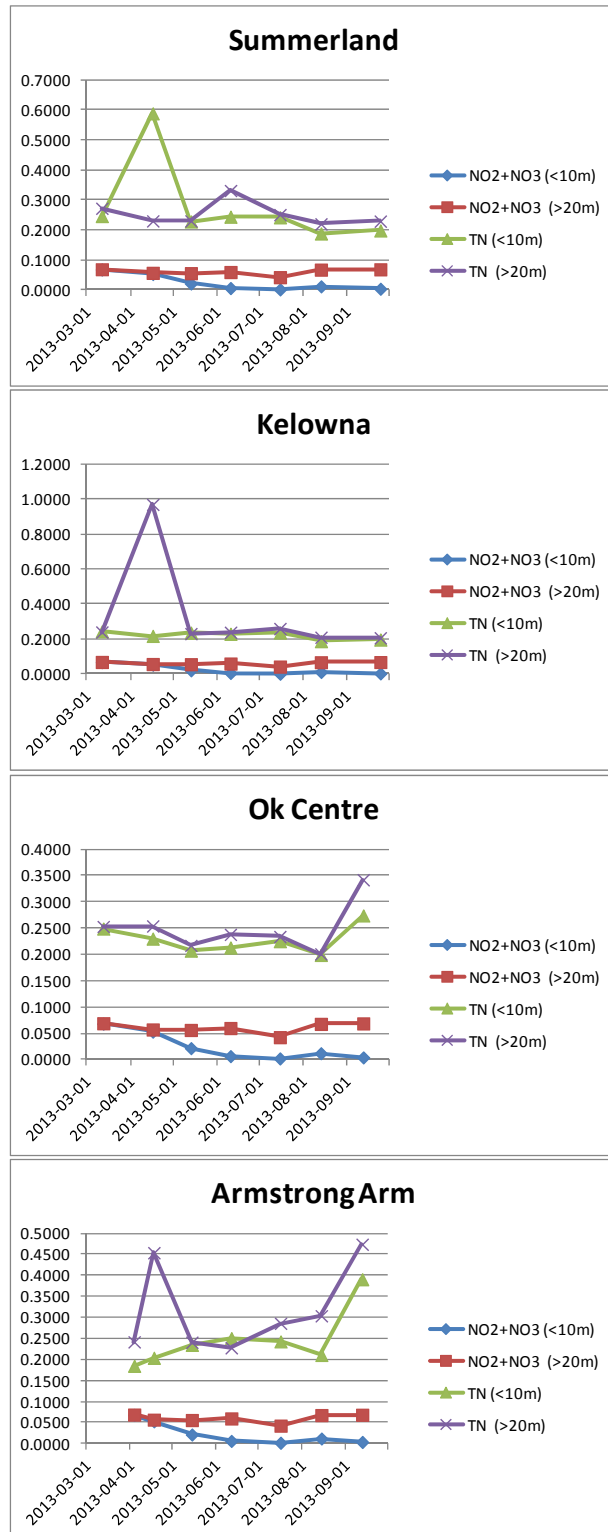
## Appendix E: Okanagan Lake seasonal data for dissolved silica data, 2013

	Summerland		Kelowna		Ok Centre		Armstrong Arm	
	Silica	Silica	Silica	Silica	Silica	Silica	Silica	Silica
	(<10m)	(>20m)	(<10m)	(>20m)	(<10m)	(>20m)	(<10m)	(>20m)
March	6.90	6.92	6.79	6.82	6.89	6.94	5.37	5.45
April	6.36	6.41	6.43	6.57	6.47	6.65	5.39	5.50
May	6.73	6.70	6.69	9.79	6.22	6.62	6.41	6.27
June	6.36	6.62	6.33	6.72	6.07	6.62	6.69	6.75
July	6.31	6.58	6.10	6.71	6.01	6.65	6.64	7.48
Aug.	6.22	6.6	6.13	7.3	6.1	6.58	2.99	3.04
Sept.	6.49	6.45	6.18	6.58	6.09	6.59	6.54	8.73
Mean	6.5	6.6	6.4	7.2	6.3	6.7	5.7	6.2
Min	6.22	6.41	6.1	6.57	6.01	6.58	2.99	3.04
Max	6.9	6.92	6.79	9.79	6.89	6.94	6.69	8.73

## Appendix F: Okanagan Lake total phosphorus and orthophosphate seasonal data, 2013.



## Appendix G: Okanagan Lake total nitrogen and nitrite+nitrate nitrogen seasonal data, 2013.



## Appendix H: Okanagan Lake phytoplankton and zooplankton data, 2013.

PHYTOPLANKTON	Okanagan L	Okanagan L	Okanagan L	Okanagan L	Okanagan L	Okanagan L
Site Name	D/S Kelowna STP (deep)	D/S Kelowna STP (deep)	D/S Kelowna STP (deep)	D/S Kelowna STP (deep)	D/S Kelowna STP (deep)	D/S Kelowna STP (deep)
Site Number	0500236	0500236	0500236	0500236	0500236	0500236
Sampling Date(s)	2013-04-16	2013-05-13	2013-06-10	2013-07-15	2013-08-13	2013-09-23
Depth (m)	1-10	1-10	1-10	1-10	1-10	1-10
units	cells/mL	cells/mL	cells/mL	cells/mL	cells/mL	cells/mL
<b>Order : Centrales</b>						
<i>Cyclotella cf bodanica</i>	<2.8	14.0	<17.8	2.8	<2.8	
<i>Cyclotella glomerata</i>	252.0	448.0	872.2	12.6	2.8	<35.6
<i>Cyclotella spp.</i>	<2.8	14.0	53.4	1.4	5.6	35.6
<i>Melosira italica</i>	134.4	78.4	53.4	23.8	86.8	71.2
<i>Melosira varians</i>	<2.8		<17.8			
<i>Melosira sp.</i>	5.6	<2.8	<17.8	<1.4		<35.6
<i>Rhizosolenia eriensis / longiseta</i>	16.8	<2.8	17.8			
<i>Stephanodiscus Niagarae</i>	<2.8		<17.8			
<i>Stephanodiscus sp.</i>	<2.8		<17.8			
<b>Order : Chlorococcales</b>						
<i>Ankistrodesmus falcatus</i>	<2.8	<2.8	17.8	<1.4		
<i>Ankistrodesmus spp.</i>	<2.8					
<i>Botryococcus braunii</i>		<2.8	<17.8	<1.4	<2.8	<35.6
<i>Closteriopsis cf longissima</i>	2.8	2.8	<17.8	<1.4		
<i>Crucigenia quadrata</i>	<2.8	<2.8	213.6	<1.4	<2.8	<35.6
<i>Dictyosphaerium cf pulchellum</i>	<2.8			<1.4		
<i>Elakatothrix gelatinosa</i>	2.8	<2.8	35.6	<1.4	<2.8	
<i>Kirchneriella sp.</i>		<2.8				
<i>Oocystis cf lacustris</i>		<2.8	<17.8	11.2	5.6	
<i>Oocystis spp.</i>	11.2	<2.8	<17.8	<1.4	11.2	
<i>Quadrigula cf lacustris</i>		<2.8				
<i>Quadrigula sp.</i>	<2.8		<17.8			
<i>Scenedesmus sp.</i>	<2.8				<2.8	
<i>Selenastrum minutum</i>			<17.8	9.8	2.8	
<i>Selenastrum sp.</i>		2.8				
<i>Sphaerocystis schroeteri</i>	<2.8			<1.4		<35.6
<i>Tetraedron minimum</i>					<2.8	

<b>Order:</b> <b>Chroococcales</b>						
<u>Anacystis elachista</u>	<2.8	<2.8	<17.8	<1.4	28.0	
<u>Anacystis cf limneticus</u>				<1.4	44.8	<35.6
<u>Anacystis sp.</u>	<2.8				<2.8	<35.6
<u>Gomphosphaeria aponina</u>					<2.8	<35.6
<u>Gomphosphaeria pallidum</u>		56.0	<17.8	56.0		
<b>Order:</b> <b>Cryptomonadales</b>						
<u>Chroomonas acuta</u>	112.0	39.2	124.6	12.6	2.8	178.0
<u>Cryptomonas ovata / erosa</u>	<2.8	<2.8	<17.8	1.4	<2.8	<35.6
<u>Cryptomonas sp.</u>	2.8	<2.8	<17.8	1.4	<2.8	
<b>Order: Dinokontae</b>						
<u>Ceratium hirundinella</u>		<2.8	<17.8			
<u>Gymnodinium sp. ?</u>			<17.8	<1.4		
<u>Peridinium cf inconspicuum</u>			<17.8	<1.4	<2.8	<35.6
<u>Peridinium / Glenodinium</u>	<2.8	<2.8	<17.8			
<b>Order : Euglenales</b>						
<u>Euglena sp.</u>						<35.6
<u>Euglena sp. ?</u>						249.2
<b>Order : Nostocales</b>						
<u>Anabaena cf affinis</u>					<2.8	
<u>Anabaena cf circinalis</u>				<1.4	140.0	
<u>Anabaena cf flos-aquae</u>				<1.4	<2.8	<35.6
<u>Anabaena cf spiroides</u>						
<u>Anabaena spp.</u>			<17.8	<1.4	<2.8	<35.6
<u>Anabaena sp. ?</u>				<1.4		
<u>Aphanizomenon sp. ?</u>				<1.4	<2.8	783.2
<u>Pseudanabaena sp. ?</u>					<2.8	
<b>Order :</b> <b>Ochromonadales</b>						
<u>Dinobryon cf bavaricum</u>	<2.8	1,282.4	53.4	15.4	<2.8	<35.6
<u>Dinobryon divergens</u>		2.8	<17.8	1.4	<2.8	
<u>Dinobryon cf sertularia</u>	14.0	42.0				
<u>Dinobryon sp</u>	5.6	56.0	17.8	46.2	2.8	106.8
<u>Kephyrion / Pseudokephyrion<sup>1</sup></u>		<2.8				
<u>Ochromonas sp. ?</u>					<2.8	<35.6
<b>Order :</b> <b>Oscillatoriales</b>						
<u>Lynqbya cf contorta</u>						

<u>Lyngbya cf limnetica</u>	697.2	714.0	2,581.0	126.0	420.0	32,146.8
<u>Oscillatoria cf tenuis</u>	364.0	770.0	801.0	<1.4	<2.8	1,246.0
<u>Oscillatoria sp.</u>	<2.8		<17.8		<2.8	
<b>Order : Pennales</b>						
<u>Achnanthes flexella</u>	<2.8					
<u>Achnanthes minutissima</u>	8.4	11.2	<17.8	1.4	<2.8	35.6
<u>Achnanthes sp.</u>	<2.8		<17.8		<2.8	
<u>Amphipleura pellucida</u>	<2.8			<1.4		
<u>Amphiprora = Entomoneis sp.</u>	<2.8					
<u>Amphora ovalis</u>	2.8				<2.8	<35.6
<u>Amphora spp.</u>	<2.8	<2.8	<17.8	<1.4	<2.8	<35.6
<u>Asterionella formosa</u>	154.0	56.0	89.0	18.2		
<u>Ceratoneis arcus</u>	<2.8	<2.8				
<u>Cocconeis placentula</u>	<2.8		<17.8	<1.4	<2.8	
<u>Cocconeis sp.</u>		<2.8	<17.8	<1.4	<2.8	
<u>Cymatopleura cf solea</u>						
<u>Cymbella affinis</u>	<2.8	<2.8	<17.8			<35.6
<u>Cymbella cf prostrata</u>	<2.8		<17.8			
<u>Cymbella cf minuta</u>	2.8	<2.8	<17.8	<1.4	2.8	<35.6
<u>Cymbella spp.</u>	<2.8	<2.8	<17.8	<1.4	<2.8	
<u>Diatoma elongatum</u>	2.8					
<u>Diatoma cf hiemale</u>	<2.8				<2.8	
<u>Diatoma vulgare</u>	<2.8					
<u>Diatoma spp.</u>	<2.8	<2.8	17.8	<1.4	<2.8	<35.6
<u>Diploneis sp.</u>		<2.8	<17.8			
<u>Epithemia sorex</u>						
<u>Epithemia turgida</u>	<2.8		<17.8	<1.4		
<u>Epithemia sp.</u>				<1.4		<35.6
<u>Eunotia cf pectinalis</u>			<17.8			
<u>Eunotia sp.</u>	<2.8	<2.8	<17.8			
<u>Fragilaria crotonensis</u>	33.6	84.0	35.6	4.2	11.2	71.2
<u>Fragilaria spp.</u>	5.6	8.4	<17.8	<1.4		<35.6
<u>Gomphonema constrictum</u>	<2.8					
<u>Gomphonema geminata</u>	<2.8					
<u>Gomphonema olivaceum</u>	2.8		<17.8		2.8	
<u>Gomphonema spp</u>	<2.8		<17.8		<2.8	
<u>Meridion cf circulare</u>			<17.8			
<u>Navicula radiosa</u>	2.8		<17.8		<2.8	
<u>Navicula spp.</u>	5.6	5.6	17.8	<1.4	<2.8	<35.6
<u>Neidium sp. ?</u>			<17.8			
<u>Nitzschia spp.</u>	<2.8		<17.8		<2.8	<35.6
<u>Pinnularia cf gibba</u>			<17.8			



<u>Pinnularia sp.</u>			<17.8			
<u>Pleurosigma / Gyrosigma</u>	<2.8					
<u>Rhopalodia gibba</u>					<2.8	
<u>Stauroneis sp.</u>	<2.8				<2.8	
<u>Surirella spp.</u>					<2.8	<35.6
<u>Synedra acus</u>	8.4	11.2	<17.8	<1.4		<35.6
<u>Synedra capitata</u>						
<u>Synedra ulna</u>	<2.8	<2.8	<17.8	1.4	<2.8	<35.6
<u>Synedra spp.</u>	<2.8	<2.8	<17.8	<1.4	<2.8	<35.6
<u>Tabellaria fenestrata</u>	33.6	201.6	427.2	71.4	<2.8	<35.6
UID girdle view			71.2	<1.4	<2.8	<35.6
UID	2.8	<2.8	17.8	<1.4	5.6	
<b>Order : Rhizochrysidales</b>						
<u>Diceras phaseolus</u>				<1.4	<2.8	
<b>Order : Tetrasporales</b>						
<u>Gloeocystis ampla</u>			<17.8	<1.4	<2.8	
<u>Gloeocystis sp. ?</u>						<35.6
<b>Order : Ulothricales</b>						
<u>Ulothrix cf variabilis</u>			<17.8			
<u>Ulothrix sp. ?</u>	<2.8	8.4	<17.8	1.4	5.6	
<b>Order : Volvocales</b>						
Chlamydomonas sp.						320.4
UID				<1.4		<35.6
<b>Order : Zygnematales</b>						
<u>Arthrodesmus spp.</u>		<2.8	<17.8	<1.4	<2.8	
<u>Cosmarium spp.</u>		<2.8	<17.8			
<u>Gonatozygon sp.</u>				<1.4		
<u>Mougeotia sp. ?</u>	<2.8	<2.8	<17.8	2.8	<2.8	<35.6
<u>Spondylosium planum</u>	<2.8	<2.8	<17.8	1.4	2.8	
<u>Staurastrum cf paradoxum</u>			<17.8		<2.8	
<u>Staurastrum sp.</u>			<17.8			
<u>Zygnema sp. ?</u>				<1.4	<2.8	
UID						
UID colonial algae		<2.8	<17.8	<1.4	<2.8	
UID unicellular algae				<1.4	<2.8	<35.6
UID cyst						<35.6
UID flagellates observed but not counted.						
UID = unidentified due to lack of size and/or missing morphological characters.						
<sup>1</sup> Note : may have previously been included under UID flagellates observed but not counted.						

PHYTOPLANKTON	Okanagan L	Okanagan L	Okanagan L	Okanagan L	Okanagan L	Okanagan L
Site Name	South Prairie Cr	South Prairie Cr	South Prairie Cr	South Prairie Cr	South Prairie Cr	South Prairie Cr
Site Number	0500454	0500454	0500454	0500454	0500454	0500454
Sampling Date(s)	2013-04-16	2013-05-13	2013-06-10	2013-07-15	2013-08-13	2013-09-24
Depth (m)	1-10	1-10	1-10	1-10	1-10	1-10
units	cells/mL	cells/mL	cells/mL	cells/mL	cells/mL	cells/mL
<b>Order : Centrales</b>						
<u>Cyclotella cf bodanica</u>	<2.8	280.0	<17.8	5.6	5.6	5.6
<u>Cyclotella glomerata</u>	67.2	478.8	801.0	14.0	5.6	14.0
<u>Cyclotella spp.</u>	2.8	<2.8		1.4	1.4	<2.8
<u>Melosira italica</u>	204.4	100.8	89.0	19.6	29.4	39.2
<u>Melosira varians</u>				<1.4		<2.8
<u>Melosira sp.</u>	<2.8	<2.8		<1.4		<2.8
<u>Rhizosolenia eriensis / longiseta</u>	<2.8	8.4	17.8			2.8
<u>Stephanodiscus Niagarae</u>	2.8	<2.8	<17.8			<2.8
<u>Stephanodiscus sp.</u>		<2.8	<17.8			<2.8
<b>Order : Chlorococcales</b>						
<u>Ankistrodesmus falcatus</u>	2.8	<2.8	<17.8	<1.4		<2.8
<u>Ankistrodesmus spp.</u>						
<u>Botryococcus braunii</u>	<2.8		<17.8	<1.4	56.0	<2.8
<u>Closteriopsis cf longissima</u>	<2.8	2.8	<17.8	<1.4		
<u>Crucigenia quadrata</u>		<2.8	<17.8		<1.4	<2.8
<u>Dictyosphaerium cf pulchellum</u>					<1.4	<2.8
<u>Elakatothrix gelatinosa</u>	<2.8	<2.8	<17.8	<1.4	<1.4	<2.8
<u>Kirchneriella sp</u>	<2.8		<17.8			
<u>Lagerhiemia sp. ?</u>					<1.4	
<u>Oocystis cf lacustris</u>		<2.8		<1.4	5.6	<2.8
<u>Oocystis spp.</u>	<2.8	<2.8	35.6	<1.4	<1.4	<2.8
<u>Oocystis sp. ?</u>				<1.4		
<u>Quadrigula closterioides</u>					<1.4	
<u>Quadrigula cf lacustris</u>						
<u>Quadrigula sp.</u>						
<u>Scenedesmus cf denticulatus</u>			<17.8			
<u>Scenedesmus quadrata/abundans</u>						<2.8
<u>Scenedesmus sp.</u>						
<u>Selenastrum minutum</u>	<2.8		<17.8	5.6	2.8	
<u>Selenastrum sp.</u>						<2.8
<u>Sphaerocystis Schroeteri</u>		<2.8			<1.4	<2.8
<u>Tetraedron minimum</u>					<1.4	<2.8
<b>Order: Chroococcales</b>						
<u>Aqmenellum sp.</u>			<17.8			
<u>Anacystis elachista</u>	<2.8	<2.8	<17.8	<1.4	42.0	

<u>Anacystis cf limneticus</u>					<1.4	44.8
<u>Anacystis sp.</u>					<1.4	<2.8
<u>Gomphosphaeria aponina</u>				<1.4	<1.4	<2.8
<u>Gomphosphaeria pallidum</u>		<2.8	<17.8	<1.4		
<u>Gomphosphaeria sp.</u>				<1.4	<1.4	
<b>Order:</b>						
<b>Cryptomonadales</b>						
<u>Chroomonas acuta</u>	36.4	<2.8	53.4	16.8	1.4	67.2
<u>Cryptomonas ovata / erosa</u>	<2.8		<17.8	<1.4	1.4	<2.8
<u>Cryptomonas sp.</u>	2.8		<17.8	<1.4		<2.8
<b>Order: Dinokontae</b>						
<u>Ceratium hirundinella</u>	<2.8	<2.8	<17.8			
<u>Gymnodinium sp. ?</u>				<1.4	<1.4	<2.8
<u>Peridinium cf inconspicuum</u>			<17.8	<1.4	<1.4	<2.8
<u>Peridinium / Glenodinium</u>		<2.8	<17.8			
UID					<1.4	
UID cyst ?			<17.8			
<b>Order : Euglenales</b>						
<u>Euglena sp. ?</u>			<17.8			
<u>Trachelomonas sp.</u>					<1.4	
<b>Order : Nostocales</b>						
<u>Anabaena cf affinis</u>						56.0
<u>Anabaena cf circinalis</u>					<1.4	
<u>Anabaena cf flos-aquae</u>				<1.4	<1.4	
<u>Anabaena cf spiroides</u>			<17.8			
<u>Anabaena spp.</u>					28.0	<2.8
<u>Anabaena sp. ?</u>				<1.4		
<u>Aphanizomenon sp. ?</u>					<1.4	56.0
<b>Order :</b>						
<b>Ochromonadales</b>						
<u>Dinobryon cf bavaricum</u>	2.8	327.6	35.6	<1.4	<1.4	<2.8
<u>Dinobryon divergens</u>		19.6	17.8	2.8	<1.4	
<u>Dinobryon cf sertularia</u>	<2.8	<2.8	<17.8			
<u>Dinobryon sp</u>	<2.8	22.4	17.8	18.2	<1.4	<2.8
<u>Kephyrion / Pseudokephyrion<sup>1</sup></u>			<17.8			
<u>Ochromonas sp. ?</u>			<17.8	<1.4		<2.8
UID						<2.8
<b>Order : Oscillatoriales</b>						
<u>Lynqbya cf contorta</u>	<2.8					
<u>Lynqbya cf limnetica</u>	448.0	350.0	3,168.4	142.8	106.4	2,722.9
<u>Limnothrix sp. ?</u>						84.0
<u>Oscillatoria cf tenuis</u>	448.0	588.0	1,691.0	8.4	<1.4	3,050.8
<u>Oscillatoria sp.</u>					<1.4	
<b>Order : Pennales</b>						

<u>Achnanthes flexella</u>	2.8	<2.8	<17.8	<1.4		<2.8
<u>Achnanthes minutissima</u>	2.8	5.6	17.8	<1.4	<1.4	5.6
<u>Achnanthes sp.</u>			<17.8	<1.4	<1.4	<2.8
<u>Amphipleura pellucida</u>		<2.8			<1.4	
<u>Amphiprora = Entomoneis sp.</u>	<2.8	<2.8	<17.8			
<u>Amphora ovalis</u>	<2.8		<17.8	<1.4	<1.4	<2.8
<u>Amphora spp.</u>	<2.8	<2.8	<17.8		<1.4	<2.8
<u>Asterionella formosa</u>	95.2	117.6	35.6	<1.4		<2.8
<u>Ceratoneis arcus</u>		<2.8				
<u>Cocconeis placentula</u>	<2.8	<2.8		<1.4		<2.8
<u>Cocconeis sp.</u>		<2.8	<17.8	<1.4		<2.8
<u>Cymatopleura cf solea</u>	<2.8				<1.4	
<u>Cymbella affinis</u>						
<u>Cymbella cf prostrata</u>	<2.8					
<u>Cymbella cf minuta</u>		<2.8	<17.8	<1.4	1.4	<2.8
<u>Cymbella spp.</u>	<2.8	<2.8	<17.8	<1.4	<1.4	<2.8
<u>Diatoma elongatum</u>	<2.8	2.8				<2.8
<u>Diatoma cf hiemale</u>					<1.4	
<u>Diatoma vulgare</u>						
<u>Diatoma spp.</u>	<2.8	<2.8	<17.8	<1.4		<2.8
<u>Diploneis sp.</u>			<17.8		<1.4	<2.8
<u>Epithemia sorex</u>	<2.8					
<u>Epithemia turqida</u>	<2.8			<1.4		<2.8
<u>Epithemia sp.</u>		<2.8	<17.8			<2.8
<u>Eunotia cf pectinalis</u>						
<u>Eunotia sp.</u>	<2.8	<2.8				<2.8
<u>Fragilaria crotonensis</u>	14.0	42.0	338.2	14.0	56.0	22.4
<u>Fragilaria spp.</u>	<2.8	8.4	<17.8	<1.4		
<u>Gomphonema acuminatum</u>						<2.8
<u>Gomphonema constrictum</u>						<2.8
<u>Gomphonema geminata</u>						
<u>Gomphonema olivaceum</u>		<2.8	<17.8		<1.4	<2.8
<u>Gomphonema spp</u>		<2.8		<1.4	<1.4	<2.8
<u>Meridion cf circulare</u>						
<u>Navicula radiosa</u>	<2.8			<1.4	<1.4	<2.8
<u>Navicula spp.</u>	2.8	<2.8	17.8	1.4	<1.4	2.8
<u>Neidium sp. ?</u>						
<u>Nitzschia spp.</u>	<2.8	<2.8	<17.8		<1.4	
<u>Pleurosigma / Gyrosigma</u>						<2.8
<u>Pinnularia cf gibba</u>	<2.8			<1.4		<2.8
<u>Pinnularia sp.</u>						
<u>Pleurosigma / Gyrosigma</u>	<2.8					
<u>Rhopalodia gibba</u>					<1.4	
<u>Stauroneis sp.</u>			<17.8			<2.8
<u>Surirella spp.</u>	<2.8		<17.8			<2.8

<i>Synedra acus</i>	<2.8	8.4	<17.8	1.4		2.8
<i>Synedra capitata</i>			<17.8			
<i>Synedra ulna</i>	<2.8	<2.8	<17.8			<2.8
<i>Synedra spp.</i>	<2.8	<2.8	<17.8		<1.4	<2.8
<i>Tabellaria fenestrata</i>	<2.8	42.0	106.8	65.8	<1.4	11.2
<i>Tabellaria flocculosa</i>						<2.8
UID girdle view	<2.8		<17.8	<1.4	<1.4	<2.8
UID	<2.8	<2.8	<17.8		<1.4	<2.8
<b>Order : Rhizochrysidales</b>						
<i>Diceras phaseolus</i>						
<b>Order : Tetrasporales</b>						
<i>Gloeocystis ampla</i>			<17.8	11.2	<1.4	<2.8
<i>Gloeocystis sp. ?</i>			<17.8			
<b>Order : Ulothricales</b>						
<i>Ulothrix cf variabilis</i>						
<i>Ulothrix sp. ?</i>			<17.8	1.4	1.4	<2.8
<b>Order : Volvocales</b>						
UID						<2.8
<b>Order : Zygnematales</b>						
<i>Arthrodesmus spp.</i>			<17.8	1.4	<1.4	<2.8
<i>Cosmarium spp.</i>	<2.8	<2.8	<17.8	<1.4		<2.8
<i>Mougeotia sp. ?</i>	<2.8	14.0	<17.8	<1.4	<1.4	<2.8
<i>Spondylosium planum</i>	<2.8	<2.8	<17.8	4.2		<2.8
<i>Staurostrum cf paradoxum</i>			<17.8	<1.4	<1.4	<2.8
<i>Staurostrum sp.</i>						<2.8
UID				<1.4		
UID colonial algae		<2.8	<17.8	<1.4	<1.4	<2.8
UID filamentous algae					<1.4	<2.8
UID unicellular algae		<2.8	<17.8	<1.4	<1.4	<2.8
UID cyst						<2.8
UID flagellates observed but not counted.						
UID = unidentified due to lack of size and/or missing morphological characters.						
<sup>1</sup> Note : may have previously been included under UID flagellates observed but not counted.						

ZOOPLANKTON		Okanagan L	Okanagan L	Okanagan L	Okanagan L	Okanagan L	Okanagan L
Site Name		Kelowna STP (Deep)	Kelowna STP (Deep)	Kelowna STP (Deep)	Kelowna STP (Deep)	Kelowna STP (Deep)	Kelowna STP (Deep)
Site Number		0500236	0500236	0500236	0500236	0500236	0500236
Sampling Date(s)		2013-04-16	2013-05-13	2013-06-10	2013-07-15	2013-08-13	2013-09-23
Depth (m)		0-45	0-45	0-45	0-45	0-45	0-45
units = total organisms / sample	stage						
Sub-class : Copepoda							
Order : Cyclopoida							
<i>Diacyclops thomasi</i>	adult	7,438	7,310	74,431	69,596	23,940	10,096
UID	copepodid	1,248	22,790	36,015	7,112	912	420
Order : Calanoida							
Family : Diaptomidae	copepodid						
<i>Leptodiaptomus ashlandi</i>	adult	37,024	34,400	11,662	37,084	36,024	29,657
<i>Leptodiaptomus ashlandi</i>	copepodid	58,240	67,940	1,029	5,588	4,789	3,994
<i>Epischura nevadensis</i>	adult			686	508	2,052	1,682
UID Calanoida / Cyclopoida	nauplii	7,488	6,020	1,029	3,556	228	420
Order : Cladocera							
<i>Bosmina longirostris</i>	adult	416	1,720	12,348	101	2,052	2,313
<i>Daphnia thorata</i>	adult			343	8,128	2,280	1,051
<i>Diaphanosoma birgei</i>	adult			686	9,144	2,736	5,048
<i>Daphnia sp.</i>	juvenile		860		1,016	456	208
Order : Mysidacea							
<i>Mysis relicta</i>			5				
Phylum : Rotifera							
<i>Kellicottia longispina</i>		4,576	10,200	604	5,080	2,280	1,262
UID Rotifera		416	1,290			228	1,051
TOTAL		116,846	152,535	138,833	146,913	77,977	57,202
UID = unidentified due to lack of size and/or missing morphological characters.							

ZOOPLANKTON		Okanagan L	Okanagan L	Okanagan L	Okanagan L	Okanagan L	Okanagan L
Site Name		Kelowna STP (Deep)	Kelowna STP (Deep)	Kelowna STP (Deep)	Kelowna STP (Deep)	Kelowna STP (Deep)	Kelowna STP (Deep)
Site Number		0500236	0500236	0500236	0500236	0500236	0500236
Sampling Date(s)		2013-04-16	2013-05-13	2013-06-10	2013-07-15	2013-08-13	2013-09-23
Depth (m)		0-45	0-45	0-45	0-45	0-45	0-45
units = total organisms / sample	stage						
Sub-class : Copepoda							
Order : Cyclopoida							
<i>Diacyclops thomasi</i>	adult	7,438	7,310	74,431	69,596	23,940	10,096
UID	copepodid	1,248	22,790	36,015	7,112	912	420
Order : Calanoida							
Family : Diaptomidae	copepodid						
<i>Leptodiaptomus ashlandi</i>	adult	37,024	34,400	11,662	37,084	36,024	29,657
<i>Leptodiaptomus ashlandi</i>	copepodid	58,240	67,940	1,029	5,588	4,789	3,994
<i>Epischura nevadensis</i>	adult			686	508	2,052	1,682
UID Calanoida / Cyclopoida	nauplii	7,488	6,020	1,029	3,556	228	420
Order : Cladocera							
<i>Bosmina longirostris</i>	adult	416	1,720	12,348	101	2,052	2,313
<i>Daphnia thorata</i>	adult			343	8,128	2,280	1,051
<i>Diaphanosoma birgei</i>	adult			686	9,144	2,736	5,048
<i>Daphnia sp.</i>	juvenile		860		1,016	456	208
Order : Mysidacea							
<i>Mysis relicta</i>			5				
Phylum : Rotifera							
<i>Kellicottia longispina</i>		4,576	10,200	604	5,080	2,280	1,262
UID Rotifera		416	1,290			228	1,051
TOTAL		116,846	152,535	138,833	146,913	77,977	57,202
UID = unidentified due to lack of size and/or missing morphological characters.							

<b>ZOOPLANKTON</b>		Okanagan L	Okanagan L	Okanagan L	Okanagan L	Okanagan L	Okanagan L
<b>Site Name</b>		<b>S Prairie Cr</b>	<b>S Prairie Cr</b>	<b>S Prairie Cr</b>	<b>S Prairie Cr</b>	<b>S Prairie Cr</b>	<b>S Prairie Cr</b>
<b>Site Number</b>		<b>0500454</b>	<b>0500454</b>	<b>0500454</b>	<b>0500454</b>	<b>0500454</b>	<b>0500454</b>
<b>Sampling Date(s)</b>		2013-04-16	2013-05-13	2013-06-10	2013-07-15	2013-08-13	2013-09-24
<b>Depth (m)</b>		0-45	0-45	0-45	0-45	0-45	0-45
<b>units = total organisms / sample</b>	<b>stage</b>						
<b>Sub-class : Copepoda</b>							
<b>Order : Cyclopoida</b>							
<i>Diacyclops thomasi</i>	adult	4,536	13,600	31,518	46,792	38,080	21,983
UID	copepo did	4,212	23,800	9,682	3,692	1,568	653
<b>Order : Calanoida</b>							
<b>Family : Diaptomidae</b>	copepo did						
<i>Leptodiaptomus ashlandi</i>	adult	8,100	18,700	7,828	17,076	40,320	34,824
<i>Leptodiaptomus ashlandi</i>	copepo did	60,264	11,900	1,854	5,538	4,928	3,918
<i>Epischura nevadensis</i>	adult	324			923	896	196
UID Calanoida / Cyclopoida	nauplii	6,804	3,740	3,296	1,154	2,464	
<b>Order : Cladocera</b>							
<i>Bosmina longirostris</i>	adult		680	1,442	231	224	1,306
<i>Daphnia thorata</i>	adult				6,923	4,928	653
<i>Diaphanosoma birgei</i>	adult			82	7,615	1,120	653
<i>Daphnia sp.</i>	juvenile				923	672	434
<b>Phylum : Rotifera</b>							
<i>Kellicottia longispina</i>		972	3,060	2,266	2,769	672	2,393
UID Rotifera		648	680			224	434
<b>TOTAL</b>		85,860	76,160	57,968	93,636	96,096	67,447
UID = unidentified due to lack of size and/or missing morphological characters.							



## Appendix I: Larratt Aquatic Consulting Ltd. Invoices, 2013



### Invoice

Date	Invoice #
2013-07-18	13023

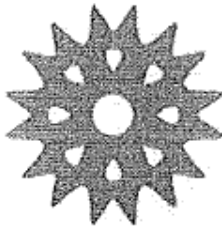
Larratt Aquatic Consulting Ltd.  
 3025 Ensign Lane  
 West Kelowna, BC  
 V4T 2Z4  
 250-769-5444

Invoice To	Project
Ministry of Environment Attn: Mike Sokal 102 Industrial Place Penticton, BC V2A 7C8	Okanagan Lake Sampling
Description	Price
Okanagan Lake sampling for April, May, June 2013 as specified under Ministry Contract GS12PNE300	
April 16, 17 J Self, B Larratt	1,663.00
May 13, 14 J Self, B Larratt	1,663.00
GST # R102372885	
GST on sales	166.30

Terms: Net 60

P.O. No. GS12PNE300

<b>Total</b>	\$3,492.30
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**LARRATT  
AQUATIC**

Larratt Aquatic Consulting Ltd.  
3025 Ensign Lane  
West Kelowna, BC  
V4T 2Z4  
250-769-5444

## Invoice

Date	Invoice #
2013-08-06	20033

Invoice To
Ministry of Environment Attn: Mike Sokal 102 Industrial Place Penticton, BC V2A 7C8

Project
GS12PNE300

Description	Price
Okanagan Lake Sampling for April, May, June 2013 as specified under Ministry Contract GS12PNE300	
June 10, 11 J Self, B Larratt, J Larratt	1,663.00
July 15, 16 J Self, B Larratt, J Larratt	1,663.00
GST on sales	166.30

Terms:	P.O. No.	GST/HST No.
Net 60	GS12PNE300	102372885

<b>Total</b>	\$3,492.30
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Larratt Aquatic Consulting Ltd.  
 3025 Ensign Lane  
 West Kelowna, BC  
 V4T 2Z4  
 250-769-5444

## Invoice

Date	Invoice #
2013-09-20	20041

Invoice To
Ministry of Environment Attn: Mike Sokal 102 Industrial Place Penticton, BC V2A 7C8

Project
GS12PNE300

Description	Price
Okanagan Lake Sampling for August 2013 as specified under Ministry Contract GS12PNE300 August 13, 14 J Self, B Larratt, J Larratt GST on sales	1,663.00 83.15

Terms:	P.O. No.	GST/HST No.
Net 60	GS12PNE300	102372885

<b>Total</b>	<b>\$1,746.15</b>
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## Appendix J: Maxxam Analytics invoice records, 2013



Success Through Science

Maxxam  
4606 Canada Way  
Burnaby British Columbia  
Canada V5G 1K5  
Tel (604) 734 7276  
Fax (604) 731 2386

Invoice : BC904070

Invoice Date: 30 Aug 13  
Page 1 of 3

To: MINISTRY OF ENVIRONMENT (PENTICTON)

#401 - 333 VICTORIA STREET  
NELSON, BC  
V1L 4K3  
Att:ALISON LIBBY

Account # : 151023

Client Code	Invoice Number	Invoice Date	Job Number	Project#(Name)	Requisition Id	Invoice Amount
4818( tq )	729679	2013/08/20	B371750	CRYSWATER	50201107	101.00
				Project CRYSWATER SubTotal :		101.00
				Project CRYSWATER GST Total :		5.05
				Project CRYSWATER YTD SubTotal :		101.00
				Project CRYSWATER GST YTD Total :		5.05
	729680	2013/08/20	B371775	CRYSWATERS	50201102	101.00
				Project CRYSWATERS SubTotal :		101.00
				Project CRYSWATERS GST Total :		5.05
				Project CRYSWATERS YTD SubTotal :		303.00
				Project CRYSWATERS GST YTD Total :		15.15
	726863	2013/08/02	B363939	LSSS	50198727	130.00
	726864	2013/08/02	B363966	LSSS	50198781	130.00
	726865	2013/08/02	B363967	LSSS	50198797	130.00
	726866	2013/08/02	B363969	LSSS	50198813	130.00
	729653	2013/08/20	B371217	LSSS	50198785	70.00
	729654	2013/08/20	B371218	LSSS	50198769	70.00
	729674	2013/08/20	B371216	LSSS	50198801	70.00
	733372	2013/08/30	B376183	LSSS	50198788	80.00
	733381	2013/08/30	B376184	LSSS	50198772	80.00
	733388	2013/08/30	B376185	LSSS	50198718	80.00
	733396	2013/08/30	B376100	LSSS	50198804	80.00
				Project LSSS SubTotal :		1,050.00
				Project LSSS GST Total :		52.50
				Project LSSS YTD SubTotal :		3,930.00
				Project LSSS GST YTD Total :		196.50
	729657	2013/08/20	B370969	OKCOLAB13	50198431	160.00
				Project OKCOLAB13 SubTotal :		160.00
				Project OKCOLAB13 GST Total :		8.00
				Project OKCOLAB13 YTD SubTotal :		160.00
				Project OKCOLAB13 GST YTD Total :		8.00
	729655	2013/08/20	B370963	OKLCOLAB13	50198446	160.00
	730842	2013/08/26	B371820	OKLCOLAB13	50198441	160.00

### TERMS

Net 30 days after date of invoice  
2% interest on overdue accounts  
Please make cheque payable to: Maxxam Analytics  
Please Remit to: PO Box 7156 Station Terminal Vancouver, BC V6B 4E2  
E.&O.E.

Continued on next page



Success Through Science®

Maxxam  
4606 Canada Way  
Burnaby British Columbia  
Canada V5G 1K5  
Tel (604) 734 7276  
Fax (604) 731 2386

Invoice : BC904070

Invoice Date: 30 Aug 13  
Page 2 of 3

To: MINISTRY OF ENVIRONMENT (PENTICTON)

#401 - 333 VICTORIA STREET  
NELSON, BC  
V1L 4K3  
Att:ALISON LIBBY

Account # : 151023

Client Code 4818 continued						
Client Code	Invoice Number	Invoice Date	Job Number	Project#(Name)	Requisition Id	Invoice Amount
				Project OKLCOLAB13 SubTotal :		320.00
				Project OKLCOLAB13 GST Total :		16.00
				Project OKLCOLAB13 YTD SubTotal :		3,202.00
				Project OKLCOLAB13 GST YTD Total :		160.10
	729656	2013/08/20	B370968	OLKCOLAB 13	50198436	160.00
				Project OLKCOLAB 13 SubTotal :		160.00
				Project OLKCOLAB 13 GST Total :		8.00
				Project OLKCOLAB 13 YTD SubTotal :		160.00
				Project OLKCOLAB 13 GST YTD Total :		8.00
	729676	2013/08/20	B371277	ONA13	50198653	163.00
	729677	2013/08/20	B371359	ONA13	50198672	135.00
	735245	2013/08/30	B371283	ONA13	50198658	28.00
				Project ONA13 SubTotal :		326.00
				Project ONA13 GST Total :		16.30
				Project ONA13 YTD SubTotal :		1,416.00
				Project ONA13 GST YTD Total :		70.80
	728373	2013/08/14	B368194	S050124STR	50202269	84.00
	728376	2013/08/14	B368195	S050124STR	50202268	84.00
	728378	2013/08/14	B368200	S050124STR	50202267	104.00
	728390	2013/08/14	B368202	S050124STR	50202270	222.00
				Project S050124STR SubTotal :		494.00
				Project S050124STR GST Total :		24.70
				Project S050124STR YTD SubTotal :		2,258.00
				Project S050124STR GST YTD Total :		112.90
	729658	2013/08/20	B371110	SIMATAIN13	50202349	150.00
	729659	2013/08/20	B371135	SIMATAIN13	50202358	150.00
	729660	2013/08/20	B371138	SIMATAIN13	50202357	150.00
	729661	2013/08/20	B371140	SIMATAIN13	50202356	150.00
	729663	2013/08/20	B371143	SIMATAIN13	50202355	150.00
	729665	2013/08/20	B371145	SIMATAIN13	50202352	150.00
	729668	2013/08/20	B371147	SIMATAIN13	50202351	150.00

## TERMS

Net 30 days after date of invoice

2% interest on overdue accounts

Please make cheque payable to: Maxxam Analytics

Please Remit to: PO Box 7156 Station Terminal Vancouver, BC V6B 4E2  
E.&O.E.

Continued on next page

## Appendix K: Fraser Environmental invoice records, 2013

**Attention : Robyn Roome**  
B.C. Ministry of Environment  
Cranbrook, Nelson and Penticton, B.C.  
Rm. 401-333 Victoria Street  
Nelson, B.C.  
V1L 4K3  
(250) 354-6333  
Robyn.Roome@gov.bc.ca



### BILLING FOR JULY 2013

**Payee : Linde Looy**  
**FRASER ENVIRONMENTAL SERVICES**  
9358 Cinnamon Drive  
Surrey, B.C., V3V 1V2  
telephone and fax (604) 588-9738

**Ministry Contract GS13ESD-003-1**

### INVOICE # 937-TQ

**Total for Client Code TQ                      \$ 1,803.24**

#### Outstanding Balances

Balance Payable from Previous Months                      \$ 0.00

**Attention : Robyn Roome**  
B.C. Ministry of Environment  
Cranbrook, Nelson and Penticton, B.C.  
Rm. 401-333 Victoria Street  
Nelson, B.C.  
V1L 4K3  
(250) 354-6333  
Robyn.Roome@gov.bc.ca

**BILLING FOR SEPTEMBER 2013**

**Payee : Linde Looy**  
**FRASER ENVIRONMENTAL SERVICES**  
9358 Cinnamon Drive  
Surrey, B.C., V3V 1V2  
telephone and fax (604) 588-9738

**Ministry Contract GS13ESD-003-1**

**INVOICE # 942-TQ**

**Total for Client Code TQ                      \$ 1,757.96**

Outstanding Balances

Balance Payable from Previous Months                      \$ 0.00

**Attention : A.J. Downie**  
 B.C. Ministry of Environment  
 Environmental Quality Section Head  
 Kootenay and Okanagan Regions  
 Rm. 401-333 Victoria Street  
 Nelson, B.C.  
 V1L 4K3  
 (250) 354-6750  
 AJ.Downie@gov.bc.ca

**BILLING FOR NOVEMBER/DECEMBER 2013**

**Payee : Linde Looy**  
**FRASER ENVIRONMENTAL SERVICES**  
 9358 Cinnamon Drive  
 Surrey, B.C., V3V 1V2  
telephone and fax (604) 588-9738

**Ministry Contract GS13ESD-003-1**

**INVOICE # 948-TQ**

**Total for Client Code TQ                      \$ 462.00**

**Outstanding Balances**

Balance Payable from Previous Months                      \$ 0.00



**Attention : A.J. Downie**  
B.C. Ministry of Environment  
Environmental Quality Section Head  
Kootenay and Okanagan Regions  
Rm. 401-333 Victoria Street  
Nelson, B.C.  
V1L 4K3  
(250) 354-6750  
AJ.Downie@gov.bc.ca

**BILLING FOR JANUARY 2014**

**Payee : Linde Looy**  
**FRASER ENVIRONMENTAL SERVICES**  
9358 Cinnamon Drive  
Surrey, B.C., V3V 1V2  
telephone and fax (604) 588-9738

**Ministry Contract GS13ESD-003-1**

**INVOICE # 952-TQ**

**Total for Client Code TQ                      \$ 2,568.80**

**Outstanding Balances**

Balance Payable from Previous Months                      \$ 0.00

**Attention : A.J. Downie**  
B.C. Ministry of Environment  
Environmental Quality Section Head  
Kootenay and Okanagan Regions  
Rm. 401-333 Victoria Street  
Nelson, B.C.  
V1L 4K3  
(250) 354-6750  
AJ.Downie@gov.bc.ca

**BILLING FOR FEBRUARY 2014**

**Payee : Linde Looy**  
**FRASER ENVIRONMENTAL SERVICES**  
9358 Cinnamon Drive  
Surrey, B.C., V3V 1V2  
telephone and fax (604) 588-9738

**Ministry Contract GS13ESD-003-1**

**INVOICE # 958-TQ**

**Total for Client Code TQ                      \$ 1,168.64**

**Outstanding Balances**

Balance Payable from Previous Months                      \$ 2,568.80

## Appendix L: Cost estimate for 2014

- Costs should remain the same or similar to 2013 costs (see table below).
- Sample collection prices will remain the same in 2014, as per MOE contract with Larratt Aquatic Consulting.
- May and July water chemistry samples are higher in cost due to QA samples being collected and analyzed.
- April and May plankton analyses are lower priced than later samples, as Fraser Environmental gives a discount to early-season sample submission.

Parameter	Supplier	March	April	May	June	July	August	September	Totals
<b>Sample Collection</b>	Larratt Aquatic Consulting	MOE	\$1,746.15	\$1,746.15	\$1,746.15	\$1,746.15	\$1,746.15	MOE	\$8,730.75
<b>Water Chemistry</b>	Maxxam Analytics	MOE	\$672.00	\$835.80	\$672.00	\$835.80	\$672.00	MOE	\$3,687.60
<b>Plankton Analyses</b>	Fraser Environmental	-	\$1,257.44	\$1,257.44	\$1,311.44	\$1,311.44	\$1,311.44	\$1,311.44	\$7,760.64
									Grand Total
									<b>\$20,178.99</b>
									Budget
									\$22,000.00
<b>2013 Costs</b>									Balance
									\$1,821.01