

# Hutchinson

# Environmental Sciences Ltd.

Oak Lake Water Quality Monitoring Report and Lake Management Plan

Prepared for: City of Quinte West Job #: J180050

October 18, 2019



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October 18, 2019

HESL Job #: J180050

Mr. Chris Angelo Director Public Works & Environmental Services City of Quinte West 7 Creswell Drive Trenton, ON K8V 5R6

Dear Mr. Angelo:

#### Re: J180050 - Oak Lake Water Quality Monitoring Report and Lake Management Plan

We are pleased to submit our report on water quality and management of Oak Lake. Oak Lake is a typical kettle lake with moderate nutrient concentrations that are driven by shoreline development practices, septic systems, agricultural inputs and internal loading. Macrophytes are abundant and algae followed a typical succession pattern until *Mougeotia spp.*, a species of filamentous green algae, spread throughout much of the lake in the summer of 2019. *Mougeotia spp.* are a nuisance for recreational uses but are non-toxic to humans and other aquatic life. Abundant algae and plant growth can however reduce oxygen concentrations as part of decomposition, which can in turn negatively impact aquatic life such as fish populations.

Water level management was identified as a major concern for residents and their properties but there are differing opinions on a water management objective. Two culverts were removed in the late winter of 2018, which appeared to help lower water levels in the spring of 2019.

Oak Lake has been well studied and several lake management recommendations have been both made and incorporated into policy, but it is unclear how successful previous recommendations and policies have been. We developed new recommendations that included realigning the adjacent agricultural tile drain so it no longer drains into Oak Lake, developing a bylaw to enforce appropriate sewage treatment system design and maintenance, as well as others related to shoreline development practices, water level management, aquatic vegetation management, waterfowl control, active lake management and long-term monitoring.

Please contact me if you have any questions or concerns.

Sincerely, per: Hutchinson Environmental Sciences Ltd.

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# Executive Summary

Hutchinson Environmental Sciences Ltd. (HESL) was retained by the City of Quinte West to complete a Water Quality Assessment of Oak Lake with input from the Ministry of Environment, Conservation and Parks (MECP) and Lower Trent Conservation (LTC). The "Oak Lake Water Quality Monitoring Report and Lake Management Plan" was designed to characterize water quality conditions in Oak Lake and develop lake management recommendations through public engagement, background review, field investigations and expert input.

Oak Lake is well-studied, and a variety of background material was reviewed and analyzed to 1) help characterize conditions in the lake and watershed, and 2) provide historic data that could be compared to 2018 data and allow for the assessment of changes over time.

HESL staff collected water quality samples on August 16, 2018, October 29, 2018, February 11, 2019, March 28, 2019 and May 8, 2019 to capture seasonal variability and high flows when samples could be collected from the inflowing tile drain. Samples were collected from 11 open water sites and three tributary sites. A sediment sample was collected on August 16, 2018 from OL-1 using a gravity corer. Phytoplankton (i.e. algae) samples were collected via 0.5 m deep grab samples from OL-1 on August 16, 2018, February 11, 2019, May 8, 2019 to characterize seasonal variability of algal assemblages, and from observed filamentous algal assemblages on May 8, 2019 and July 4, 2019. Field investigations also included an examination of water levels, determination of the impact of culvert elevation on water levels during each sampling event and documented through photographs.

Information on septic systems, the nature of shoreline development and lake management concerns was gathered through a mailed-out questionnaire and scoped level 1 septic site investigations in 2018. Site investigations were completed from August 21 to 26, 2018 at 80 properties where landowners were present and allowed access.

Nutrient concentrations indicate that Oak Lake is mesotrophic and average annual phosphorus concentrations have remained stable at 0.014 mg/L since 2001. Winter measurements made in 2019 showed that phosphorus and nitrate concentrations were markedly elevated. This could be driven by a variety of processes. Nutrient concentrations were also elevated in the inflowing tile drain which drains approximately 40 hectares of agricultural lands that are used to grow corn and raise both cattle and pigs. Concentrations were similar to those observed in the literature and typical of enriched agricultural runoff. Bacteria concentrations were generally low in Oak Lake, and lower than concentrations measured as part of past studies.

Phosphorus was enriched in the sediments of Oak Lake. The total phosphorus concentration of 1990  $\mu$ g/g exceeded the Lowest Effect Level (600  $\mu$ g/g) and was close to the Severe Effect Level (2000  $\mu$ g/g) identified in the Provincial Guidelines (Ministry of Environment and Energy, 1993; Table 11), suggesting a high potential internal load to the lake.

The phytoplankton community at OL-1 followed typical seasonal succession during our sampling program. Phytoplankton was dominated by Chrysophytes and Cryptophytes in the winter, with substantially increased green algae (Chlorophytes) relative abundance in the spring and increased cyanobacteria during the late summer/fall sampling event. The filamentous algal colonies observed in the water during spring and



summer 2019 sampling were comprised of *Mougeotia spp.*, a diverse genus of green algae which includes many of the most common filamentous green algal species in freshwaters. Blooms of filamentous green algae, such as *Mougeotia*, can be a nuisance for recreational uses but are non-toxic to humans and other aquatic life.

The development patterns, lot size and nature of waterfront land use at Oak Lake does not meet the current environmental standards associated with waterfront development. Lots on Oak Lake are highly developed and while many septic systems showed no evidence of poor repair, the maintenance periods reported by residents varied substantially, problems were noted with some systems, and many that were not examined due to lack of landowner permission may be in poor repair. Similar conditions were noted in 2001 and there is little evidence that Best Management Practices and recommendations such as establishing natural shorelines or improving septic system maintenance from previous studies (e.g. LTC 2002, Ontario Lake Assessments, 2002a) have been implemented.

The combined phosphorus load from runoff, atmospheric deposition, septic system leaching, and sediment internal load was 312.5 to 336.5 kg/yr (based on internal load estimates of 136 and 160 kg/yr respectively). Internal loading from sediments represent the largest source of phosphorus to Oak Lake, contributing almost 50% of the annual load; followed by septic systems, which contribute one third of the total annual load. Runoff from agricultural land uses was also an appreciable source of phosphorus, adding approximately 15% of the total phosphorus load.

Results from the mailed-out questionnaire indicated that 47% of landowners consider that water levels are "good as is", while 30% believe water levels are currently too high and 23% believe water levels are currently too low, so it is clear there are differing perspectives on the most appropriate water levels in Oak Lake. Our culvert inspections indicated that water flow isn't impeded by sediment build-up in the culverts or in the adjacent areas, but the system is instead limited by a very small drainage area adjacent to Culvert #2 and largely controlled by the management of wetland water levels via Culvert #5. Water level management is a challenge moving forward because of climate change and it is particularly challenging in Oak Lake because a) development setbacks are limited and nearshore areas are flat so slight changes in water levels impact residences and water intake lines, b) there is limited inflow or outflow so there isn't much water to work with, and c) there are differing opinions on a water management objective.

Oak Lake has been well studied and several lake management recommendations have been both made and incorporated into policy, but it is unclear how successful previous recommendations and policies have been. We developed new recommendations that included realigning the adjacent agricultural tile drain so it no longer drains into Oak Lake, developing a bylaw to enforce appropriate sewage treatment system design and maintenance, as well as others related to shoreline development practices, water level management, aquatic vegetation management, waterfowl control, active lake management and long-term monitoring. Successful execution of the management recommendations requires buy-in by shoreline residents and enforcement.



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# 1. Introduction

Oak Lake is a small (51 ha), shallow, isolated lake with no defined inflows or outflows, whose hydrology is driven by groundwater and surface runoff from a small (287 hectare) agriculturally-dominated watershed with deep, loamy soils (Figure 1; Ontario Lake Assessment, 2000). Oak Lake has a mean depth of 3.3 m, a maximum depth of 10.6 m and only 11% of the lake is greater than 7.5 m (Lower Trent Conservation (LTC), 2002; MECP, 2018). It supports a warmwater fish community, including Northern Pike (*Esox Lucius*), Smallmouth Bass (*Micropterus dolomieu*), Largemouth Bass (*Micropterus salmoides*), Yellow Perch (*Perca flavescens*), Rock Bass (*Ambloplites rupestris*), Brown Bullhead (*Ameiurus nebulosus*), Pumpkinseed (*Lepomis* gibbosus) and Longnose Gar (*Lepisosteus* osseus; LTC, 2002).

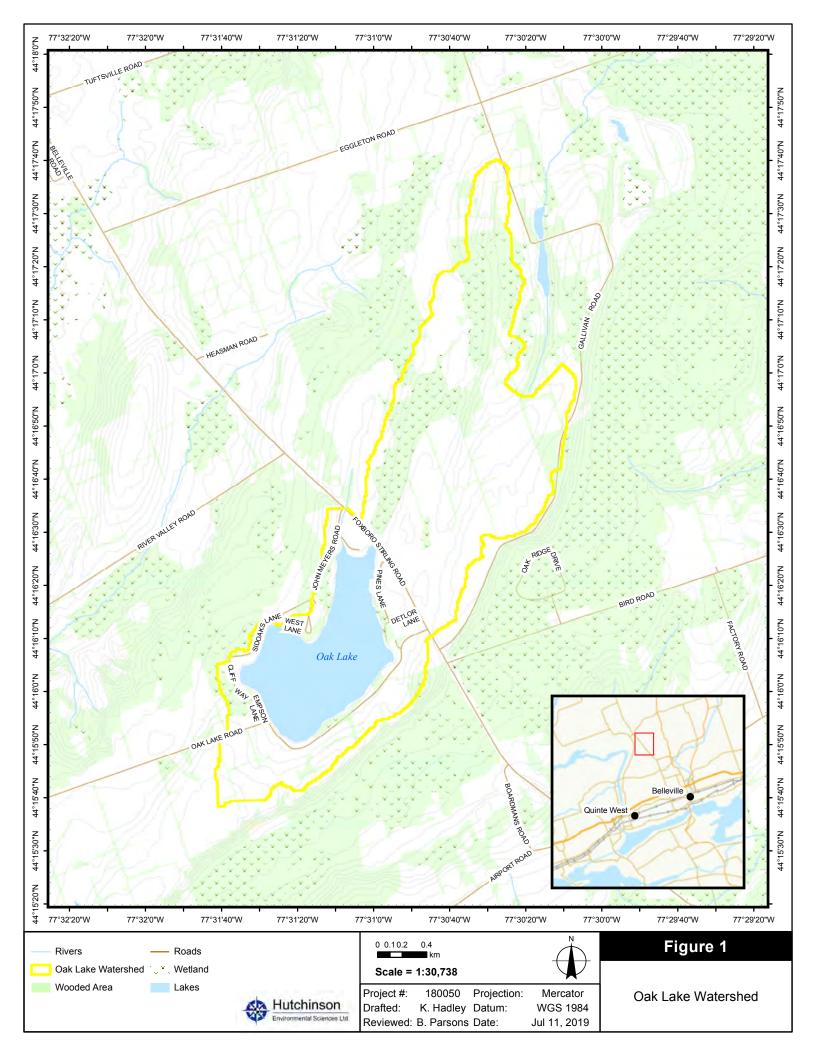
Previous data collection on the lake by the City of Quinte West and MECP identified several management challenges including phosphorus enrichment (range 0.01 - 0.02 mg/L), oxygen deficiency, elevated nearshore bacteria concentrations and excessive growth of the aquatic macrophyte Eurasian Water Milfoil (*Myriophyllum spicatum*). A list of the previous studies consulted is provided in Section 2.1. Recent community concern also identified issues with rising lake levels (City of Quinte West City Council, April 30<sup>th</sup>, 2018) and aquatic macrophyte growth, while MECP was called in to investigate and assess the impact of a significant manure spill on the eastern shore in the winter of 2018. These incidents reflect the challenge of managing lakes in the face of multiple stressors and community concerns and highlighted the need for this study.

Hutchinson Environmental Sciences Ltd. (HESL) was retained by the City of Quinte West to complete a Water Quality Assessment of Oak Lake with input from the Ministry of Environment, Conservation and Parks (MECP) and Lower Trent Conservation (LTC). The "Oak Lake Water Quality Monitoring Report and Lake Management Plan" was designed to characterize water quality conditions in Oak Lake and develop lake management recommendations through public engagement, background review, field investigations and expert input. The study was completed through the following tasks:

- Compilation and review of existing data collected on Oak Lake and its watershed,
- Completion of a four-season sampling program of water quality, sediment quality and phytoplankton from August 2018 to July 2019,
- Inspections of sewage treatment systems and shoreline development practices,
- Culvert inspections in relation to water level management,
- Calculation of a phosphorus budget, and
- Development of various lake management recommendations.

The study also included several project team meetings, public open houses and a mailed-out questionnaire designed to solicit information from residents and the project team. Methods, results and discussion related to the above-noted tasks are provided in the report, as are management recommendations based on the findings.





# 2. Methods

## 2.1 Background Review

Oak Lake is well-studied, and a variety of background material was reviewed and analyzed to 1) help characterize conditions in the lake and watershed, and 2) provide historic data that could be compared to 2018 data and allow for the assessment of changes over time.

The following studies were consulted as part of the background review:

- City of Quinte West. 2011. Updated Summary Report Oak Lake
- City of Quinte West. 2017. Official Plan. Amended December 4, 2017.
- City of Quinte West. 2017. Planning Advisory Committee Presentation.
- City of Quinte West. 2014. Comprehensive Zoning By-Law.
- Lower Trent Conservation. 1978. Aquatic Plant Growth Control.
- Lower Trent Conservation. 2002. Oak Lake Shoreline Regeneration Plan.
- Ministry of Environment. 1973. Report of Water Quality in Oak Lake Sidney Twp. Hastings County
- Ministry of Environment. 2005. Oak Lake Agricultural Runoff Assessment
- Ministry of Environment and Climate Change. 2013. Agricultural Runoff Assessment
- Ministry of Environment and Climate Change. 2014. Oak Lake Water Quality Assessment
- Ministry of Environment and Climate Change. Lake Partner Program data 2002 2014.
- Ministry of Environment, Conservation and Parks. 2018. Provincial Officer's Report
- Ministry of Environment, Conservation and Parks. 2018. Oak Lake Manure Spill
- Ontario Lake Assessments. 2000. Water Quality Summary and Lake Sensitivity Evaluation for Oak Lake.
- Ontario Lake Assessments. 2002a. An Evaluation of the On-Site Sewage Disposal Systems for Properties Fronting on Oak Lake.
- Ontario Lake Assessments. 2002b. An Assessment of the Water Quality of Oak Lake

## 2.2 Water Quality

HESL staff collected water quality samples on August 16, 2018, October 29, 2018, February 11, 2019, March 28, 2019 and May 8, 2019 to capture seasonal variability and high flows when samples could be collected from the inflowing tile drain. Samples were collected from 11 open water sites (OL-1 to OL-11) and three tributary sites ((Trib-2, Trib-4 and Trib-5), Figure 2).

Sample sites were selected to a) overlap previously sampled locations to allow for temporal comparisons, b) characterize water quality across the lake and c) sample the limited inflows and outflows when those tributary sites contained flowing water (Table 1). Trib-4 and Trib-5 were located at the outfall of the tile drain and ~10 m upstream of its confluence with Oak Lake, respectively. The tiles drain approximately 40 hectares of adjacent agricultural lands. Trib-2 was only sampled on one occasion due to a lack of flowing water, while Trib-1 and Trib-3 were never sampled due to a lack of flowing water.

Samples were either analyzed for a full suite of chemical parameters (i.e. water quality station) or just bacteria (i.e. bacteria only station), again to overlap with historical data and to help characterize bacteria concentrations which are often spatially variable (Table 1). OL-1-bottom was also sampled approximately



1-m off bottom and samples were analyzed for total suspended solids, total phosphorus and iron to support the calculation and assessment of any internal phosphorus loading. All samples were collected, stored on ice and analyzed by ALS Laboratories in Kitchener or Winnipeg depending on the parameter.

Samples collected from the water quality sampling stations were analyzed for the following parameters: total hardness, total suspended solids, total alkalinity, total ammonia, chloride, nitrate, total Kjeldahl nitrogen, total phosphorus, sulfate, dissolved organic carbon, *E. coli*, fecal coliforms, fecal streptococcus, *Pseudomonas aeruginosa*, chlorophyll a, and metals, while samples collected from the bacteria only sampling stations were analyzed for *E. coli*, fecal coliforms, fecal streptococcus and *Pseudomanus aeruginosa*. Temperature, conductivity, dissolved oxygen and pH were measured with a YSI multimeter at 0.5 m depth during each event at every water quality and bacteria only sampling location. Field measurements of temperature, conductivity, dissolved oxygen and pH were also measured at 1-m water depth intervals at OL-1 throughout the water column during each water sampling event.

Sample Site	Water Quality Station	Bacteria Only Station	Sample Site Descriptions	GPS Coordinates	Water Depth (m)
OL-1 OL-1-Bottom <sup>1</sup>	✓ ✓		Long-term deep water quality	44°15'59.21"N 77°31'20.76"W	12
OL-2	~		Nearshore water quality	44°15'51.76"N 77°31'23.48"W	0.8
OL-3		~	Nearshore water quality	44°16'0.53"N 77°31'31.26"W	1.2
OL-4		~	Nearshore water quality	44°16'8.37"N 77°31'27.83"W	2.4
OL-5		~	Nearshore water quality	44°16'8.50"N 77°31'16.12"W	0.9
OL-6		~	Nearshore water quality	44°16'15.67"N 77°31'10.13"W	1.2
OL-7	✓		Nearshore water quality	44°16'24.26"N 77°31'3.70"W	1.1
OL-8		~	Nearshore water quality	44°16'14.51"N 77°31'0.18"W	0.8
OL-9 ✓			Nearshore water quality adjacent to inflowing agricultural drainage	44°16'5.91"N 77°30'55.61"W	2.1
OL-10		~	Nearshore water quality	44°15'57.46"N 77°31'6.87"W	0.8
OL-11		~	Nearshore water quality	44°15'53.42"N 77°31'14.17"W	1.0

Table 1.	Type of Water	r Quality Sampling Locations.	
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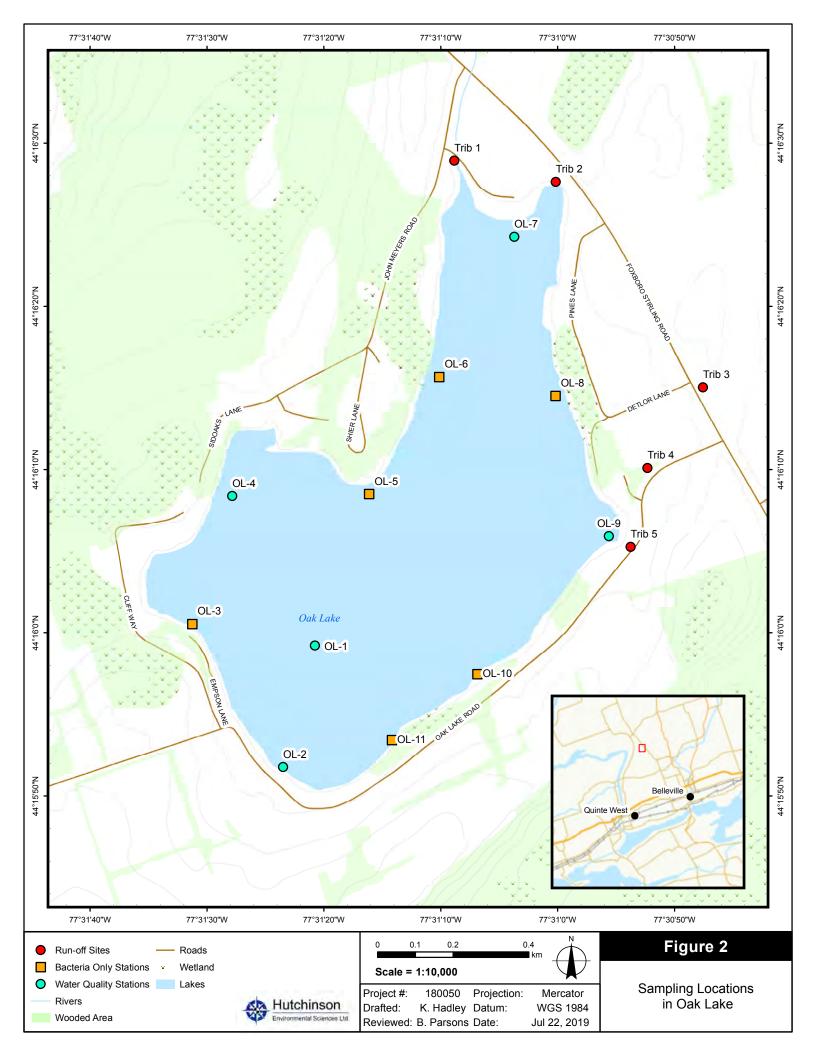


Trib-2	~	Outflowing lake water quality	<0.5
Trib-4	~	Inflowing agricultural drainage	<0.5
Trib-5	~	Inflowing agricultural drainage	<0.5

<sup>1</sup> Samples were only analyzed for total suspended solids, total phosphorus and iron.

Values below detection limit were replaced with a value equivalent to half the detection limit for statistical summaries. Water quality parameters were evaluated against applicable Provincial Water Quality Objectives (PWQOs; MOE, 1994) and Canadian Water Quality Guidelines (CWQGs) for the protection of Freshwater Aquatic Life (FAL) (CCME, 2012). PWQOs are protective of all life forms of aquatic life at all life stages during indefinite exposure to water and are used to make water quality management decisions. CWQGs provide science-based goals for the quality of aquatic ecosystems.





# 2.3 Sediment Quality

A sediment sample was collected on August 16, 2018 from OL-1 using a gravity corer. The top 5 cm of the sediment core was removed using a cross-section extruder and analyzed for a standard suite of parameters (phosphorus, total Kjeldahl nitrogen and metals) at ALS Laboratories in Kitchener. Sediment quality parameters were evaluated against applicable Guidelines for the Protection and Management of Aquatic Sediment in Ontario (Ministry of Environment and Energy, 1993) and Canadian Sediment Quality Guidelines (CWQGs) for the protection of Freshwater Aquatic Life (CCME, 2012).

Samples were also analyzed at Guelph University for Psenner fractionation to quantify the chemical forms of phosphorus in the sediments and provide context for the assessment of internal loading of nutrients from the sediments in Oak Lake.

## 2.4 Phytoplankton

Phytoplankton (i.e. algae) samples were collected via 0.5 m deep grab samples from OL-1 on August 16, 2018, February 11, 2019, May 8, 2019 to characterize seasonal variability of algal assemblages, and from observed filamentous algal assemblages on May 8, 2019 and July 4, 2019. Samples were preserved with Lugol's iodine solution and submitted to ALS Laboratories in Winnipeg, Ontario for taxonomic identification to the lowest practical taxonomic level and enumeration (cells/unit volume of water). Samples collected on July 4, 2019 were also assessed for microcystin concentrations which are toxins produced by cyanobacteria (i.e. blue-green algae). Phytoplankton abundance was evaluated against World Health Organization (WHO, 2003) guidelines for cyanobacteria and microcystin abundance was evaluated against Guidelines for Canadian Recreational Water Quality (Health Canada, 2012).

# 2.5 Inspections of Sewage Treatment Systems and Shoreline Development Practices

"An Evaluation of the On-Site Sewage Disposal Systems for Properties Fronting on Oak Lake" (Ontario Lake Assessments, 2002a) was completed in 2001 to identify substandard systems and provide an educational tool for shoreline owners that would encourage maintenance of sewage systems due to the potential impacts on water quality. Systems were classified as high, moderate or low risk depending on proximity to the water, physical condition and maintenance schedule. The degree of development of each property was also evaluated according to the amount of naturalized area, size of remaining buffer strip and percentage of property occupied by buildings.

Updated information on septic systems, the nature of shoreline development and lake management concerns was also gathered through a mailed-out questionnaire and scoped level 1 septic site investigations in 2018. The questionnaire and site investigations were designed to allow for a comparison with 2001 data and to assess changes in the condition of septic systems and shoreline development practices over the last 17 years. Information was also collected to assess key septic system and shoreline development aspects that may influence lake health, and to characterize landowner's lake management concerns, satisfaction with the lake and recreational use for input into the development of lake management recommendations. The questionnaire that was mailed out to 141 shoreline residents is provided in Appendix A.



Site investigations were completed from August 21 to 26, 2018 at 86 properties where landowners were present and allowed access. Investigations were completed to confirm information provided in the questionnaire and collect additional information on shoreline development practices (% cleared lawn, presence of absence of buffer strip, % property developed), sewage system condition (i.e. evidence of septic failure), and other incidental information.

# 2.6 Phosphorus Budget

Phosphorus is often the limiting nutrient for growth of algae and macrophytes in freshwater systems and is present in human and domestic waste and agricultural runoff, while the clearing of forests and vegetation reduces the ability of lands to retain phosphorus. Phosphorus loads from the watershed, atmosphere, sewage treatment systems, and lake sediments were estimated based on loading rates presented in protocols or peer-reviewed literature, or through data collected as part of this study. The quantification of phosphorus loads allows phosphorus loads and potential reduction measures to be compared in a like-for-like manner and used to inform management recommendations.

## 2.6.1 Watershed Phosphorus Load

An export coefficient modelling approach was used to asses the relative contributions of external phosphorus sources (land use runoff) to Oak Lake. Export coefficient modelling is a well-established method of estimating phosphorus export for a specific site, in the absence of measured data. The total phosphorus load transported to the lake is predicted as the sum of export of phosphorus from each land use in the catchment using the equation:

## $L = \Sigma E i A i + P$

Where L is the phosphorus load delivered to the lake, *Ei* is the export coefficient (kg/ha/yr) selected for the specific land use, *Ai* is the area (ha) of the land use, and P is the input from precipitation to the lake (surface area).

This approach serves as the foundation for the Phosphorus Budget Tool for the Lake Simcoe Watershed ("P Tool"; HESL 2011). The P Tool was developed by Hutchinson Environmental Sciences Ltd. (HESL), Greenland International Consulting Ltd. and Stoneleigh Associates for the Ontario Ministry of the Environment, to provide a consistent science-based approach when estimating phosphorus loadings from stormwater runoff in the Lake Simcoe watershed (HESL 2011). It uses literature derived phosphorus export coefficients (kg/ha/yr) combined with the area of the different land use types present in a watershed to estimate the external phosphorus load (kg/yr) to the lake.

The P Tool was used to estimate non-point source phosphorus loadings from land uses to Oak Lake. Land use classifications and export coefficients used for the analysis were based on those in the Tool (Table 2).



Land Use	Export Coefficient (kg/ha/yr)	Rationale							
Forest	0.06								
Transition	0.07	Mean phosphorus export for all 'monitored' Lake Simcoe subwatersheds (n = 7) derived using phosphorus loads from							
Wetland	0.05	CANWET modeling. Monitored subwatersheds were those with							
Aggregate	0.08	sufficient measured data to validate and calibrate the model (HESL 2011, HESL 2014a).							
Residential	0.13								
Agriculture	0.36	Maximum export coefficient (range: 0.11 to 0.36 kg/ha/yr) for all 'monitored' Lake Simcoe subwatersheds (n = 7). The maximum export coefficient was selected because tile drains (direct channels to the lake) are present in agricultural fields and contain elevated phosphorus concentrations (0.15 mg/L - 0.57 mg/L (Section 3.1.2) when flowing.							
Open Water/ Atmosphere	0.26	Calculated from the mean measured atmospheric load of 19 tonnes/yr averaged over 5 years from 2002 to 2007 to the surface of Lake Simcoe (surface area = 722 km <sup>2</sup> ) (LSRCA, 2009).							

#### Table 2. Phosphorus Export Coefficients Used in the Oak Lake Phosphorus Budget.

The Oak Lake watershed area is 287 ha. Land use areas were determined using the Southern Ontario Land Resource Information System Version 2.0 (MNRF 2015) in a GIS environment, and cross-checked with Google Earth imagery and ground-truthing. Agriculture is the dominant land use, comprising 130.5 ha, or 46% of the watershed area (Figure 3, Table 3). Forests, wetlands, and open water areas represent a lesser proportion (12% to 17%) of the watershed. Residential land uses (e.g. homes, manicured lawns, driveways and roads) surround the lake (Figure 3) and cover 9% of the watershed. Transitional and aggregate land uses represent a minor (<5%) portion (Figure 3, Table 3) of the watershed area.

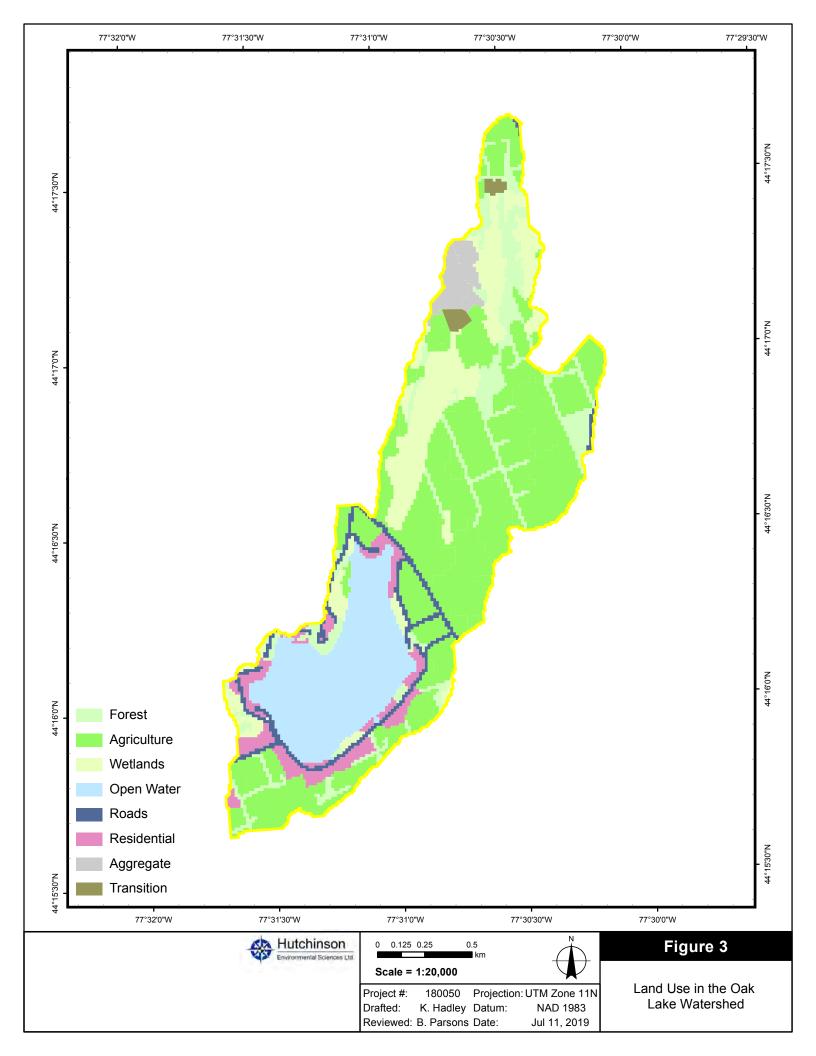
#### Table 3. Land Uses Areas in the Oak Lake Watershed.

Land Use	Area (ha)
Agriculture	130.5
Wetland	38.8
Forest	33.6
Transition	2.1
Residential	26.2
Aggregate	7.1
Open Water/Atmosphere	48.4
Total	286.8



It should be noted that phosphorus concentrations from the tile drain at sampling locations Trib-4 and Trib-5 were collected but it is not possible to assign a phosphorus load from the tile drain and associated agricultural lands unless flows and related phosphorus concentrations in the tile drain are quantified continuously throughout the year. Also, we acknowledge that a pig manure spill occurred on February 12-16, 2018 which resulted in a large, one-time load of phosphorus, in addition to other pollutants entering Oak Lake. This phosphorus load cannot be estimated and was assumed to be a non-recurring event and so was not entered into the phosphorus budget but the occurrence of the manure spill and elevated nutrient concentrations in the tile drain justify elevated phosphorus loading rates recommended in related literature and protocols.





#### Oak Lake Water Quality Monitoring Report and Lake Management Plan

#### 2.6.2 Sewage Treatment System Phosphorus Load

Phosphorus loads from sewage treatment systems were estimated based on guidance in Province of Ontario (2010):

• septic load rate (0.66 kg/capita yrs/yr) \* occupancy rate (0.69 to 2.56) \* # of units

Occupancy rates were determined based on the results of 52 completed questionnaires that answered question #3 (Do you use your cottage or residence: summer only, summer and occasionally in winter, regularly throughout the year, permanent resident) and assigned a corresponding usage from Province of Ontario (2010) for permanent (2.56 capita yrs/yr), extended seasonal (1.27 capita yrs/yr) or seasonal (0.69 capita yrs/yr) usage. The occupancy rates of the remaining residences from landowners who did not provide the information were assumed based on the ratio of occupancies from those who did.

#### 2.6.3 Internal Phosphorus Load

Internal loading of phosphorus to the lake from sediments occurs under anoxic conditions and may represent a significant input of nutrients to the system. In some cases, internal loading can account for over half of the total annual phosphorus load to shallow lakes and may prevent improvements in water quality when managing point and non-point source pollution (Søndergaard, 2003). Internal phosphorus is released from sediments primarily in dissolved form that is available for biological uptake by algae and cyanobacteria and so may trigger nuisance growths. In addition, some cyanobacteria are able to take phosphorus directly from the sediments.

A commonly used method to calculate the internal load is the Nürnberg in-situ method (Nürnberg 1988, 2009), which is based on changes in phosphorus concentrations between two dates. This approach assumes that the external phosphorus and the water loads to Oak Lake remain static between the two dates and that any increase in lake phosphorus concentrations is due to internal loading. This method is appropriate for Oak Lake because it receives very little inflow or outflow, especially between spring and late summer which are the dates typically used in the assessment to calculate the summer internal load, which makes up the majority of the annual internal load.

The equation for strongly stratified lakes was used to calculate the summer internal phosphorus load as the difference between end-of-summer hypolimnetic phosphorus mass and phosphorus mass from samples collected at the beginning of the anoxic period (i.e. spring):

Summer internal phosphorus load = (end of summer phosphorus concentration \* volume of Oak Lake) – (phosphorus concentration at the beginning of the anoxic period \* volume of Oak Lake) / area of lake

The same equation was used to calculate the winter internal phosphorus load as the difference between winter hypolimnetic phosphorus mass and phosphorus mass from samples collected after fall turnover:

Winter internal phosphorus load = (phosphorus concentration under ice \* volume of Oak Lake) – (phosphorus concentration after fall turnover \* volume of Oak Lake) / area of lake



# 2.7 Water Levels

Rising lake levels were identified as a major concern for residents and their properties. Water level management recommendations were informed by the background review, which included review of historical water levels and survey results focused on a) the level of concern related to water level fluctuation, b) seriousness of problems with lake (including water level fluctuation), c) whether water levels are too high, too low or are good as is, and d) what impacts water levels have had on shoreline properties.

Field investigations included an examination of water levels, determination of the impact of culvert elevation on water levels during each sampling event and documented through photographs.

It should be noted that although water level fluctuation and water level management has become the primary issue of concern for residents, the current study was focused on water quality and not on management of water levels. The scope of study did include consideration of water levels and how management would impact water quality and so that was addressed but determination of an engineered solution for water levels was outside of the scope of the current study. We have, however, included recommendations on steps needed to address water level management issues for Oak Lake.

# 3. Results

# 3.1 Water Quality

Water quality results for open water sites (i.e. minimum, maximum and mean) are summarized by site on Table 4 and by season on Table 5, while results for tributary sites are presented on Table 6. Bacteria results are summarized for open water sites on Table 8 and Table 9, and for tributary sites on Table 10.

A master spreadsheet with all water quality results is presented in Appendix B, while additional laboratory related water quality information such as Chains of Custody, Sample Receipt Confirmations and Certificates of Analysis are provided in Appendix C.

## 3.1.1 Temperature

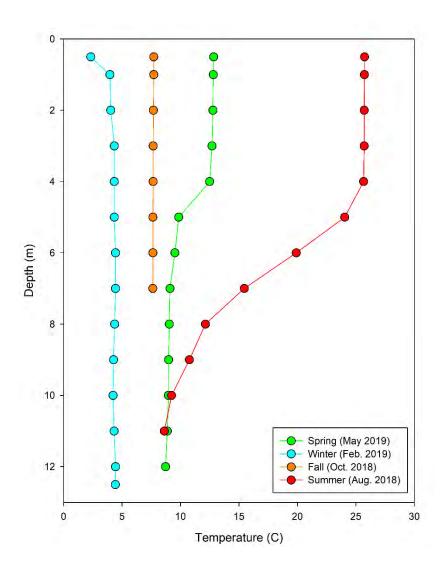
Temperature profiles followed typical seasonal stratification found in dimictic lakes. Stratification, the separation of the lake into distinctive thermal layers which do not mix, was established in May/June and persisted throughout the summer until fall overturn in late September (Figure 4). The establishment of thermal stratification in lakes prevents mixing of water between the warm surface waters (epilimnion) and the relatively cool deeper water (hypolimnion) and as a result prevents oxygen rich surface water from mixing with oxygen depleted bottom waters. As oxygen is consumed in the deep water over time by bacterial decomposition and other processes, anoxia may develop and result in internal phosphorus loading to the lake (See Section 3.1.2)

## 3.1.1 Dissolved Oxygen

Dissolved oxygen concentrations were similar between sites and followed a seasonal pattern where the lowest concentrations were recorded in summer and concentrations increased in fall and winter/spring in an inverse relationship with water temperature (Table 5). The relationship between water temperature and



dissolved oxygen exists because solubility of dissolved oxygen decreases as temperature increases. Profiles indicated that the lake was stratified at ~6-9m in summer, fall and winter.





Dissolved oxygen concentrations at Trib-2, Trib-4 and Trib-5 ranged from 44.4% (6.41 mg/L) to 132% (14.17 mg/L). The lowest concentrations were recorded at Trib-4 and Trib-5 downstream of the tile drain in the winter, likely because the organic inputs from the tile drain resulted in abundant bacteria that use up the oxygen during respiration.

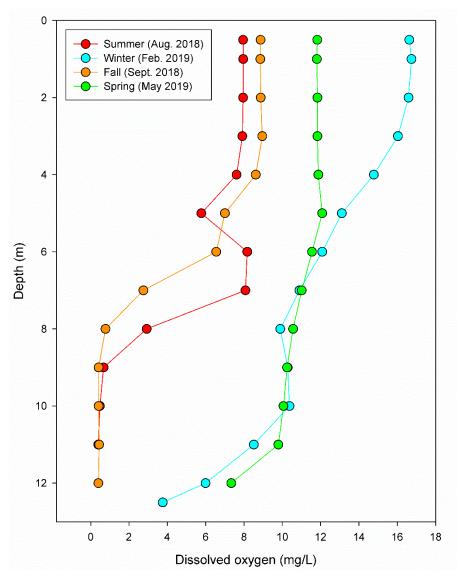
Dissolved oxygen increased between 6 and 7 m, where algal assemblages and associated photosynthesis provided increased oxygen, before sharply declining to approximately 0.67 mg/L at 9 m on August 16, 2018, indicating the bottom of the lake was anoxic (i.e. lacked oxygen) at that time (Figure 5). MECP measured a similar oxygen profile in September 2018 where dissolved oxygen conditions <1 mg/L were measured at 8 m and deeper. Dissolved oxygen (and water temperatures) were similar throughout the water column on



September 1, 2018, February 11, 2019 and May 8, 2019, indicating the lake was mixed and not thermally stratified.

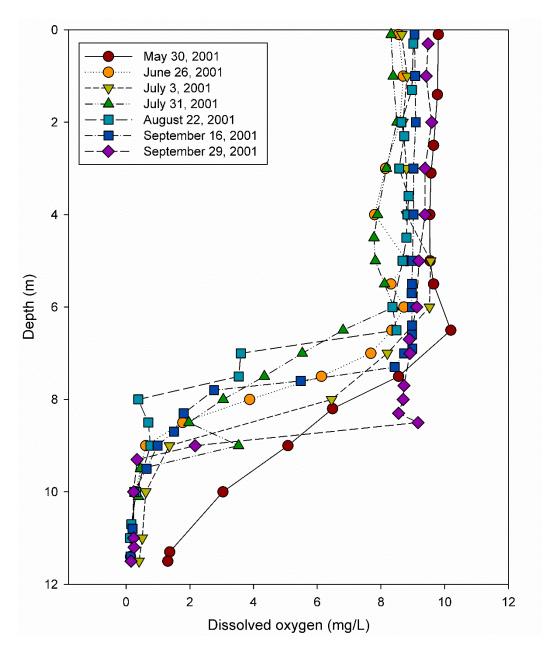
A number of dissolved oxygen profiles were recorded by Ontario Lake Assessment (OLA,2002b) throughout the open water season in 2001 (Figure 6). The profiles showed that dissolved oxygen concentrations declined sharply below approximately 7-8 metres and remained near zero throughout the rest of the water column. Dissolved oxygen concentrations measured at the beginning (i.e. May 30, 2011) and end (i.e. January 29, 2011) of the sampling season contained the highest oxygen concentrations at the greatest depths, as they represented early summer conditions after spring overturn and earlier winter conditions, both prior to any substantial oxygen demand. The OLA profiles showed the same oxygen conditions documented by HESL and MECP in 2018-2019.













# Table 4. Water Quality Summary by Site.

	Units	Guideline		OL-1			OL-2			OL-4			OL-7		OL-9			
Field Parameters			Minimum	Maximum	Mean													
Temperature	°C		2.32	25.74	12.15	2.98	24.94	12.14	3.47	25.43	12.46	2.47	24.63	11.82	2.57	25.04	11.83	
Conductivity	µS/cm^c		274	328	293	271	328	300	269	330	301	287	344	313	264	330	301	
Conductivity	µS/cm		156	282	222	177	270	224	182	271	226	188	286	233	179	264	223	
Dissolved Oxygen	%	47	91.9	123.3	106.2	88.7	113.3	100.5	94.1	124.6	108	73.2	118	100.3	71.8	115.3	98.7	
Dissolved Oxygen	mg/L		7.95	16.62	11.84	7.35	13.59	11.17	8.34	16.4	11.92	6.88	15.22	11.66	5.93	15.42	11.24	
рН	pH units	6.5 - 8.5	8.08	8.77	8.39	7.71	8.84	8.2	8.02	8.82	8.44	7.93	8.84	8.3	7.97	8.81	8.29	
Physical Tests (Water)																		
Hardness (as CaCO3)	mg/L		59.00	85.60	72.90	61.00	83.60	73.15	59.00	83.60	71.90	54.00	83.50	69.13	55.00	87.90	74.98	
рН	pH units	6.5 - 8.5	7.97	8.60	8.21	7.95	8.66	8.25	7.92	8.62	8.22	7.61	8.70	8.19	7.59	8.81	8.16	
Total Suspended Solids	mg/L		2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	4.30	2.58	2.00	3.10	2.60	
Anions and Nutrients (Water)																		
Alkalinity, Total (as CaCO3)	mg/L		50.00	83.00	67.00	49.00	81.00	68.25	46.00	81.00	65.25	48.00	80.00	64.25	41.00	83.00	67.00	
Ammonia, Total (as N)	mg/L		0.07	0.13	0.11	0.01	0.54	0.16	0.02	0.21	0.11	0.03	0.37	0.17	0.05	0.74	0.39	
Unionized Ammonia	mg/L	0.02	0.0007	0.03	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.02	0.01	0.00	0.03	0.01	
Chloride (CI)	mg/L	120	49.60	51.60	51.05	49.60	57.90	52.63	48.90	51.60	50.43	50.20	53.70	52.10	49.30	51.80	51.08	
Nitrate (as N)	mg/L	13	0.01	0.08	0.03	0.01	0.09	0.04	0.01	0.21	0.06	0.01	0.26	0.08	0.02	0.30	0.09	
Total Kjeldahl Nitrogen	mg/L		0.37	0.65	0.51	0.53	0.74	0.61	0.46	0.82	0.59	0.46	0.81	0.66	0.63	1.02	0.77	
Total Phosphorus (Top)	mg/L	0.02	0.009	0.053	0.021	0.008	0.037	0.017	0.010	0.018	0.013	0.005	0.071	0.026	0.022	0.151	0.061	
Total Phosphorus (Bottom)	mg/L		0.007	0.032	0.020													
Sulfate (SO4)	mg/L		1.54	2.04	1.78	1.55	2.17	1.81	1.54	2.04	1.78	1.13	2.23	1.71	1.61	2.52	1.92	
Organic / Inorganic Carbon (Water)																		
Dissolved Organic Carbon	mg/L		5.88	6.19	5.98	4.89	6.54	5.78	4.85	6.47	5.72	5.30	7.68	6.30	5.02	8.23	6.69	
Plant Pigments (Water)																		
Chlorophyll a	mg/L		1.63	6.92	3.91	2.55	13.50	6.70	2.65	4.65	3.90	2.76	10.20	5.68	3.40	9.23	7.18	
Total Metals (Water)																		
Aluminum (Al)-Total	mg/L	0.075	0.0119	0.0196	0.0157	0.0066	0.0252	0.0140	0.0059	0.0139	0.0100	0.0077	0.0350	0.0173	0.0083	0.0658	0.0338	
Antimony (Sb)-Total	mg/L		0.00010	0.00011	0.00010	0.00010	0.00011	0.00010	0.00010	0.00013	0.00011	0.00010	0.00011	0.00010	0.00010	0.00016	0.00012	
Arsenic (As)-Total	mg/L	0.005	0.0005	0.0006	0.0006	0.0005	0.0006	0.0006	0.0005	0.0007	0.0006	0.0005	0.0006	0.0005	0.0005	0.0007	0.0006	
Barium (Ba)-Total	mg/L		0.015	0.016	0.016	0.014	0.017	0.016	0.014	0.016	0.015	0.014	0.016	0.015	0.013	0.019	0.016	



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Boron (B)-Total	mg/L	0.2	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
Cadmium (Cd)-Total	mg/L	0.0001	0.000005	0.000006	0.000005	0.000005	0.000017	0.000009	0.000005	0.000014	0.000008	0.000005	0.000030	0.000013	0.000005	0.000052	0.000021
Calcium (Ca)-Total	mg/L		18.8	29.6	24.6	19.6	28.9	24.6	18.8	28.8	24.3	16.7	28.6	23.0	17.2	30.3	25.2
Chromium (Cr)-Total	mg/L	0.1	0.0005	0.0091	0.0062	0.0005	0.0005	0.0005	0.0005	0.0006	0.0005	0.0005	0.0014	0.0008	0.0005	0.0005	0.0005
Cobalt (Co)-Total	mg/L	0.0006	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Copper (Cu)-Total	mg/L	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.005	0.002	0.001	0.002	0.001
Iron (Fe)-Total	mg/L	0.3	0.013	0.050	0.035	0.012	0.050	0.027	0.012	0.050	0.023	0.044	0.062	0.050	0.020	0.091	0.052
Lead (Pb)-Total	mg/L	0.005	0.00005	0.00005	0.00005	0.00005	0.00006	0.00005	0.00005	0.00009	0.00006	0.00005	0.00009	0.00006	0.00005	0.00016	0.00009
Magnesium (Mg)-Total	mg/L		2.66	2.85	2.79	2.76	2.84	2.81	2.50	3.05	2.81	2.40	2.93	2.79	2.87	2.99	2.94
Manganese (Mn)-Total	mg/L		0.004	0.006	0.005	0.003	0.005	0.004	0.003	0.005	0.004	0.010	0.014	0.011	0.006	0.039	0.017
Molybdenum (Mo)-Total	mg/L	0.01	0.00011	0.00021	0.00017	0.00009	0.00012	0.00011	0.00008	0.00010	0.00009	0.00005	0.00014	0.00010	0.00008	0.00022	0.00013
Nickel (Ni)-Total	mg/L	0.025	0.0005	0.0024	0.0011	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Potassium (K)-Total	mg/L		1.40	2.20	1.78	1.40	1.86	1.70	1.44	1.74	1.60	1.70	2.27	1.92	1.51	4.38	2.56
Rubidium (Rb)-Total	mg/L		0.0013	0.0017	0.0014	0.0013	0.0015	0.0014	0.0012	0.0013	0.0012	0.0013	0.0017	0.0015	0.0013	0.0021	0.0016
Selenium (Se)-Total	mg/L	0.1	0.00005	0.00007	0.00006	0.00005	0.00005	0.00005	0.00005	0.00006	0.00005	0.00005	0.00007	0.00006	0.00005	0.00009	0.00006
Silicon (Si)-Total	mg/L		0.10	0.15	0.12	0.10	0.11	0.10	0.10	0.11	0.10	0.10	0.22	0.16	0.10	0.43	0.22
Sodium (Na)-Total	mg/L		27.9	29.2	28.5	27.5	32.1	29.6	25.7	30.1	27.8	28.6	31.3	30.2	28.2	30.6	29.5
Strontium (Sr)-Total	mg/L		0.058	0.066	0.062	0.058	0.067	0.063	0.056	0.064	0.059	0.053	0.066	0.058	0.058	0.067	0.063
Sulfur (S)-Total	mg/L		0.71	0.84	0.78	0.77	0.87	0.82	0.71	0.83	0.78	0.68	1.11	0.88	0.82	0.96	0.88
Titanium (Ti)-Total	mg/L		0.0003	0.0070	0.0026	0.0003	0.0004	0.0003	0.0003	0.0004	0.0003	0.0003	0.0013	0.0006	0.0003	0.0028	0.0012
Uranium (U)-Total	mg/L	0.005	0.00002	0.00003	0.00002	0.00002	0.00003	0.00002	0.00002	0.00003	0.00002	0.00001	0.00003	0.00002	0.00003	0.00005	0.00004
Zinc (Zn)-Total	mg/L	0.02	0.003	0.003	0.003	0.003	0.006	0.004	0.003	0.004	0.003	0.003	0.004	0.003	0.003	0.010	0.005
Aggregate Organics (Water)																	
BOD	mg/L		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.9	2.2	2.0	2.7	2.2

Note: Minimum values are presented as 1/2 the detection limit for results that were less than the detection limit. Mean results were also calculated using 1/2 the detection limit.



# Table 5. Water Quality Summary by Season

			08-May-19			16-Aug-18			29-Oct-18		11-Feb-19		
Field Measurements	Units	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean
Temperature	°C	12.83	13.98	13.17	24.63	25.74	25.16	6.21	7.80	7.24	2.32	3.47	2.76
	µS/cm^c	328	330	329	264	287	274	293	299	295	274	344	309
Conductivity	µS/cm	252	260	255	264	286	275	188	197	194	156	196	178
	%	111.8	118.0	114.1	71.8	101.6	86.6	91.9	98.9	95.4	100.9	124.6	114.8
Dissolved Oxygen	mg/L	11.8	12.3	12.0	5.9	8.3	7.3	11.0	12.2	11.5	13.6	16.6	15.5
рН		8.29	8.54	8.41	7.71	8.39	8.07	8.77	8.84	8.82	7.93	8.08	8.00
Physical Tests													
Hardness (as CaCO <sub>3</sub> )	mg/L	84	88	85	54	61	58	70	77	74	65	80	73
рН	pH units	8.27	8.38	8.31	8.60	8.81	8.68	7.97	8.07	8.02	7.59	7.97	7.81
Total Suspended Solids	mg/L	1.00	1.00	1.00	1.00	2.40	1.28	1.00	2.90	1.38	1.00	4.30	2.08
Anions and Nutrients													
Alkalinity, Total (as CaCO₃)	mg/L	80.0	83.0	81.6	41.0	50.0	46.8	62.0	65.0	64.2	64.0	80.0	72.8
Ammonia, Total (as N)	mg/L	0.005	0.738	0.254	0.025	0.130	0.052	0.145	0.562	0.365	0.051	0.210	0.121
Unionized Ammonia	mg/L	0.0005	0.0308	0.0119	0.005	0.025	0.011	0.002	0.009	0.006	0.001	0.002	0.001
Chloride (CI)	mg/L	49.3	50.2	49.7	51.6	53.4	52.0	51.1	51.7	51.4	48.9	57.9	52.7
Nitrate (as N)	mg/L	0.010	0.027	0.013	0.010	0.010	0.010	0.010	0.010	0.010	0.080	0.299	0.187
Total Kjeldahl Nitrogen	mg/L	0.500	0.780	0.610	0.500	0.640	0.582	0.460	0.650	0.562	0.370	1.020	0.752
Phosphorus, Total	mg/L	0.0104	0.0215	0.0135	0.0106	0.0255	0.0152	0.0050	0.0441	0.0152	0.0182	0.1510	0.0662
Sulfate (SO <sub>4</sub> )	mg/L	1.84	1.88	1.86	1.13	1.68	1.55	1.54	1.68	1.59	2.04	2.52	2.20
Organic / Inorganic Carbon													
Dissolved Organic Carbon	mg/L	4.85	5.91	5.19	6.19	7.68	6.84	5.87	6.19	5.98	5.56	8.23	6.36
Plant Pigments													
Chlorophyll a	μg/L	2.55	5.72	3.40	2.76	8.44	4.72	4.02	7.63	5.92	1.63	13.50	7.84
Total Metals													
Aluminum (AI)-Total	mg/L	0.0059	0.0119	0.0084	0.0077	0.0272	0.0157				0.0101	0.0658	0.0303
Antimony (Sb)-Total	mg/L	0.00005	0.00005	0.00005	0.00005	0.00010	0.00006				0.00011	0.00016	0.00012
Arsenic (As)-Total	mg/L	0.00046	0.00053	0.00050	0.00060	0.00070	0.00064				0.00047	0.00069	0.00057
Barium (Ba)-Total	mg/L	0.0155	0.0162	0.0158	0.0134	0.0147	0.0142				0.0149	0.0187	0.0163
Beryllium (Be)-Total	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005				0.00005	0.00005	0.00005
Bismuth (Bi)-Total	mg/L	0.000025	0.000025	0.000025	0.000025	0.000025	0.000025				0.000025	0.000025	0.000025
Boron (B)-Total	mg/L	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050				0.0050	0.0100	0.0060
Cadmium (Cd)-Total	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025				0.0000061	0.0000519	0.0000238
Calcium (Ca)-Total	mg/L	28.6	30.3	29.2	16.7	19.6	18.2	23.4	26.1	24.9	22.0	27.1	24.9
Cesium (Cs)-Total	mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005				0.000005	0.000005	0.000005
Chromium (Cr)-Total	mg/L	0.00025	0.00139	0.00054	0.00025	0.00909	0.00202				0.00025	0.00025	0.00025
Cobalt (Co)-Total	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005				0.00005	0.00011	0.00006
Copper (Cu)-Total	mg/L	0.0005	0.0013	0.0007	0.0005	0.0005	0.0005				0.0005	0.0049	0.0021
Iron (Fe)-Total	mg/L	0.018	0.044	0.027	0.012	0.046	0.031	0.025	0.025	0.025	0.012	0.091	0.041
Lead (Pb)-Total	mg/L	0.000025	0.000051	0.000030	0.000025	0.000025	0.000025				0.000025	0.000162	0.000085



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Lithium (Li)-Total	mg/L	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005				0.0005	0.0005	0.0005
Magnesium (Mg)-Total	mg/L	2.76	2.99	2.87	2.82	3.05	2.92	2.82	2.93	2.86	2.40	2.92	2.66
Manganese (Mn)-Total	mg/L	0.00504	0.01010	0.00647	0.00392	0.01420	0.00686				0.00341	0.03900	0.01193
Molybdenum (Mo)-Total	mg/L	0.000102	0.000124	0.000112	0.000025	0.000207	0.000097				0.000098	0.000217	0.000150
Nickel (Ni)-Total	mg/L	0.00025	0.00025	0.00025	0.00025	0.00238	0.00068				0.00025	0.00025	0.00025
Potassium (K)-Total	mg/L	1.70	1.86	1.77	1.40	1.80	1.51				1.63	4.38	2.46
Rubidium (Rb)-Total	mg/L	0.00125	0.00146	0.00133	0.00126	0.00136	0.00130				0.00121	0.00210	0.00165
Selenium (Se)-Total	mg/L	0.000025	0.000025	0.000025	0.000025	0.000025	0.000025				0.000053	0.000094	0.000069
Silicon (Si)-Total	mg/L	0.005	0.005	0.005	0.110	0.160	0.126				0.005	0.430	0.162
Silver (Ag)-Total	mg/L	0.000025	0.000025	0.000025	0.000025	0.000025	0.000025				0.000025	0.000025	0.000025
Sodium (Na)-Total	mg/L	27.5	28.6	28.0	29.1	31.3	30.1				25.7	32.1	29.3
Strontium (Sr)-Total	mg/L	0.0643	0.0671	0.0657	0.0555	0.0583	0.0570				0.0527	0.0667	0.0607
Sulfur (S)-Total	mg/L	0.710	0.840	0.796	0.680	0.850	0.768				0.790	1.110	0.914
Tellurium (Te)-Total	mg/L	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001				0.0001	0.0001	0.0001
Thallium (TI)-Total	mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005				0.000005	0.000005	0.000005
Thorium (Th)-Total	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005				0.00005	0.00005	0.00005
Tin (Sn)-Total	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005				0.00005	0.00005	0.00005
Titanium (Ti)-Total	mg/L	0.00015	0.00350	0.00085	0.00015	0.00037	0.00019				0.00035	0.00281	0.00120
Tungsten (W)-Total	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005				0.00005	0.00005	0.00005
Uranium (U)-Total	mg/L	0.000027	0.000035	0.000031	0.000005	0.000027	0.000018				0.000020	0.000050	0.000028
Vanadium (V)-Total	mg/L	0.000250	0.000250	0.000250	0.000250	0.000250	0.000250				0.000250	0.000250	0.000250
Zinc (Zn)-Total	mg/L	0.001500	0.005700	0.002700	0.001500	0.001500	0.001500				0.001500	0.010300	0.004780
Zirconium (Zr)-Total	mg/L	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150				0.000150	0.000150	0.000150
Aggregate Organics													
BOD	mg/L	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.90	1.92

Note: Minimum values are presented as 1/2 the detection limit for results that were less than the detection limit. Mean results were also calculated using 1/2 the detection limit.



Table 6. Water Quality Results from Tributary Sites.

		Guideline	Trib-2		Trib-4			Trib-5	
Field Measurements	Units		8-May- 2019	Minimum	Maximum	Mean	Minimum	Maximum	Mean
Temperature	°C		14.85	0.67	8.32	3.55	0.07	12.62	5.22
	µS/cm^c		335	251	607	371	246	589	382
Conductivity	µS/cm		270	134	413	229	128	449	252
<b>5</b> 1 1 1 <b>0</b>	%	47	112.5	44.4	94.0	61.9	45.4	132.0	75.0
Dissolved Oxygen	mg/L		11.63	6.41	10.71	7.88	6.10	14.17	9.02
рН	pH units	6.5 - 8.5	8.38	7.95	8.77	8.31	7.97	8.24	8.12
Physical Tests (Water)									
Hardness (as CaCO3)	mg/L		84.8	97.0	287.0	221.3	96.0	279.0	210.3
рН	pH units	6.5 - 8.5	8.23	7.03	7.63	7.41	7.15	7.98	7.60
Total Suspended Solids	mg/L		1.0	10.3	15.3	12.0	4.6	5.5	5.1
Anions and Nutrients (Water)									
Alkalinity, Total (as CaCO3)	mg/L		83	108	280	218	109	270	214
Ammonia, Total (as N)	mg/L		0.026	0.940	2.210	1.447	0.641	1.580	1.010
Unionized Ammonia	mg/L	0.02	0.002	0.0186	0.0461	0.0316	0.0063	0.0245	0.0180
Chloride (Cl)	mg/L	120	51.1	6.7	12.2	9.7	6.8	14.4	10.5
Nitrate (as N)	mg/L	13	0.010	0.786	6.720	2.783	0.491	6.580	2.596
Total Kjeldahl Nitrogen	mg/L		0.37	2.33	3.45	2.72	1.60	2.71	2.19
Phosphorus, Total	mg/L	0.02	0.020	0.153	0.572	0.351	0.148	0.512	0.353
Sulfate (SO4)	mg/L		1.85	3.65	8.28	6.17	3.39	7.97	6.19
Organic / Inorganic Carbon (Water)									
Dissolved Organic Carbon	mg/L		5.2	6.5	22.9	13.6	6.7	22.1	12.6
Plant Pigments (Water)									
Chlorophyll a	ug/L		6.1	14.2	14.2	14.2	16.0	16.0	16.0
Total Metals (Water)									
Aluminum (Al)-Total	mg/L	0.075	0.0108	0.0495	0.278	0.1655	0.0224	0.128	0.0703
Antimony (Sb)-Total	mg/L		0.00005	0.00011	0.00014	0.0001267	0.00012	0.00013	0.0001233
Arsenic (As)-Total	mg/L	0.005	0.00053	0.00053	0.00139	0.00093	0.00062	0.00121	0.0008767
Barium (Ba)-Total	mg/L		0.0157	0.0251	0.0534	0.0409	0.0218	0.0427	0.03533
Beryllium (Be)-Total	mg/L		0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Bismuth (Bi)-Total	mg/L		0.000025	0.000025	0.000025	0.000025	0.000025	0.000025	0.000025
Boron (B)-Total	mg/L	0.2	0.005	0.011	0.031	0.02	0.011	0.023	0.018
Cadmium (Cd)-Total	mg/L	0.0001	0.0000025	0.000011	0.0000313	0.0000239	0.0000122	0.0000238	0.000017
Calcium (Ca)-Total	mg/L		29.2	32.5	100.0	77.2	32.6	98.5	73.3
Cesium (Cs)-Total	mg/L		0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Chromium (Cr)-Total	mg/L	0.1	0.00140	0.00053	0.00082	0.00063	0.00025	0.00160	0.00081
Cobalt (Co)-Total	mg/L	0.0006	0.00005	0.00030	0.00126	0.00068	0.00023	0.00115	0.00061
Copper (Cu)-Total	mg/L	0.005	0.00050	0.00150	0.00520	0.00280	0.00130	0.00520	0.00267



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Iron (Fe)-Total	mg/L	0.3	0.06500	0.20600	0.96700	0.47300	0.13300	0.82600	0.37967
Lead (Pb)-Total	mg/L	0.005	0.00003	0.00010	0.00017	0.00015	0.00005	0.00014	0.00010
Lithium (Li)-Total	mg/L		0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Magnesium (Mg)-Total	mg/L		2.90	3.72	8.93	6.86	3.61	8.28	6.61
Manganese (Mn)-Total	mg/L		0.0097	0.1560	0.8600	0.4033	0.1120	1.3100	0.5537
Molybdenum (Mo)-Total	mg/L	0.01	0.00013	0.00049	0.00069	0.00056	0.00056	0.00059	0.00057
Nickel (Ni)-Total	mg/L	0.025	0.00025	0.00025	0.00110	0.00064	0.00051	0.00079	0.00062
Phosphorus (P)-Total	mg/L		0.025	0.146	0.635	0.365	0.136	0.587	0.379
Potassium (K)-Total	mg/L		1.72	6.38	11.30	8.32	6.48	11.50	8.51
Rubidium (Rb)-Total	mg/L		0.0013	0.0016	0.0024	0.0020	0.0015	0.0026	0.0021
Selenium (Se)-Total	mg/L	0.1	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Silicon (Si)-Total	mg/L		0.50	2.00	4.51	3.29	1.85	3.72	2.76
Silver (Ag)-Total	mg/L		0.000025	0.000025	0.000025	0.000025	0.000025	0.000025	0.000025
Sodium (Na)-Total	mg/L		29.30	3.18	6.79	5.57	3.45	8.50	6.35
Strontium (Sr)-Total	mg/L		0.067	0.060	0.183	0.138	0.059	0.183	0.133
Sulfur (S)-Total	mg/L		0.81	1.32	2.97	2.26	1.25	2.86	2.22
Tellurium (Te)-Total	mg/L		0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Thallium (TI)-Total	mg/L		0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Thorium (Th)-Total	mg/L		0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Tin (Sn)-Total	mg/L		0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Titanium (Ti)-Total	mg/L		0.00037	0.00228	0.01230	0.00713	0.00093	0.00484	0.00242
Tungsten (W)-Total	mg/L		0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Uranium (U)-Total	mg/L	0.005	0.00003	0.00029	0.00282	0.00127	0.00025	0.00169	0.00089
Vanadium (V)-Total	mg/L		0.00025	0.00116	0.00222	0.00157	0.00109	0.00125	0.00118
Zinc (Zn)-Total	mg/L	0.02	0.00150	0.00400	0.01160	0.00790	0.00490	0.01890	0.01250
Zirconium (Zr)-Total	mg/L		0.00015	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015
Aggregate Organics (Water)	mg/L								
BOD			1.50	4.90	12.60	8.75	2.90	11.10	7.00

Note: Minimum values are presented as 1/2 the detection limit for results that were less than the detection limit. Mean results were also calculated using 1/2 the detection limit.



#### 3.1.2 Nutrients

#### 3.1.2.1 Phosphorus

Phosphorus can enter lakes via external loading from the watershed, precipitation or through internal loading. Effluent from sewage treatment systems and stormwater runoff can have particularly high loadings. Phosphorus is the primary limiting nutrient in freshwaters in support of macrophyte and algal growth. Concentrations ranged between 0.005 mg/L and 0.151 mg/L at open water sites and exhibited considerable spatial and seasonal patterns (Table 4, Table 5). Average concentrations at open water sites were much higher in the winter (0.07 mg/L) than spring (0.01 mg/L), summer (0.02 mg/L) or fall (0.02 mg/L). Average concentrations were also much higher at OL-9 (0.06 mg) than the rest of the sites (0.01 mg/L - 0.03 mg/L).

Phosphorus concentrations were elevated at Trib-4 and Trib-5 on each sampling occasion (0.15 mg/L - 0.57 mg/L) with the highest average concentrations measured on February 11, 2019 (0.54 mg/L) and declining throughout the late winter (0.36 mg/L) and early spring (0.15 mg/L; Appendix B; Table 6).

The average phosphorus concentration at OL-1 was 0.021 mg/L based on all data collected, and 0.010 during the open water season, the latter of which is lower than the PWQO for phosphorus concentrations during the ice-free period (0.02 mg/L) that is recommended to "avoid nuisance concentrations of algae in lakes". 72 samples have been collected and analyzed at OL-1 as part of a variety of background studies between 1999 and 2014. Historical phosphorus concentrations ranged between 0.002 and 0.032 mg/L with an average concentration of 0.014 mg/L. Annual average phosphorus concentrations at OL-1 between 1999 - 2018 were calculated from historical data and were consistent over time beyond a somewhat elevated concentration in 1999 (0.02 mg/L; Figure 7). Mann Kendall trend analysis did not find a significant trend in total phosphorus concentrations (p=0.46).



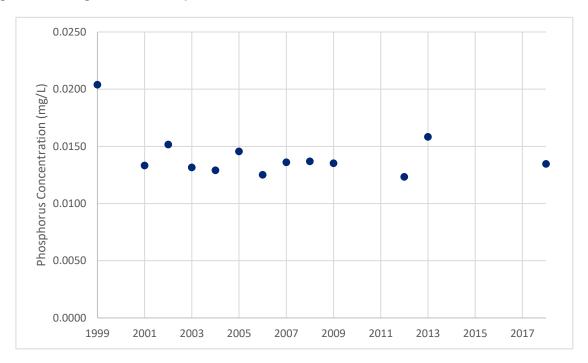


Figure 7. Average Annual Phosphorus Concentrations at OL-1 Over Time

Phosphorus concentrations at OL-1, 1 m off bottom, ranged between 0.007 mg/L on October 29, 2018 and 0.0321 mg/L on August 16, 2018 (Table 7). Phosphorus concentrations at OL-1 were similar near the surface and 1 m off bottom on May 8, 2019 and October 29, 2018 (Table 7). Concentrations were  $\sim$ 3x higher near bottom on August 16, 2018 yet  $\sim$ 3x higher at the surface on February 11, 2019 when samples were collected under ice.

11 samples were collected at OL-1, 1 m off bottom during historical studies, including approximately monthly during the open water season in 2001. Concentrations ranged between 0.01 mg/L and 0.1 mg/L with an average of 0.04 mg/L while the average concentration in 2018/19 was 0.02 mg/L.

# Table 7. Phosphorus Concentrations at OL-1 from Near Surface Samples and Samples Collected 1 metre off Bottom

	16-Aug-2018	29-Oct-2018	11-Feb-2019	8-May-2019
OL-1 (top)	0.0108	0.0086	0.0532	0.0104
OL-1 (btm)	0.0321	0.007	0.0193	0.0137

All phosphorus concentrations at Trib-4 and Trib-5 were elevated and ranged from 0.148 mg/L to 0.572 mg/L with the highest concentrations noted on February 11, 2019 and March 28, 2019 (Table 6).

## 3.1.2.2 Nitrogen Parameters

Nitrate occurs from nitrate oxidation of nitrogen compounds, notably ammonia from septic systems and agricultural runoff, and it can cause excessive growth of algae and macrophytes when phosphorus is also

enriched. Nitrate ranged from 0.03 mg/L to 0.3 mg/L at open water sites (Table 4). Average concentrations were much higher in the winter (0.19 mg/L) than other seasons (0.01 mg/L - 0.03 mg/L; Table 5). Highest average concentrations were noted at OL-9 (0.09 mg/L) but all concentrations were well below the CCME toxicity guideline of 3 mg/L. Concentrations measured at Trib-4 and Trib-5 were elevated, some beyond the CCME guidelines, and ranged from 0.49 mg/L to 6.72 mg/L with the highest concentrations noted on May 8, 2019 (Table 6).

Total Kjeldahl Nitrogen (TKN) is a measure of ammonia plus organic nitrogen and is generally related to the supply of ammonia from the hydrolysis of organic compounds. TKN concentrations ranged between 0.37 mg/L and 1.02 mg/L, averaged 0.62 mg/L and were similar between sites and seasons (Table 4 and Table 5). Concentrations measured at Trib-4 and Trib-5 sites averaged 2.15 mg/L (Table 6). There are no provincial or federal water quality guidelines for TKN but McNeeley et al. (1979) recommended that a range of 0.1 mg/L to 0.5 mg/L is indicative of surface waters that are not affected by organic inputs.

Ammonia concentrations were converted to unionized ammonia because it is the most toxic form to aquatic biota and has a PWQO of 0.02 mg/L. Concentrations ranged between 0.0005 mg/L and 0.031 mg/L and exceeded the guideline of 0.02 mg/L at OL-1 on August 16, 2018 (0.025 mg/L), and OL-7 (0.021 mg/L) and OL-9 (0.031 mg/L) on May 8, 2019 (Table 4; Table 5). The concentration at OL-1 on August 16, 2018 appears erroneous based on other water quality results from that day of sampling. Total ammonia nitrogen at OL-1 on August 16, 2018 was 0.130 mg/L, 10x what was recorded at the other lake stations that same day suggesting potential contamination of the sample. Unionized ammonia concentrations ranged from 0.001 mg/L – 0.046 mg/L at the tributary sites and exceeded the PWQO on numerous occasions.

## 3.1.3 Other Notable Parameters

## 3.1.3.1 Metals

Concentrations of metals in Oak Lake are summarized in Table 4. Beryllium, Bismuth, Cesium, Lithium, Silver, Tellurium, Thallium, Thorium, Tin, Tungsten, Vanadium and zirconium were all below detection limits in all samples collected. Eighteen of the metals measured have available Provincial Water Quality Objectives (PWQO). No exceedances of PWQO guidelines were noted.

## 3.1.3.2 Chlorophyll a

Chlorophyll *a* is a photosynthetic pigment which is often used as a proxy to determine the abundance of algae in lakes and rivers. A detailed examination of phytoplankton assemblages is provided in Section 3.3. The average chlorophyll *a* concentration was higher in the winter (7.84  $\mu$ g/L) than the other seasons (3.4  $\mu$ g/L - 5.9  $\mu$ g/L; Table 5), which is likely a result of limited light availability under ice. Algae tend to cluster in the winter directly under the ice which can result in increased chlorophyll *a* concentrations.

## 3.1.4 Bacteria

*E. coli* are a species of fecal coliform bacteria that comes from warm-blooded animals, including humans and are a useful indicator of potential pathogens in the water. Values ranged from less than the detection limit to 18 colony forming units (CFU)/100 mL, and averaged 2 CFU/100 mL at the open water sites (Table 8; Table 9). Concentrations measured at the tributary sites were slightly higher (range = 1 - 22 CFU/100 mL, mean = 9.14 CFU/100 mL) but all concentrations were low compared to the PWQO of 100 *E. coli*/100



mL and Health Canada's single-sample maximum concentration of 400 *E. colil* 100 mL or geometric mean concentration (minimum five samples) of 200 *E. colil* 100 mL for primary contact recreation guideline (Health Canada, 2012; Table 10). Provincial and Health Canada water quality guidelines are based on a geometric mean of 5 samples within a one-month period because bacteria concentrations are notably variable both spatially and temporally. Bacteria sampling to the degree required by the Health Canada and PWQO guidelines was beyond the scope of this study, however the guidelines provide a useful point of reference.

Samples were collected and analyzed for E. coli in 2001 on May 30, Jul 3, July 31, August 22 and September 16 by Ontario Lake Assessments from the same sample sites used in 2018. Data collected in 2001 ranged from 0 CFU/100 mL - 300 CFU/100 mL and averaged 20.5 CFU/100 mL. The minimum detection limit was higher in 2001, indicating that non-detects at half the detection limit are greater than those data in 2018 but it is clear that E. coli concentrations were lower in 2018 than 2001.

Fecal coliforms are a subset of total coliform bacteria and are commonly fecal in origin. Concentrations ranged from 0 CFU/100 mL - 21 CFU/100 mL (mean = 2.40 CFU/100 mL) at open water sites and 2 CFU/100 mL - 50 CFU/100 mL (mean = 14.7 CFU/100 mL) at tributary sites (Table 8; Table 9; Table 10). Average fecal coliform concentrations were also much lower in 2018 than those measured in 2001 (mean = 114 CFU/100 mL).

*Fecal streptococcus* lab results refer to all members of genus names *Streptococcus* and *Enterococcus*, which are commonly referred to as *Fecal streptococci* and are an index of fecal pollution used for recreational waters. Concentrations ranged from 0.5 CFU/100 mL - 113 CFU/100 mL (mean = 11.19 CFU/100 mL) at open water sites and from 0.5 to >200 CFU/100 mL at tributary sites (Table 8; Table 9; Table 10). Average concentrations for all open water sites were highest in the summer (10.1 CFU/100mL) and winter (14.2 CFU/100mL) while average concentrations were highest at OL-9 (28 CFU/100mL) and OL-10 (41 CFU/100mL). Average open water concentrations were again lower than those reported in 2001 (mean = 53.5 CFU/100 mL). Elevated *Fecal streptococcus* concentrations were found at Trib-4 and Trib-5 on February 11, 2019 (66 CFU/100 mL and 74 CFU/100mL) and March 28, 2019 (>200 CFU/100 mL and >200 CFU/100 mL). We are not aware of provincial or federal water quality guidelines for *Fecal streptococcus* so those comparisons have not been completed but studies have indicated that rates of gastroenteritis increased when densities exceeded 32/100 mL and bathers exhibited higher illness rates at 20 CFU/100 mL (Environmental Protection Agency, 2012).

*Pseudomonas aeruginosa* is a causative agent in many infections when present in recreational waters. *Pseudomonas aeruginosa* concentrations ranged from 0.5 CFU/100 mL - 117 CFU/100 mL (mean = 13.5 CFU/100 mL) at open water sites and from 3 CFU/100 mL - 43 CFU/100 mL (mean = 24.6 CFU/100 mL) at tributary sites (Table 8; Table 9; Table 10). Levels of *Pseudomonas aeruginosa* in Ontario recreational waters range from 0/100 mL to more than 100/100 mL with a median level is typically less than 1/100 mL (MOE 1984). Pseudomonas levels in excess of 100 organisms/100 mL can be measured in waters receiving surface drainage from urban areas. Lastly, for primary recreation British Columbia recommends that at least 5 samples are collected in a 30-day period and the level of Pseudomonas aeruginosa not exceed 2/100 mL in at least 75% of the samples (Ministry of Water, Land and Air Protection, 2001).



# Table 8. Bacteria Summary by Site

		OL-1			OL-2			OL-3			OL-4			OL-5			OL-6	
Bacteriological Tests	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean
E. Coli	0.0	1.0	0.3	0.0	1.0	0.5	1.0	2.0	1.3	0.0	10.0	2.8	0.0	6.0	2.3	0.0	4.0	1.8
Fecal Coliforms	0.0	2.0	0.5	0.0	4.0	1.3	0.0	4.0	1.4	0.0	6.0	2.3	0.0	4.0	1.6	0.0	2.0	1.0
Fecal Streptococcus	0.5	3.0	1.3	0.5	5.0	3.1	0.5	37.0	14.3	0.5	4.0	1.4	1.0	4.0	2.8	0.5	26.0	11.4
Pseudomonas aeruginosa	0.5	4.0	1.4	0.5	11.0	3.1	0.5	29.0	14.8	0.5	49.0	12.6	4.0	21.0	12.5	4.0	58.0	31.0
		OL-7			OL-8		OL-9		OL-10		OL-11							
Bacteriological Tests	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean			
E. Coli	0.0	4.0	2.0	0.0	6.0	2.3	1.0	14.0	5.0	0.0	18.0	4.8	0.0	14.0	3.8			
Fecal Coliforms	0.0	6.0	2.5	0.0	2.0	1.0	0.0	21.0	8.8	0.0	7.0	2.0	0.0	14.0	3.9			
Fecal Streptococcus	1.0	12.0	4.5	1.0	51.0	14.0	2.0	59.0	28.0	3.0	113.0	40.8	0.5	4.0	1.8			
Pseudomonas aeruginosa	0.5	62.0	19.3	4.0	117.0	60.5	0.5	16.0	4.4	3.0	12.0	7.5	1.0	16.0	8.5			

# Table 9. Bacteria Summary by Season

	08-May-19			28-Aug-18			2	28-Oct-18		22-Feb-19		
Bacteriological Tests	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean
E. Coli	0.0	3.0	0.8	1.0	14.0	3.6	0.0	3.0	3.6	0.0	18.0	3.6
Fecal Coliforms	0.0	2.0	0.6	1.0	14.0	4.4	0.0	10.0	4.4	0.0	21.0	4.4
Fecal Streptococcus	0.5	3.0	0.9	0.5	34.0	10.1	0.5	20.0	10.1	0.5	113.0	10.1
Pseudomonas aeruginosa	0.5	16.0	6.3	0.5	117.0	25.3	0.5	0.5	25.3	0.5	0.5	25.3



	Trib-2		Trib-4			Trib-5	
Bacteriological Tests (Water)	8-May-2019	Minimum	Maximum	Mean	Minimum	Maximum	Mean
E. Coli	22.0	3.0	19.0	8.7	1.0	12.0	5.3
Fecal Coliforms	50.0	5.0	20.0	10.7	2.0	11.0	7.0
Fecal Streptococcus	2.0	7.0	66.0	36.5	6.0	74.0	40.0
Pseudomonas aeruginosa	3.0	16.0	43.0	29.5	20.0	41.0	30.5

#### Table 10. Bacteria Results from Tributary Sites

# 3.2 Sediment Quality

Phosphorus was enriched in the sediments of Oak Lake. The total phosphorus concentration of 1990  $\mu$ g/g exceeded the Lowest Effect Level (600  $\mu$ g/g) and was close to the Severe Effect Level (2000  $\mu$ g/g) identified in the Provincial Guidelines (Ministry of Environment and Energy, 1993; Table 11), suggesting a high potential internal load to the lake.

All metal concentrations were lower than Canadian Sediment Quality Guidelines for the Protection of Aquatic Life (CCME, 2012) and the Provincial Guideline's Severe Effect Level (Ministry of Environment and Energy, 1993) but Arsenic (8.59  $\mu$ g/g), Cadmium (1.70  $\mu$ g/g), Copper (25.5  $\mu$ g/g), Lead (126  $\mu$ g/g), Nickel (17.2  $\mu$ g/g) and Zinc (120  $\mu$ g/g) all exceeded the corresponding Low Effect Levels. The Low Effect Level is a concentration which has no effect on the majority of sediment-dwelling organisms and is considered clean to marginally polluted. It is also worth noting that some of these metals are naturally elevated based on the geology of the lake and associated watershed. For example, a background level of copper concentrations in the Great Lakes is 25  $\mu$ g/g, roughly the same concentration noted in Oak Lake.

	Units	Guid	eline	OL-1
		LEL	SEL	
Phosphorus (P)	μ <b>g/g</b>	600	2000	1990
Leachable Anions & Nutrients (Soil)				
Total Kjeldahl Nitrogen	%			2.34
Metals (Soil)				
Aluminum (Al)	μ <b>g/g</b>			18000
Antimony (Sb)	μ <b>g/g</b>			1.14
Arsenic (As)	μ <b>g/g</b>	6	33	8.59
Barium (Ba)	μ <b>g/g</b>			128
Beryllium (Be)	μ <b>g/g</b>			0.65
Bismuth (Bi)	μg/g			0.49

## Table 11. Phosphorus, TKN and Metal Concentrations in Sediment from OL-1



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Poron (P)	μ <b>g/g</b>			12.9
Boron (B)				12.9
Cadmium (Cd)	μg/g			1.70
Calcium (Ca)	μg/g			8960
Chromium (Cr)	μ <b>g/g</b>	26	110	25.2
Cobalt (Co)	μ <b>g/g</b>			7.20
Copper (Cu)	μ <b>g/g</b>	16	110	25.5
Iron (Fe)	μ <b>g/g</b>			21800
Lead (Pb)	μ <b>g/g</b>	31	250	126
Lithium (Li)	μ <b>g/g</b>			15.4
Magnesium (Mg)	μ <b>g/g</b>			4350
Manganese (Mn)	μ <b>g/g</b>	460	1100	283
Molybdenum (Mo)	μ <b>g/g</b>			1.29
Nickel (Ni)	μ <b>g/g</b>	16	75	17.2
Potassium (K)	μ <b>g/g</b>			1630
Selenium (Se)	μ <b>g/g</b>			2.27
Silver (Ag)	μ <b>g/g</b>			0.27
Sodium (Na)	μ <b>g/g</b>			996
Strontium (Sr)	μ <b>g/g</b>			25.8
Sulfur (S)	μ <b>g/g</b>			13300
Thallium (TI)	μ <b>g/g</b>			0.275
Tin (Sn)	μ <b>g/g</b>			4.9
Titanium (Ti)	μ <b>g/g</b>			404
Tungsten (W)	μ <b>g/g</b>			<0.50
Uranium (U)	μ <b>g/g</b>			0.963
Vanadium (V)	μ <b>g/g</b>			35.7
Zinc (Zn)	μ <b>g/g</b>	120	820	180
Zirconium (Zr)	μg/g			1.5

## 3.2.1 Phosphorus Fractionation

Phosphorus fractionation resulted in concentrations of six different chemical forms. Three forms have the potential to be released into the water column: loosely sorbed phosphorus, iron associated phosphorus (Fe-P) and organic phosphorus, while the remaining three forms (residual phosphorus, Ca-phosphorus and Al-phosphorus) are generally immobile (Messer et al. 1983). Loosely sorbed P contains loosely attached phosphorus, phosphorus associated with CaCO<sub>3</sub> which occurs in hardwater lakes, and phosphorus dissolved in porewater. Fe-P are forms of phosphorus that are adsorbed to iron (Fe) and manganese (Mn)



and that can be released under conditions of low redox potential (i.e. anoxic waters). Available organic-P forms originate mostly from settled organisms, such as aquatic plants, algae, and bacteria. Ca-P forms are assumed to consist mainly of apatite (Rydin, 2000), which is highly insoluble (Lukawska-Matuszewska and Burska, 2011) and thus not considered releasable. Al-P are forms of phosphorus that are exchangeable with hydroxides (OH<sup>-</sup>), mainly aluminum hydroxides. The last form of phosphorus is residual-P which consists mainly of refractory organic P and inert inorganic P that are stable and unlikely to be released under most conditions (Rydin, 2000).

Releasable phosphorus concentrations amounted to 706  $\mu$ g/g or 40% of the total sample which is comparable to other studies that have looked at these concentrations of releasable phosphorus (e.g. Hutchinson Environmental Sciences Ltd., 2016; Yasseri and Van Goethem, 2016). HESL (2016) quantified a range of 22% - 74% releasable phosphorus from sediments collected in Pigeon Lake, Alberta as part of in-lake management investigations, while Yasseri and Van Goethem (2016) noted a range of 39% - 54% as part of a similar study of Elk Lake, British Columbia. It should be noted however, that these studies were investigating active in-lake management techniques to control algae blooms so releasable phosphorus was likely high compared to most lakes. Unfortunately, similar data in lakes that are not being actively investigated for in-lake management are not available with which to further compare results.

Phosphorus fraction	"Loosely sorbed-P" (NH₄CI-P)	rbed-P" (NaOH-tot (BD-P) (NaOH-tot P-nrP), Calculated		"Al-P" (NaOH-rP)	"Ca-P" (HCI-P)	"Res-P" (Residual- P)	
Units	ug/g	ug/g	ug/g	ug/g	ug/g	ug/g	
OL-1	54.6	134.5	517.2	424.6	226.6	392.8	

Table 12. Phosphorus Fraction Results for Sediment Collected at OL-1

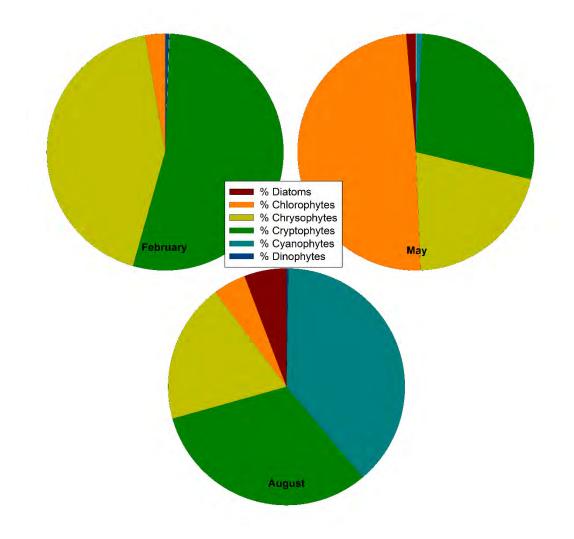
# 3.3 Phytoplankton

Phytoplankton in Oak Lake were sampled on August 16<sup>th</sup>, 2018, February 11<sup>th</sup>, May 8<sup>th</sup>, and July 4<sup>th</sup>, 2019, to characterize the algal community. During the 2019 sampling events, a filamentous green algal bloom was observed during water quality sample collection in May and an additional phytoplankton sample was collected to characterize the algal bloom (Photograph 1). An additional sample was collected in July to further describe the bloom. Microcystin (i.e. toxin) analysis was not performed in May 2019 as field observation indicated that the bloom was green algae and not harmful blue-green cyanobacteria. Microcystin analysis was completed in July 2019 despite similar observations as part of a conservative approach and was below analytical detection limits (0.20  $\mu$ g/L) in both samples tested.

The phytoplankton community at OL-1 followed typical seasonal succession during our sampling program. Phytoplankton was dominated by Chrysophytes and Cryptophytes in the winter, with substantially increased green algae (Chlorophytes) relative abundance in the spring and increased cyanobacteria during the late summer/fall sampling event (Figure 8).



The filamentous algal colonies observed in the water during May and July of 2019 sampling were comprised of *Mougeotia spp.*, a diverse genus of green algae (Chlorophytes) which includes many of the most common filamentous green algal species in freshwaters (Guiry & Guiry, 2013; Tapolczai et al. 2014). Blooms of filamentous green algae, such as *Mougeotia*, can be a nuisance for recreational uses but are non-toxic to humans and other aquatic life. In July, 2 phytoplankton samples were collected, Algae 1 was taken from the thick surface accumulations and Algae 2 from a less dense algal mat sampled offshore in ~0.5m of water (Figure 10). Chrysophyte algae comprised a significant portion of the Algae 1 sample. Chrysophytes are small colonial organisms which were likely entrained within the filamentous *Mougeotia* bloom, however based on field observations the bloom in the lake was predominantly comprised of *Mougeotia* species.



## Figure 8. Summary of Phytoplankton Relative Abundance at OL-1.



Figure 9. Summary of Phytoplankton Relative Abundance of the Sampled Bloom (May 8, 2019).

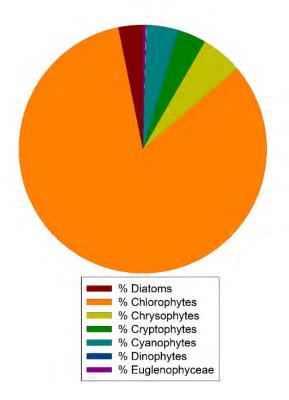
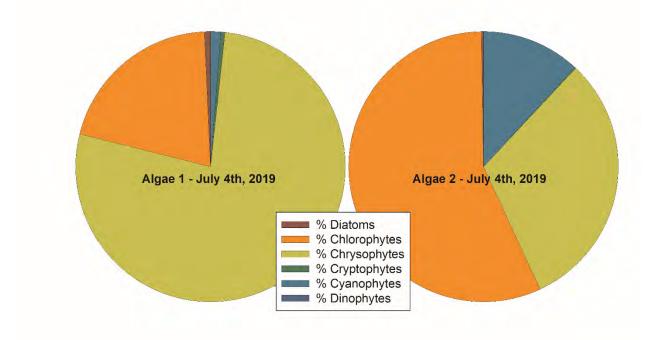


Figure 10. Summary of Phytoplankton Relative Abundance of the Sampled Bloom (July 4, 2019).





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Photograph 1. One of many filamentous algal colonies observed on May 8, 2019.



Photograph 2. A close-up view of abundant filamentous algal observed on July 4, 2019.

# 3.4 Inspections of Sewage Treatment Systems and Shoreline Development Practices

The City of Quinte West identified ninety shoreline owners on Oak Lake, at least one of which leases shoreline individual lots, and 115 residences. 81 questionnaires were completed, and 86 surveys were completed on shoreline lots. Characterization of septic systems and shoreline development practices was completed through compilation of survey results and field investigations. 81 respondents of 159 the surveys that were circulated indicated the type of septic system used to service their residence: 20 (25%) used holding tanks, 59 (73%) tank and bed systems and 2 (2%) outhouses, which was similar to the results indicated in 2001 (i.e. 19% holding tanks, 79% tank and bed systems and 2% outhouses).

Maintenance ranged considerably for both holding tanks and tank and bed systems with maintenance/pump outs ranging between 1 - 12.5 years for holding tanks (mean = every 2.36 years) and 1 to never for tank and bed systems (mean = every 2.49 years).

Visual indications of septic system problems were noted at 8 properties as thick vegetation (4), tree roots (3) or divots (1) present in the tile bed. Thick vegetation may indicate a partially plugged pipe or a pipe close to the surface that can be accessed by roots, tree roots can plug the distribution pipes, and divots are usually caused by collapsed pipes or supporting material due to old age. One resident mentioned that a neighbour empties their holding tank directly into the lake while many residents did not respond to the survey, provide information or provide access for site investigations so the number of systems with problems is likely higher than what was indicated in our survey. It was also evident that many sewage treatment systems are low-lying and would be underwater at certain times of the year. It wasn't possible to quantify the number of those systems or describe the degree of related water quality impairment because a) we couldn't define the boundaries of all sewage system components as part of a visual assessment, and b) the assessment wasn't completed during high water levels or in relation to a surveyed high water mark. The issue is however addressed further In Section 5.0 - Management Recommendations.

22.4% of systems were classified as either high or moderate risk in 2001 based on the age of the system, setback, physical condition and indicated maintenance frequency. High and moderate risk systems were identified based on different information in 2018 so a temporal comparison could not be completed with 2001 data but more importantly, high and moderate risk systems were moved to the top of the queue for more detailed investigations (as discussed in 4.4). High and moderate risk systems included systems with one or more of the following characteristics:

- Systems that were not surveyed in 2018 due to a lack of homeowner permission or presence during investigations (81)
- Evidence of septic failure (8)
- Maintenance interval > 5 yr for tank and bed systems, maintenance interval > 1 yr for holding tank systems or unknown maintenance interval (33)
- Distance between shoreline and sewage treatment system of <15 m (Ontario Building Code requirement) (33)
- Privvy systems (2)

The distance between the shoreline and the closest part of the septic system ranged from 2.5 - 91 m (mean = 18.5 m). The average distance between the primary residence and the shoreline on Oak Lake was predominantly <10 m (56%) with lesser occurrences of distances 10-20 m (30%), 20-30 m (6%) or >30 m



(8%). The majority (69%) of residences contained no buffer strip between the developed portions of the lot and the shoreline despite a general lack of restrictions to having a more naturalized vegetated area. Ontario Lake Assessments (2002a) indicated that 24% of properties retained a buffer strip which is similar to 2018 (31%).

10% - 90% of the area of properties were developed (mean = 47%) and % cleared lawn ranged from 10% - 100% (mean = 68%) both of which align with 2001 results (i.e. 79% contained >50% lawn and 83% were >50% developed).

Additional landowner comments were received via the City of Quinte West throughout the study as part of completed surveys, emails, letters and comments at public meetings. All comments were reviewed and considered during reporting. Landowner comments and responses are provided in Appendix D.

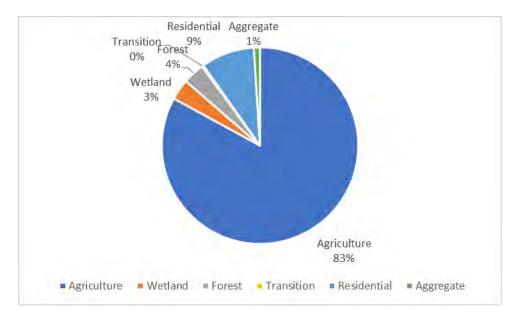
# 3.5 Whole Lake Phosphorus Budget

## 3.5.1 Watershed Phosphorus Load

The total phosphorus export to the lake from runoff from all sources was estimated as 56.6 kg/yr (Table 13). Agricultural runoff had the highest phosphorus export of the land uses, representing 83% (47.0 kg/yr) of the phosphorus load. The high phosphorus load from the agricultural land use is supported by the nutrient enriched tributary sites (Section 3.1.2) conveying runoff from the agricultural fields, and anecdotal observations by numerous residents of direct runoff from agricultural sites prior to the 2018 manure spill. Residential land uses exported 5 kg/yr of phosphorus to the lake, comprising 9% of the total but this does not include phosphorus loading from sewage treatment systems which are estimated in Section 3.6.3. Phosphorus loads from wetlands, forested areas, aggregate and transitional (i.e. area between forested and aggregate lands, and between forested and agricultural lands) lands were small, and represented less than 10% of the total load (Table 13, Figure 11).

Land Use	Area (ha)	Export Coefficient (kg/ha/yr)	Phosphorous Load (kg/yr)	% Load
Agriculture	130.5	0.36	47.0	83%
Wetland	38.8	0.05	1.9	3%
Forest	33.6	0.06	2.0	4%
Transition	2.1	0.07	0.1	0%
Residential	26.2	0.19	5.0	9%
Aggregate	7.1	0.08	0.6	1%
Total	286.8		69.2	

#### Table 13. Watershed Phosphorus Budget.



#### Figure 11. Watershed Phosphorus Contributions.

### 3.5.2 Atmospheric Phosphorus Load

The atmospheric phosphorus load to Oak Lake was estimated as 12.6 kg/yr.

## 3.5.3 Sewage Treatment System Phosphorus Load

The type of sewage treatment system was indicated by 81 of the residents who responded to the circulated questionnaire: 59 residences were serviced with tank and bed systems, 20 with holding tanks and 2 with outhouses. Existing ratios of sewage treatment systems were calculated based on the information provided and the type of systems used to service the remaining residences were assumed based on the existing ratios resulting in an assumed count of existing treatment systems for the entire 115 shoreline residences:84 residences serviced with a tank and bed system, 28 with holding tanks and 3 with outhouses. The phosphorus load associated with holding tanks were not included in the calculations per recommendations in Province of Ontario (2010) because theoretically the treated effluent and associated phosphorus concentrations are removed after the waste is pumped out and taken outside of the watershed.

The occupancy rates of residences (i.e. summer (10), summer and some winter (6), regularly (9) or permanent (27)) were indicated on 52 of the completed questionnaires. The occupancy rates on the questionnaires were associated with occupancy rates recommended in Province of Ontario (2010): summer = seasonal, summer and some winter = extended seasonal, regularly = extended seasonal, permanent = permanent. Ratios were calculated based on information provided in completed questionnaires and used to assume the occupancy rates of the remaining residences resulting in the following occupancy rates for the 84 tank and bed systems: seasonal (16), extended seasonal (24), permanent (44).

Permanent: 44 units \* 2.56 cap yrs/yr \* 0.66 kg/cap/yr = 74.34 kg/yr Extended Seasonal: 24 units \* 1.27 cap yrs/yr \* 0.66 kg/cap/yr = 20.12 kg/yr



Seasonal: 16 units \* 0.69 cap yrs/yr \* 0.66 kg /cap/yr = 7.29 kg/yr Outhouses: 3 units \* 0.175 cap yrs/yr \* 0.66 kg/cap/yr = 0.35 kg/yr

The potential phosphorus load associated with sewage treatment systems on Oak Lake is 107.16 kg/yr.

3.5.4 Internal Phosphorus Load

Internal loading of phosphorus is a common problem in freshwater lakes in Ontario and can be exacerbated in lakes where dissolved oxygen is reduced in bottom waters creating a condition called anoxia. Dissolved oxygen profiles collected for Oak Lake by HESL and the MECP show anoxic conditions setup early on Oak Lake (June) and persist through much of the ice-free period (September/October), suggesting the potential for internal loading of phosphorus to the lake is high.

Summer internal loads were calculated by comparing phosphorus concentrations from samples collected 1 m off bottom at OL-1 on May 30 and September 16, 2001, as well as May 8, 2019 and August 16, 2018. Estimated internal phosphorus loads were 177 kg/yr based on 2001 data and 168 kg based on 2018 data which indicates good agreement between years. An average internal load of 172.5 kg/yr was calculated based on both years.

A winter internal load of 41 kg was calculated based on data collected on October 29, 2018 and February 11, 2019.

The total internal phosphorus load using the average summer internal load and the winter internal load from 2018/19 was 213.5 kg (172.5 kg/yr + 41 kg/yr).

Date	Phosphorus Concentration (mg/L)	Date	Phosphorus Concentration (mg/L)	Phosphorus Load (kg)	
May 30, 2001	0.047	September 16, 2001	0.100	177	
May 8, 2019	0.0137	August 16, 2018	0.064	168	
	172.5				
October 29, 2018	0.007	February 11, 2019	0.0193	41	
Total Annual				213.5	

## Table 14. Internal Phosphorus Loads Calculated using the In-Situ Method.

## 3.5.5 Whole Lake Phosphorus Load

The combined phosphorus load from runoff, atmospheric deposition, septic system leaching, and sediment internal load was 390 kg/yr (Table 15). Internal loading from sediments represent the largest source of phosphorus to Oak Lake, contributing 55% of the annual load; followed by septic systems, which contribute 27% of the total annual load. The role of septic systems in phosphorus loading to lakes is likely overstated, however, as recent studies show substantial attenuation and binding of septic system phosphorus by mineralized soil such that there is a low likelihood that the phosphorus migrates to the lake (Robertson et

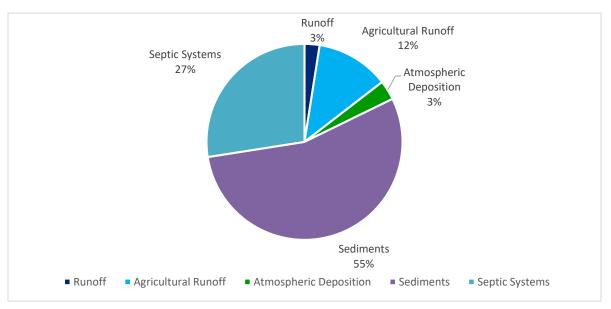


al. 2005). Runoff from agricultural land uses was also an appreciable source of phosphorus, adding approximately 12% of the total phosphorus load. Atmospheric deposition and runoff from other land uses (e.g. residential, forests, wetlands) were minor contributors, with less than 6% of the total phosphorous load combined (Table 15, Figure 12).

Phosphorus Source	Phosphorus Load (kg/yr)	% Load	
Runoff	9.7	2%	
Agricultural Runoff	47	12%	
Atmospheric Deposition	12.6	3%	
Internal Load from Sediments	213.5	55%	
Septic Systems	107.2	27%	
Total	390	100%	

## Table 15. Whole Lake Phosphorus Budget.

## Figure 12. Whole Lake Phosphorus Contributions.



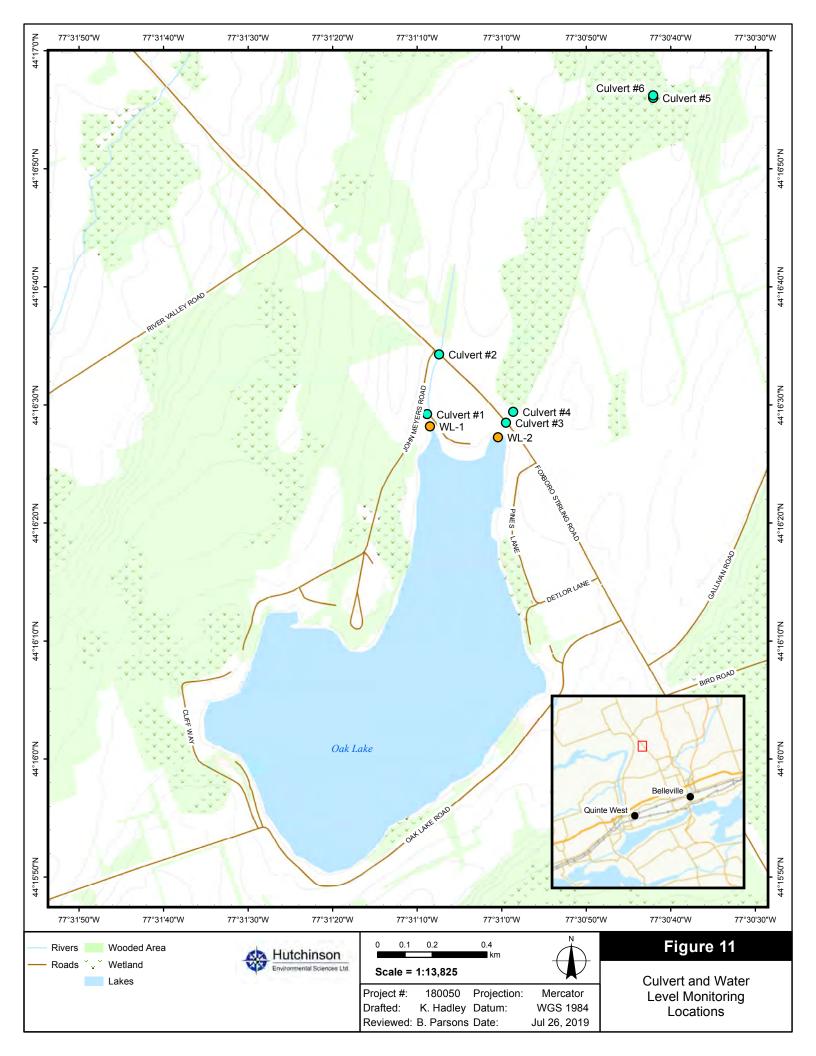
# 3.6 Water Levels

Water level is partially controlled by six culverts (Figure 13). Culvert #1 passes water underneath Neighbourly Road to a large ditch that runs along John Meyers Road (Photographs 2 and 3). Culvert #2 is located underneath Foxboro Stirling Road (Highway 14), which conveys flow to the north from the ditch into a small wetland that is surrounded by forest and agricultural fields (Photographs 4 and 5). Culvert #3 conveys flow from Oak Lake underneath Foxboro Stirling Road to a small wetland and culvert #4 before transitioning to a large wetland surrounded by forest and agricultural fields. Culverts #5 and #6 are located at the far northern end of the wetland and appears to partially control water levels through this part of the



system. Culverts #5 and #6 were removed by the City of Quinte West in late winter 2019 to help lower water levels in Oak Lake.







Photographs 2 and 3. A view from Culvert #1 facing Oak Lake (left) and facing the ditch to the north (right).



Photographs 4 and 5. A dredged section of the ditch located adjacent to Culvert #2 (left) and a view of the isolated wetland facing north from Culvert #2 (right).





Photographs 6 - 8. A view of the inlet of Culvert #3 at Oak Lake (top left), the outlet draining north of Highway #14 into the wetland (top right), Culvert #4 located about 6 m downstream, and the adjacent wetland (bottom).



Culvert inspections were completed at Culverts #1 - #4 on each sampling event. The culverts were almost always partially to fully submerged during observations but very few flows were noted as the systems are relatively stagnant (Table 16):

- very slight flow was observed on October 29, 2018 moving south towards the lake, likely as a result of excavation on the south side of Culvert #2,
- very slight flow was observed flowing away from the lake along Culverts #3 and #4 on March 28, 2019, and
- moderate flow was observed flowing away from the lake along Culverts #3 and #4 on May 8, 2019.

Water levels were monitored by the City of Quinte West approximately weekly from July 23 to September 21 in 2009 at WL-1, approximately monthly from February 2, 2010 to August 18, 2010 at WL-2, and at a variable time scale at both locations between March 14 and August 31, 2011.

Water levels remained consistent at WL-1 in the late summer in 2009 (Figure 14). Water levels were highest at WL-2 in February and March 2010 before decreasing throughout the remainder of the monitoring period (Figure 15). In 2011, water levels were highest in the spring but remained relatively consistent through the remainder of the year (Figure 16).



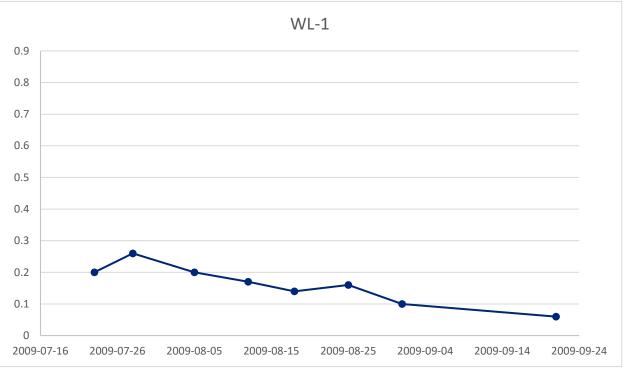


Figure 14. Water Levels Measured at WL-1 in 2009.

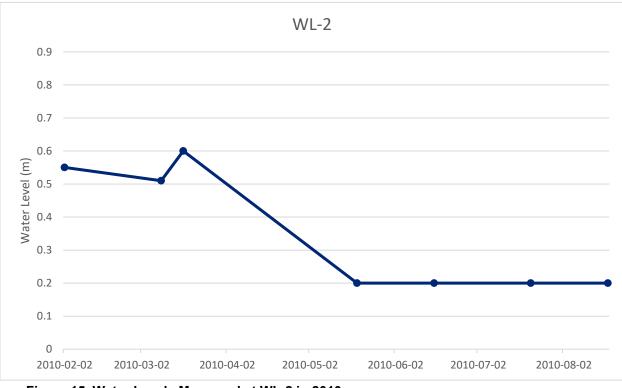


Figure 15. Water Levels Measured at WL-2 in 2010.



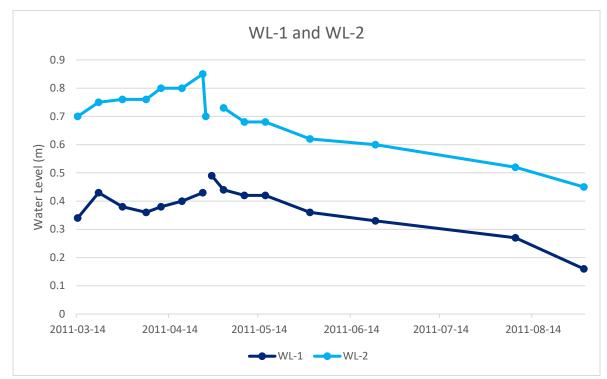


Figure 16. Water Levels Measured at WL-1 and WL-2 in 2011.



## Table 16. Results of Culvert Inspections

Date	Culvert #1			Culvert #2		Culvert #3			Culvert #4			
	Water Level at Outlet	Flow at Outlet	Notes	Water Level at Outlet	Flow at Outlet	Notes	Water Level at Outlet	Flow at Outlet	Notes	Water Level at Outlet	Flow at Outlet	Notes
August 16, 2018	Fully submerged	No flow		Partially submerged	No flow		Partially submerged	No flow		Partially submerged	No flow	
October 29, 2018	Fully submerged	No flow	Recent evidence of ditch being excavated to increase flow	Slightly submerged	Limited flow to lake, likely as a result of recent dredging	Recent evidence of ditch being excavated to increase flow	Partially submerged	No flow		Partially submerged	No flow	
March 28, 2019	Fully submerged	No flow		Partially submerged	No flow	Still frozen	Fully submerged	Very little flow		Fully submerged	Very little flow	
May 8, 2019	Fully submerged	No flow		Partially submerged	No flow		Partially submerged	Flowing	Water quality sample collected	Fully submerged	Flowing	



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# 4. Discussion

# 4.1 Water Quality

Temperature profiles in Oak Lake followed typical seasonal stratification found in dimictic lakes which prevents mixing of water between the warm surface waters (epilimnion) and the relatively cool deeper water (hypolimnion) and as a result the bottom waters in Oak Lake were anoxic throughout much of the growing season in 2001 and in 2018 due to thermal stratification and respiration requirements associated with the decomposition of organic plant material in the sediments. Anoxic conditions were noted at OL-1 but hypoxia or anoxia is likely present throughout much of the hypolimnion and at the sediment/water interface. Anoxia drives internal loading of nutrients from the lake sediments into the water column as is further discussed in Section 4.5.

Nutrient concentrations indicate that Oak Lake is mesotrophic and average annual phosphorus concentrations have remained stable at 0.014 mg/L since 2001. Winter measurements made in 2019 showed that phosphorus and nitrate concentrations were markedly elevated. This could be driven by a variety of processes such as:

- Elevated nutrient concentrations in the inflowing tile drain
- Under ice anoxia at the water sediment interface driving increased internal loading of phosphorus
- Continued inflow of elevated nutrient concentrations in groundwater from an agriculture dominated catchment
- Reduced uptake of nutrients by plants in winter
- Increased under ice generation of nitrate due to increased rates of nitrification which is common under ice. Knowles and Lean (1987) reported substantial rates of nitrate accumulation (i.e. 13 µg/L/d) using in situ water column measurements in Lake St. George, Ontario, a similar, mesotrophic, small (140 ha) kettle lake in central Ontario.

Nutrient concentrations were also elevated in the inflowing tile drain which drains approximately 40 hectares of agricultural lands that are used to grow corn and raise both cattle and pigs. As a result runoff from these lands is nutrient-enriched from fertilizer and manure inputs, and related adsorption of nutrients to suspended solids in runoff generated by erosion and soil disturbance. Nutrient concentrations in tile drainage from agricultural fields are highly variable and significant portions of phosphorus loss can be in dissolved form which is bioavailable to aquatic plants and algae. Moore (2016) noted that phosphorus concentrations in tile drainage varied between less than the detection limit to 9.75 mg/L. Clement (2016) examined nine different tile drains that drained between 7 and 80 acres, and noted phosphorus concentrations ranged between 0.01 mg/L and 0.56 mg/L, and Fleming et al. (1998) calculated an average phosphorus concentration of 0.48 mg/L from tile drains at twenty farms in southwestern Ontario. Concentrations of 0.15 mg/L to 0.57 mg/L measured at Trib-4 and Trib-5 in this study were therefore similar to those observed in the literature and typical of enriched agricultural runoff. Oak Lake is a small kettle lake and so these inputs could be a significant driver of nutrient enrichment in the lake.

Bacteria concentrations were generally low in Oak Lake, and lower than concentrations measured as part of past studies but elevated concentrations of *Fecal streptococci* (>200 CFU/100 mL) were noted at Trib-4

and Trib-5 on March 28, 2019 and elevated concentrations of *Pseudomonas aeruginosa* (117 CFU/100 mL) were observed at OL-8 on August 16, 2018 indicating that runoff posed a threat to water quality.

# 4.2 Sediment Quality

Phosphorus concentration in sediment at OL-1 was high in relation to Provincial guidelines and it is in the high range of typical concentrations noted in lakes (1000  $\mu$ g/g - 2000  $\mu$ g/g; New Hampshire Department of Environmental Services, 1995). Releasable phosphorus concentrations are similar to those reported in other studies that were focused on in-lake management techniques to control cyanobacteria blooms (e.g. Hutchinson Environmental Sciences Ltd., 2016; Yasseri and Van Goethem, 2016). It is clear that phosphorus concentrations and releasable phosphorus fractions are relatively high in sediment in Oak Lake and extended periods of anoxia in Oak Lake indicate that the internal phosphorus load to Oak Lake is substantial as is further discussed in Section 4.5.

# 4.3 Phytoplankton

The phytoplankton community at OL-1 followed typical seasonal succession during our sampling program. Phytoplankton was dominated by Chrysophytes and Cryptophytes in the winter, with substantially increased green algae (Chlorophytes) relative abundance in the spring and increased cyanobacteria during the late summer/fall sampling event. Phytoplankton succession in northern, temperate waterbodies is driven by changes in nutrients, water stability and light regime, and Oak Lake is no different. Briefly, winter phytoplankton under the ice is commonly dominated by small motile algae which are adapted to low light, low water temperature and high water-column stability, such as Chrysophytes (e.g., *Dinobryon, Mallomonas*, and *Synura*) and Cryptophytes (e.g., *Cryptomonas* and *Rhodomonas*)

In the late winter, light availability improves as the snowpack melts, resulting in increased abundance of dinoflagellates and small centric diatoms. As ice cover is lost in the spring, mixing in the water column creates conditions of low stability and high nutrient concentrations. This results in a marked increase in phytoplankton productivity, particularly diatoms, and is frequently the annual peak in phytoplankton biomass. This spring bloom is often dominated by a single species (e.g. *Asterionella*, or *Cyclotella*). Sampling at Oak Lake did not capture increased diatom production which may be a result of the timing of sampling or other nutrient limitation (e.g., silica) favouring green algae communities.

During initial summer stratification, increased water temperature stabilizes the water column and light availability increases, while nutrient concentrations decline. Total phytoplankton biomass general decreases as grazing pressure from zooplankton rapidly increases. By late summer high water temperatures and water column stability often favour Chrysophytes and colonial green algae. When silica concentrations are high diatoms may replace green algae, however if silica becomes depleted dinoflagellates and cyanobacteria often dominate the phytoplankton assemblage. As plankton consume available nitrogen resources to below detectable concentrations, cyanobacteria can become increasingly dominant (e.g. see August results in Figure 6). Cyanobacteria are capable of fixing molecular nitrogen from the atmosphere and regulating their buoyancy to take advantage of nutrients outside the photic zone. Certain species of cyanobacteria may also be recruited into the water column directly from resting stages in the sediments, drawing phosphorus directly from lake sediments rather than relying on the limited resources available in the lake water.



The mixing of the water column in the fall is characterized by decreased water temperatures and light availability along with increased concentrations of key nutrients (phosphorus and nitrogen). Large unicellular and filamentous diatoms often dominate fall phytoplankton assemblages.

Cyanobacteria identified during August sampling included species of *Anabaena*, *Aphanizomenon*, *Aphanocapsa*, *Aphanothece*, *Chroococcus*, *Gomphosphaeria*, *Planktolyngbya* and *Pseudanabaena*, some of which can produce toxins which are harmful to humans and aquatic life. The World Health Organization (WHO) guidelines suggest low probability of adverse health effects at 20,000 cells/mL of cyanobacteria. Cyanobacteria concentrations in Oak Lake during our sampling program were measured at 601 cells/mL, well below the WHO guideline, however ongoing monitoring for cyanobacterial blooms is recommended in addition to public education on identifying and reporting potential algal blooms to the appropriate authority (i.e., Ministry of Conservation and Parks; MECP) as discussed in Section 5.7.

The filamentous algal colonies observed in the water during spring sampling were predominantly comprised of *Mougeotia spp.*, which can be a nuisance for recreational uses but are non-toxic to humans and other aquatic life. Blooms of this species have not been clearly related to nutrient levels, nor is there sufficient evidence to connect this algal bloom to the manure spill which occurred in 2018. Ongoing algae monitoring on the lake is recommended to track algae bloom frequency and monitor any potential cyanobacteria later in the year when the water temperature favours cyanobacterial blooms. Blooms of *Mougeotia*, while not toxic to humans, may have an impact on the lake in the near future. After a significant bloom, oxygen concentrations in the lake (during the decomposition of algal material) is expected to decline. Oak Lake already has depleted oxygen concentrations in the deep waters and an increased oxygen demand during decomposition may impact the potential internal loading from lake sediments and may also put pressure on fish communities and could in extreme cases result in fish kills.

# 4.4 Sewage Treatment Systems and Shoreline Development Practices

The development patterns, lot size and nature of waterfront land use at Oak Lake does not meet the current environmental standards associated with waterfront development. HESL (2014) reviewed current development standards in 12 jurisdictions across North America and found that minimum lot frontages range from 30 m to 90 m, lot sizes range from 0.19 ha to 1.2 ha, minimum building setbacks range from 7.6 m to 90 m but are typically ~20m, and the most common septic setback is 30 m. South Frontenac, which is located north of Kingston and is more local than the other jurisdictions reviewed, has a minimum lot frontage of 91 m, lot area of 1 ha, building setback of 30 m. Lot sizes and setbacks are variable on Oak Lake but in general lot frontages and sizes are small and both average septic (18.5 m) and building setbacks (56% < 10 m) are substantially less than current standards (Photographs 9 and 10).

Lots on Oak Lake are highly developed (i.e. average development footprint = 47%) which is substantially higher than the range in limits for impervious surface on a lot (15% - 30%) managed by Hew Hampshire, Maine, Minnesota and Wisconsin (HESL 2014), or the findings from over 225 research studies that predict water quality decline when watershed impervious cover exceeds 10% or severe degradation beyond 25% (Center for Watershed Protection, 2003). Naturalized buffers are also generally lacking despite a lack of physical restrictions and instead, manicured lawns dominate the landscape (Photographs 11 and 12).



While many septic systems showed no evidence of poor repair, the maintenance periods reported by residents varied substantially, problems were noted with some systems, and many that were not examined due to lack of landowner permission may be in poor repair. Similar conditions were noted in 2001 and there is little evidence that Best Management Practices and recommendations such as establishing natural shorelines or improving septic system maintenance from previous studies (e.g. LTC 2002, Ontario Lake Assessments, 2002a) have been implemented.

Unmanaged waterfront development may degrade water quality through nutrient loading associated with stormwater and wastewater runoff. Small lot sizes and setbacks, high development footprints, lawns and associated fertilizer use, old and poorly maintained sewage treatment systems and a lack of natural shoreline buffers that would help to mitigate these practices, are all major threats to the water quality of Oak Lake and represent areas for potential improvement. While the lot sizes and setbacks are established, more effort on naturalization, reduction in manicured areas and development of naturalized shoreline buffers would stabilize shorelines, improve wildlife and songbird habitat and reduce nutrient runoff.





Photographs 9 and 10. A view of typical residences on Oak Lake which highlights the small lots, small setbacks and highly developed nature of the nearshore environment.





Photographs 11 and 12. A view of residences on Oak Lake which highlights the small setbacks, manicured lawns and lack of natural shoreline buffers.



# 4.5 Phosphorus Budget

Phosphorus is the primary nutrient that limits the growth of algae and aquatic plants. The primary sources of phosphorus that enrich Oak Lake are internal loading from sediments (44% - 48%), septic systems (32% - 34% as potential but likely lower) and agricultural runoff (14% - 15%).

Other important sources of phosphorus that were not quantified as part of the study are the manure spill in 2018 and waterfowl feces as a few residents noted that 500 - 1000 Canadian Geese (*Branta canadensis*) can be observed on the lake in the fall at a given time. The impacts of the manure spill could not be quantified but as discussed previously, this is not expected to be a recurring event and provides justification for selecting elevated nutrient loading rates for calculation of the phosphorus load from agricultural lands.

Quantification of the impact of waterfowl species on nutrient loading is complex because ~87% of the phosphorus from goose feces is derived from the lake itself as food passes quickly through a goose and the process is part of the nutrient cycle as opposed to a source (Fleming and Fraser, 2001). Phosphorus from feces is however also more bioavailable for uptake by aquatics plants and algae. Quantification of waterfowl impacts was not included as part of the study but waterfowl feces can lead to elevated concentrations of bacteria, pathogens and nutrients so management recommendations have been provided in Section 5.8 to try and minimize those impacts.

# 4.6 Water Levels

Results from the mailed-out questionnaire indicated that 47% of landowners consider that water levels are "good as is", while 30% believe water levels are currently too high and 23% believe water levels are currently too low, so it is clear there are differing perspectives on the most appropriate water levels in Oak Lake. Furthermore, 32 residents indicated water levels were their greatest concern while 22 noted it was of no concern so there is a wide range of opinions on the issue.

Our knowledge of water levels in the lake is limited to site observations and the restricted 2009 - 2011 dataset which indicates, unsurprisingly, that water levels are relatively consistent and the highest water levels occur in the late winter and spring. Our culvert inspections indicated that water flow isn't impeded by sediment build-up in the culverts or in the adjacent areas, but the system is instead limited by a very small drainage area adjacent to Culvert #2 and largely controlled by the management of wetland water levels via Culverts #5 and #6. According to residents, water levels have however dropped in Oak Lake following sediment removal, so water levels appear to be controlled by both sediment build-up and wetland water levels, in addition to a myriad of climate-related factors.

Water level management is a challenge moving forward because of climate change and it is particularly challenging in Oak Lake because a) development setbacks are limited and nearshore areas are flat so slight changes in water levels impact residences and water intake lines, b) there is limited inflow or outflow so there isn't much water to work with, c) flooded sewage treatment systems are a source of nutrients to Oak Lake, and d) there are differing opinions on a water management objective.



# 5. Management Recommendations

Lake management should be guided by scientific data as well as inputs from local users. Results were presented in Section 4 and are discussed in Section 5, both of which included specific results from the mailed-out questionnaire where appropriate. The questionnaire also included questions and responses associated with overarching concerns, seriousness of problems with Oak Lake and recreational activities.

The questionnaire was mailed to 159 residents and 80 responded. Respondents considered the following issues to be the greatest concern in Oak Lake (number of respondents expressing concern): agriculture (54), water quality for recreation (46), aesthetics (35), water quality for consumption (33), water level (32) and dead fish (30), Issues which were identified as not a concern included too much recreation (48) and too much development (31). Agriculture (33), water quality for recreation (18) and water level (13) were noted as the most serious issues, while too much recreation (4) and too much development (1) were noted as the least serious. In terms of recreational activities on Oak Lake, sitting by the water/enjoying the view (66) was the most popular, followed by swimming/wading nearshore (56), and canoeing/rowing (35).

Oak Lake has been well-studied over the years and many studies have included lake management recommendations, some of which have been translated into policies to manage and protect the water quality of Oak Lake and the health of its residents. Section 9.3 of the City of Quinte West Official Plan (2017) identifies Oak Lake as being at risk and establishes the Oak Lake Special Policy Area (Area Specific Policy 3), which is intended to facilitate the improvement of the overall water quality of Oak Lake and to protect the health and safety of the shoreline residents. We have consolidated previous recommendations and existing policy under common themes and added additional recommendations where appropriate so that all of the recommendations and policies can be examined as a whole, to critically examine the success or lack thereof of pre-existing policy, and to not "reinvent the wheel" and duplicate previous recommendations.

# 5.1 Development Planning

Oak Lake is almost entirely developed so recommendations and policies have been primarily focused on redevelopment, such as conversion from seasonal to permanent residency, consolidation of lots, additions, renovations and/or alterations.

## 5.1.1 Previous Recommendations

An Evaluation of the On-Site Sewage Disposal Systems for Properties Fronting on Oak Lake (Ontario Lake Assessments, 2002a):

- The Municipality should establish measures in the official plan which are protective of water quality, shoreline alteration, and deter further urbanization of Oak Lake. These protective measures could include: establishing stringent setback requirements for re-development, preventing conversions from seasonal to permanent residences, setting maximum building envelope size
- Where development on existing vacant lots of record meet the criteria below, only seasonal residences should be considered. Existing vacant lots of record should not be developed on the basis of on-site disposal unless the sewage system and building can be setback >30 metres from the high-water mark. Where a setback of >15 to 30 metres from the high-water mark can be



achieved then development should be conditional upon a seasonal residence only on a holding tank. Existing vacant lots of record that can not achieve a setback of > 15 metres from the high-water mark should not be developed.

• The setback distance for redevelopment of a seasonal residence on an existing lot should require a minimum setback distance as remote from the water as the lot will allow. Any lot that can not achieve a setback distance of 30 metres from the high-water mark for the septic system should be serviced on the basis of a holding tank.

Oak Lake Shoreline Regeneration Plan (LTC, 2002):

- New development (buildings and septic systems) be set back 15 to 30m from the shoreline. Under no circumstances should new buildings/septics be permitted within 15 metres of the shore. For development proposed between 15 and 30 metres from the shore, an Environmental Impact Assessment should be completed to determine if there will be any impacts on water quality or fish habitat.
- Conversion of seasonal to permanent residences should not be permitted.
- Additions onto existing buildings should be discouraged. No additions should be permitted within 15 metres of the shoreline as naturalization is encouraged in this zone. For additions proposed between 15 and 30 metres from the shore, an Environmental Impact Assessment should be completed to determine if there will be any impacts on water quality or fish habitat.

#### 5.1.2 Existing Policies

Oak Lake was identified as being at risk with respect to water quality and the ability to sustain the level of shoreline development based on findings in Ontario Lake Assessments 2002a and 2002b. Several policies were developed and incorporated into the City of Quinte West Official Plan (2017) with the aim to improve water quality in the lake. Policies are sorted in the Official Plan per Area Specific Policy 3A which is in the vicinity of Oak Lake and Area Specific Policy 3B which encompasses the balance of the Oak Lake drainage basin.

City of Quinte West Official Plan (2017):

9.3.2.2 Residential Development Policies Notwithstanding any policies of this Plan to the Contrary:

- (i) The creation of new lots is prohibited within the Area Specific Policy "3A."
- (ii) The consolidation of lots within the Area Specific Policy "3A" shall be permitted provided:

(a) the lot consideration is not for the purpose of, directly or indirectly, the conversion of a seasonal residence to a permanent residence;

(b) the existing building footprint is maintained, or an increased setback is achieved from the highwater mark of Oak Lake for the building and sewage disposal system;

(c) where the consolidation involves two or more vacant lots, development within 30 metres of the high-water mark of Oak Lake is prohibited;



(d) a natural vegetative buffer is established along the shoreline abutting such lots to a distance to be determined as part of the Environmental Impact Assessment identified in (v) below; and

(e) an Environmental Impact Assessment is completed by a qualified professional to the satisfaction of the City in consultation with the Lower Trent Conservation for the subject property addressing such issues as:

- the impact of the proposed development on water quality and fish habitat;

- mitigation measures to be taken for the protection of the water quality and fish habitat of Oak Lake;

- the identification of the extent and composition of the natural vegetative buffer to be established along the shoreline of the subject property;

- other matters as deemed necessary by the City in consultation with the Lower Trent Conservation; and

(f) the requirements of 9.3.2.2 (viii) of this Plan, if applicable, are adhered to.

(iii) The development of existing vacant lots of record within 30 metres of the high-water mark of Oak Lake is prohibited.

(iv) The development of existing vacant lots of record greater than 30 metres from the high water mark of Oak Lake shall be permitted subject to the completion of an Environmental Impact Assessment by a qualified professional to the satisfaction of the City, in consultation with the Lower Trent Conservation for the subject property addressing such issues as:

- the impact of the proposed development on water quality and fish habitat of Oak Lake; and

- mitigation measures to be taken for the protection of water quality and fish habitat of Oak Lake; and

- the identification of the extent and composition of natural vegetative buffer to be established along the shoreline of the subject property; and

- other matters as deemed necessary by the City in consultation with the Lower Trent Conservation.

(v) Notwithstanding (iv) above, on existing vacant lots of record where a private sewage disposal system can be located in excess of 30 metres from the high water mark of Oak Lake, minor encroachments into the required 30 metre setback for a proposed seasonal residential dwelling may be considered without an amendment to the Plan subject to:

(a) The completion of an Environmental Impact Assessment is completed by a qualified professional to the satisfaction of the City in consultation with the Lower Trent Conservation for the subject addressing such issues as:

- the impact of the proposed development on water quality and fish habitat;

- mitigation measures to be taken for the protection of the water quality and fish habitat of Oak Lake;

- the identification of the extent and composition of the natural vegetative buffer to be established along the shoreline of the subject property; and

- other matters as deemed necessary by the City in consultation with the Lower Trent Conservation.

(vii) The conversion of seasonal residences to permanent residences shall be prohibited within the Oak Lake Specific Policy Area.

(viii) Additions, renovations and/or alterations to any residence shall only be permitted where:

(a) the proposed addition, renovation and/or alteration is not for the purpose of, directly or indirectly, the conversion of a seasonal residence to a permanent residence;

(b) the proposed addition, renovation and/or alteration does not create an increase, or potential for increase, in wastewater load from such residence;

(c) the existing building footprint is maintained or an increased setback from the high-water mark of Oak Lake for the building and sewage disposal system;

(d) a natural vegetative buffer is established along the shoreline to a distance to be determined as part of the Environmental Impact Assessment identified in (e) below; and

(e) an Environmental Impact Assessment is completed by a qualified professional to the satisfaction of the City in consultation with the Lower Trent Conservation for the subject property for all development to be completed within 30 metres of the high-water mark addressing such issues as:

- the impact of the proposed development on water quality and fish habitat;

- mitigation measures to be taken for the protection of the water quality and fish habitat of Oak Lake;

- the identification of the extent and composition of the natural vegetative buffer to be established along the shoreline of the subject property; and

- other matters as deemed necessary by the City in consultation with the Lower Trent Conservation.

(f) Written confirmation is obtained from the local Health Unit stating that the existing sewage disposal system is capable of accommodating the proposed addition, renovation and/or alteration in accordance with all applicable laws and regulations.

(ix) Notwithstanding subsection (viii) above, renovation and/or alteration shall be permitted without an Environmental Impact Assessment in circumstances where:

(a) the proposed renovation and/or alteration is to restore the building to a safe condition provided that it is not for the purpose of, directly or indirectly, conversion from a seasonal residence to a permanent residence; and

(b) there is no increase in the size of the building or an increase, or potential for increase, in wastewater load.

(x) Alterations to land within 30 metres of the high-water mark of Oak Lake will only be permitted subject to the completion of an Environmental Impact Assessment by a qualified professional to the satisfaction of the City in consultation with the Lower Trent Conservation for the subject property addressing such issues as:

- the impact of the proposed alteration on water quality and fish habitat;

- mitigation measures to be taken for the protection of the water quality and fish habitat of Oak Lake;

- the identification of the extent and composition of a natural vegetative buffer to be established along the shoreline of the subject property; and

- other matters as deemed necessary by the City in consultation with the Lower Trent Conservation.



9.3.3 Area Specific Policy Area "B"

### 9.3.3.1 Permitted Uses

(i) Except where specifically referenced to the contrary, the permitted use of all lands within the Area Specific Policy "B" shall be in keeping with the underlying land use designation identified on Schedule "A" and referenced in Sections 5.1, 5.2 and 5.8 of this Plan.

### 9.3.3.2 Residential Development Policies

(i) Except where specifically referenced to the contrary, the residential development policies for all lands within the Area Specific Policy "B" shall be in keeping with the underlying land use designation identified on Schedule "A" and referenced in Sections 5.1, 5.2 and 5.8 of this Plan.

### 5.1.3 New Recommendations

Previous recommendations have been successfully converted into policies that are aimed at minimizing impacts to water quality associated with various development activities. We have not suggested any new recommendations but question how effectively these policies are enforced. Official Plan policies and Implementation Guidelines are just that, policies and guidelines (HESL, 2014b). They cannot be enforced through immediate remedies or the court system. In the Planning jurisdictions throughout Canada and the United States, enforcement is done through Bylaws and Ordinances.

Enforcement through bylaws passed under the Planning Act must be done through the court system which can be very frustrating due to:

- Time to get the matter to trial,
- Cost of court proceedings,
- Challenge of collecting evidence,
- End result of low fines and little retribution.

Many municipalities may not want to make the necessary significant expenditures to go through the court system to enforce their bylaws (HESL, 2014b). Bylaws passed under other legislation, however, can be more easily enforced. A Site Alteration Bylaw passed pursuant to the Municipal Act, for example, can contain items of immediate response to a violation. Stop Work Orders and Orders to Remedy can be embedded in the bylaw and enforced immediately upon infraction. The Township of Seguin and the Township of Muskoka Lakes each enforce approximately 20 - 25 infractions every year. The Township of Seguin takes the approach that they need to go to court to prevent future contraventions and court cases.

Quinte West has an Application Form for Oak Lake Drainage Basin Zoning By-Law Amendment – Holding Removal – Site Plan Control, and the Comprehensive Zoning By-law (City of Quinte West, 2014) but nonetheless, the City of Quinte West should review the enforceability of their development-related policies through this lens and upon past performance, and assess both the tools and staff needed to enforce the policies that exist. Further discussions related to planning tools and enforcement are outside the scope of the project and are better deliberated by planning staff and/or lawyers.



# 5.2 Sewage Treatment Systems

Visual septic inspections were completed in 2001 and 2018, and similar septic re-inspection programs are completed by many Municipalities and Conservation Authorities throughout Ontario in order to identify septic systems with some benchmark of failure such as soft ground or ponding. The re-inspection programs are important in diagnosing failing septic systems, many of which were designed for much less use than they receive, and to increase awareness because it is ultimately the homeowner's responsibility to ensure their septic system is operating effectively (Ontario Building Code (OBC), 2006, Section 8.9.2.3 (2)) and is in compliance with the Ontario Building Code regulations. Visual septic system inspections are however limited by landowners providing access and the visual nature of the assessment.

## 5.2.1 Previous Recommendations

An Evaluation of the On-Site Sewage Disposal Systems for Properties Fronting on Oak Lake (Ontario Lake Assessments, 2002a):

- The Municipality should establish measures in the official plan which are protective of water quality, shoreline alteration, and deter further urbanization of Oak Lake. These protective measures could include: development of a by-law to ensure pump out frequency and maintenance of all septic systems.
- The Municipality should develop a mechanism to ensure all septic tanks and holding tanks are maintained and pumped on a frequent schedule.

Oak Lake Shoreline Regeneration Plan (LTC, 2002):

- Septic systems should be inspected regularly, and the septic tanks pumped routinely. Faulty systems should be replaced with new systems to meet the current standards. Recommendations regarding the maintenance of septic systems will form part of the concurrent study of septic systems.
- 5.2.2 New Recommendations

The modelled phosphorus load from septic systems on Oak Lake is substantial (107 kg/yr), many systems are poorly maintained, and limited setbacks and a general lack of shoreline buffers limit the potential for nutrient-laden runoff to be attenuated. The impacts of sewage systems should be considered in terms of both design and maintenance. A more detailed, in-depth examination of sewage treatment systems that are often completed as part of home inspections should be completed for every system on Oak Lake, starting with the systems that have been categorized as moderate or high risk as discussed in Section 4.4.to assess design and functionality. Detailed sewage treatment system surveys should include the following components:

• Building permits and associated documentation for each sewage treatment system should be gathered to determine the age of each system, the capacity of each system to handle the size of the associated residence and other OBC requirements.



- The functionality of each system should be determined through an examination of tank condition, liquid levels, baffles, scum and sludge depth. A flush test should also be completed to determine the ability of the leaching bed to disperse effluent.
- Replace dysfunctional systems with systems that meet the OBC and consider systems that are specifically designed to attenuate phosphorus such as the Waterloo EC-P, Ecoflo DpEC system or utilization of iron-rich, non-calcareous "B" horizon soils for construction of leaching beds.

In terms of maintenance, we agree with previous recommendations that are focused on implementing a bylaw that forces sewage treatment systems to be maintained on a regular basis such as that used to identify moderate or high risk systems (i.e. once per year for holding tanks or once every 5 years for tank and bed systems).

# 5.3 Shoreline Development Practices

A shoreline buffer is an area along the shoreline that is naturally vegetated or re-vegetated. Shoreline buffers are a well-studied mitigation measure associated with waterfront development. The availability of information results from the well-known and established effectiveness of shoreline buffers in mitigating the impacts of stormwater though filtering, infiltration and attenuation. Buffers filter sediment and other pollutants, and absorb nutrients from runoff, thereby helping to mitigate impacts of stormwater (Beacon Environmental, 2012). Vegetative buffers can also mitigate social density by screening the view of the shoreline from the lake and providing a buffer for view and noise between lots and maintain more of a wilderness perspective.

Shoreline development practices on Oak Lake are predominantly establishment and maintenance of manicured lawns. Manicured, carpet-like green grass lawns are a relatively recent phenomenon that became established during suburbanization after World War II (Steinberg, 2007). Manicured lawns, especially those which are fertilized, have a wide variety of environmental repercussions but are particularly bad practice when living adjacent to a waterbody. Natural shoreline vegetation filters runoff, prevents erosion, provides wildlife habitat, and ultimately help to mitigate impacts to water quality associated with residential development.

#### 5.3.1 Previous Recommendations

An Evaluation of the On-Site Sewage Disposal Systems for Properties Fronting on Oak Lake (Ontario Lake Assessments, 2002a):

- The Municipality should establish measures in the official plan which are protective of water quality, shoreline alteration, and deter further urbanization of Oak Lake. These protective measures could include protection against tree removal, or maximum lawn sizes.
- Direct runoff from hardened surfaces to the lake carries pesticides, fertilizers, sediment, and other contaminants to the lake. Landowners should ensure that runoff from hardened surfaces does not go directly into the lake. On sloping shorelines, cares should be taken to ensure that pathways to the water are angled along the slope so that runoff is not channelled directly to the water.



• The use of pesticides and fertilizers should be reduced, and preferably eliminated. Fertilizers on lawns can run off into the lake and contribute to excessive growth of aquatic plants.

Oak Lake Shoreline Regeneration Plan (LTC, 2002):

- On the land:
  - Leave an unmown strip of natural vegetation along the length of the shoreline
  - Establish a vegetative buffer aim for a minimum of 15 metres (the wider the better)
  - Incorporate a variety of native vegetation in the buffer strip including trees, shrubs, grasses and wildlflowers
  - Remove invasive exotic species, like purple loosestrife, yellow flag iris and buckhorn, that disrupt native vegetation
- For work in the water:
  - Replace retaining walls with natural materials
  - Maintain rocks, gravel, woody debris and aquatic plants in the shallow waters
  - Remove concrete docks and replace with floating, canti-lever, or post construction docks.
- Direct runoff from hardened surface to the lake carries pesticides, fertilizers, sediment, and other contaminants to the lake. Landowners should ensure that runoff from hardened surfaces does not go directly to the lake.
- The use of pesticides and fertilizers should be reduced, and preferably eliminated.
- 5.3.2 Existing Policies

City of Quinte West Official Plan (2017):

• The City and the Lower Trent Conservation are encouraged to work with the Oak Hill Lake Association and the land owners within the Oak Lake Special Policy Area to develop a land stewardship program to provide educational and practical means for land owners for the improvements of individual properties and every day operational practices.

#### 5.3.3 New Recommendations

A variety of previous recommendations have focused on improving shoreline development practices on Oak Lake, but little has changed over the intervening time period. We recommend that:

• Improved shoreline and property management should be made an enforceable condition of any application for a building permit or redevelopment on Oak Lake.



• Stewardship activities on existing lots that do not seek a building permit are encouraged through public awareness and education.

# 5.4 Water Level Management

Water level, water quality and aquatic biota are intrinsically linked through a wide variety of processes which can not all be discussed here-in but in summary, water level change has a marked impact on a) sediment and nutrient fluxes in lakes, mainly through the establishment of macrophytes because water levels affect light availability and associated growth of macrophytes, and b) phytoplankton assemblages because of changes to macrophyte abundance, sedimentation and grazing rates (Coops and Hosper, 2002). Our study did not, however, reveal any consensus or majority opinion on water level management among lake residents

#### 5.4.1 Previous Recommendations

Oak Lake Shoreline Regeneration Plan (LTC, 2002):

- The culvert on the north side of Oak Lake Road, at the intersection with Empson Lan and Cliff Way, is not working efficiently. Runoff from the road ditch overflows onto adjacent properties and the boat launch causing erosional damage. Drainage in this area should be re-designed to ensure that it is not affecting adjacent properties or running off directly into the lake.
- The two culverts on County Road 14 appear to be interfering with hydrological and biological (pike spawning) connections between the wetlands and the lake.

#### 5.4.2 Recommendations

While no clear consensus on water level concern resulted from the survey, water level should remain relatively stable year-round at a level that avoids flooding damage, submersion of sewage treatment systems, erosion of shorelines and uprooting of trees in the riparian zone but also allows for boating access to docks and doesn't cause water lines to be exposed. The culvert system on Oak Lake is generally fixed as elevation of the culverts cannot be changed like a dam.

An integral first step in Water Level Management is the determination of a consensus opinion on the problem(s), translating that to management objectives and linking the objectives with surveyed, standardized water levels on Oak Lake. Management objectives are typically associated with avoiding property damage, but they should also incorporate ecological considerations such as water quality, fish migration and spawning, etc. such as those mentioned by LTC (2002). Management objectives can then be related to high and low lake level limits that support the ecology of the lake. Typically, lakes are drawn down during the fall and winter to provide storage capacity for spring run-off and rain, and levels are increased in the late spring early summer to a summer start level. It is not clear to what extent the existing system can be manipulated, such as alteration to the sluice gate or excavation of sediment, to meet the water level objectives. If the existing system is deemed inappropriate a water budget should be completed and engineered solutions proposed. A water budget would consider the volumes of water in Oak Lake and



it's watershed and considers the hydrologic cycle and flow paths from recharge to discharge over a variety of spatial and temporal scales (Conservation Ontario, 2010).

In the meantime, to avoid further property damage the system could be partially manipulated through replacement of Culverts #4 and #5, which should continue to lower high water levels in the spring like was completed in the late winter of 2019 after removal of Culvert #5. Sediment removal has been used to clear the culverts and lower water levels effectively in the past. Sediment removal should continue to be used, if needed, following culvert replacement.

- Replace Culverts #4 and #5 with larger, more recessed culverts so that high water levels in Oak Lake can be drained more effectively through that drainage system
- Continue to remove sediment from culverts as a water level management technique
- Assess the degree of flooding of properties and sewage treatment systems during high water levels. Develop site-specific mitigation measures to reduce social and environmental impacts from flooding such as construction of flood walls and dry flood proofing
- Establish a staff gauge on Oak Lak and collect seasonal water level data
- Establish water level management objectives
- Relate objectives to water levels on Oak Lake
- Determine if the existing drainage system, including the replacement of Culvert #4 and #5 can meet the objectives
- Complete a water budget and design an alternative water control system for Oak Lake ((if required)

# 5.5 Agricultural Runoff

Agriculture was noted as the issue of greatest concern (54) and the most serious problem (33) by residents in the mailed questionnaires. Nutrient enrichment of lakes is a global problem and nutrient loadings from agriculture are well known as a major driver of these changes in water quality (Withers et al. 2014) so it is not surprising that nutrient-rich and on occasion bacteria-rich runoff from the tile drain characterized by sites Trib-4 and Trib-5 is of concern to residents.

Mr. Larry Detlor and Mr. Greg Barr own and operate the majority of agricultural lands located in the Oak Lake watershed, which are northeast of the lake. Mr. Detlor raises cattle and Mr. Barr raises pigs while both also grow soybeans and corn. A large swath of the agricultural lands is drained via a tile drain that drains in a southwestern direction adjacent to both farms, flows underneath Foxboro-Stirling Road (#14) and eventually into Oak Lake. The manure spill that occurred in 2018 occurred as a result of a ruptured manure storage silo on Mr. Barr's land and conveyance of manure through the tile drain. The spill was reported to MECP and Hastings Prince Edward Public Health, and since that time Mr. Barr has removed tile drains from that area.



### 5.5.1 Previous Recommendations

Oak Lake Shoreline Regeneration Plan (LTC, 2002):

• The upland portions of the watershed are predominantly void of woodland vegetation communities. This is resulting in increased runoff, decreased groundwater recharge, and some site-specific erosion problems. Reforestation is recommended for areas that are not being used for agricultural practices. Where there is agriculture, best management practices should be adopted (e.g. vegetative buffers, grassed waterways, no-till or reduce till, contour planting, etc.)

## 5.5.2 Existing Policies

### 9.3.2.3 Agricultural Development Policies

(i) The City, in consultation with the Lower Trent Conservation and the Hastings Federation of Agriculture, shall conduct an assessment of the impact of agricultural run-off on the water quality of Oak Lake.

(ii) The City, in consultation with the Hastings Federation of Agriculture, shall encourage all farm operations within the Oak Lake Special Policy Area to complete Environmental Farm Plans in an effort to minimize the impact of sources of nutrients on Oak Lake.

## 9.3.3.3 Agricultural Development Policies

(i) Except where specifically referenced to the contrary, the agricultural development policies for all lands within the Area Specific Policy "B" shall be in keeping with the underlying land use designation identified on Schedule "A" and referenced in Sections 5.1 and 5.2 of this Plan.

(ii) The City, in consultation with the Lower Trent Conservation and the Hastings Federation of Agriculture, shall conduct an assessment of the impact of agricultural run-off on the water quality of Oak Lake.

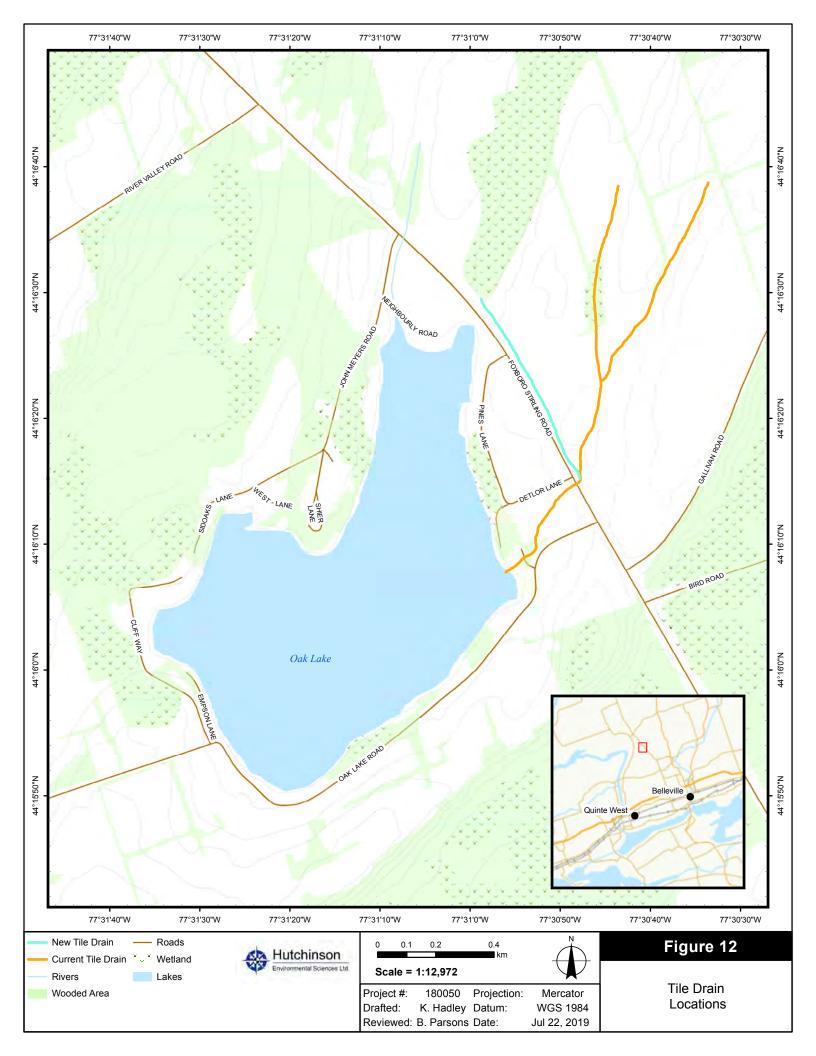
(iii) The City, in consultation with the Hastings Federation of Agriculture, shall encourage all farm operations within the Oak Lake Area Specific Policy to complete Environmental Farm Plans in an effort to minimize the impact of sources of nutrients on Oak Lake.

#### 5.5.3 New Recommendations

A variety of best management practices can be used to minimize nutrient runoff from agricultural lands. Mr. Detlor and Mr. Barr currently plant cover crops and use no-till crop management, two common stewardship practices and manure stockpiles have been moved previously to reduce nutrient enriched runoff. Additionally, we recommend that:

• The tile drain is re-routed along Foxboro Stirling Road (#14), approximately 500 m north up to the wetland (Figure 17). The wetland flows away from the lake (see Section 4.6) and wetlands can retain nutrients through a variety of biotic and abiotic factors (HESL 2017). Mr. Detlor, Mr. Barr and the City of Quinte West have agreed to this recommendation. A quotation has been provided from K.G. Reid Trenching and Construction Ltd. for to complete the work for \$230,000.





# 5.6 Aquatic Vegetation Management

Macrophytes are abundant in Oak Lake and dense macrophytes are common in shallow lakes with nutrient rich sediments and good water clarity so the accumulation of macrophytes is not surprising. Macrophytes are a natural feature of Oak Lake that provide fish habitat and reduce algal concentrations through competition for light and nutrients.

MOE noted the presence of abundant and widespread growth of aquatic plants almost 50 years ago (MOE 1973) but beyond anecdotal information from residents, it is unclear how macrophyte abundance has changed over time. Macrophyte abundance has likely increased over time due to the presence of Eurasian Watermilfoil (*Myriophyllum spicatum*), which is one of the most widely distributed invasive aquatic plant species in the world and it is also present in Oak Lake, as well as a result of anthropogenic nutrient inputs and the natural aging process of lakes which results in more wetland-like characteristics such as shallower depths and increased nutrient concentrations. Also, residents noted that it has become increasingly difficult to access their dock via boats because of macrophyte density.

### 5.6.1 Previous Recommendations

Oak Lake Shoreline Regeneration Plan (LTC, 2002):

• Aquatic vegetation in the northeast corner of the lake, and wetland vegetation fringing this reach of shoreline, is dominated by invasive alien plants. Establishment of native emergent vegetation in this area would help improve nutrient cycling.

### 5.6.2 Recommendations

A variety of physical (i.e. raking, hand pulling, rotovating), chemical (i.e. Reward) and biological removal (i.e. weevils) options exist but management of macrophytes will be a challenge because the inherent lake characteristics of Oak Lake that encourage growth can't be changed, climate change promotes macrophyte growth, Eurasian Watermilfoil is present in Oak Lake, the sediments likely contain a dense seed bed, and removal often results in the generation of many plant fragments, many of which can root directly, so any reductions will be temporary. Also, removal of macrophytes can result in oxygen depletion, shifts in zooplankton abundance, sediment disturbance, and most notably encourage algae growth, especially toxic cyanobacteria (Wojciechowski et al. 2016).

Aquatic plant removal should be minimized to those areas where they threaten or impair water use (e.g. beaches) and where it is deemed necessary, hand pulling should be used and plant fragments should be controlled to encourage further dispersal. Pulling should also be completed outside of the spring spawning period for resident fish species (July 15<sup>th</sup>) so that sensitive life stage is protected.

Motorized boats stir up sediment and sediment-related nutrients into the water column and propellers cut up plants which encourages dispersal as mentioned previously. We recognize that motorized boats are a popular recreational use of Oak Lake, but a motorized boat ban would help limit nutrient resuspension and aquatic plant dispersal in Oak Lake and should be considered.

We recommend that the following measures are implemented:



- Limit macrophyte removal to small areas, complete removal outside of sensitive fish windows (after July 15), utilize hand pulling in the areas and limit the dispersal of plant fragments by removing entire plants. Dispose of the plants/materials on dry land to prevent it from entering the water.
- Consider banning motorized boats, implementing a speed limit or restricting motor size.

## 5.7 Waterfowl Control

The predominant waterfowl species utilizing Oak Lake appears to be Canada Geese which is a migratory bird that is protected under the Migratory Birds Convention Act. Geese prefer manicured grassy areas near open water for feeding and security reasons (AECOM, 2009) and according to residents, populations have increased over time. Presence of geese in the fall but not earlier in the year indicates that Oak Lake is used as a migratory stopover location. Several management approaches have been developed to control nuisance populations of Canada Geese such as non-lethal passive deterrents, active scare techniques and lethal management.

### 5.7.1 New Recommendations

We have reviewed management techniques and recommend the following techniques to control nuisance Canada Geese populations on Oak Lake:

- Discourage feeding by residents
- Landscape Alteration
  - Increase natural shoreline buffer to make the nearshore less appealing to Geese
  - Obstruct views of the shoreline to make Geese feel less comfortable
  - Install barriers such as flash tape or monofilament strands along the shoreline to prevent goose access to lawns
- Use a professional dog handler to scare geese away from the site.

### 5.8 Active Lake Management

A number of different active lake management methods can be used to reduce internal phosphorus loads to lakes: 1) oxygenation or aeration which prevents the development of anoxia and release of phosphorus from sediments, 2) sediment inactivation which prevents the release of phosphorus from sediments, and 3) withdrawal methods designed to remove internally loaded phosphorus from bottom waters.

Oxygenation/aeration is typically accomplished via direct injection of oxygen or air into the hypolimnion by a diffuser or through prevention or breakdown of stratification to allow circulation throughout the entire water column. Prepas et al. 1997 utilized a fine bubble, pure oxygen diffuser system in Amisk Lake, Alberta to increase oxygen concentrations in bottom waters and reduce cyanobacterial blooms. Hypolimnetic dissolved oxygen concentrations were maintained above 5 mg/L, total phosphorus concentrations in the



hypolimnion decreased by > 50%, total algal biomass decreased by 33% and the dominant assemblage shifted from cyanobacteria to diatoms. Other commonly used injection systems like the Lake Lung have proven ineffective because of damage sustained during ice break-up.

Laminar Flow Inversion and Oxygenation System, offered by Clean Flo, and SolarBee systems are two water circulation systems that are designed to mix water throughout the water column and prevent stratification of the water column. The Laminar Flow Inversion and Oxygenation System pumps compressed air through a ceramic diffuser which creates a laminar flow as it rises to the surface. The SolarBee system is a solar-powered circulation system that draws water from a specified depth and discharges it to the surface. SolarBees could be used to circulate the surface waters in the shallow portions of Oak Lake and more importantly, the deep waters in the central portion of the lake by setting intake hoses at different depths.

Sediment phosphorus inactivation is a popular technique used to bind organic and inorganic phosphorus in sediment using typically either aluminum sulfate (alum) or lanthanum enriched clay (i.e. Phoslock) to prevent internal phosphorus loading. Macrophytes can disrupt the effectiveness of sediment inactivation through interference with application or sediment phosphorus recycling from below the floc layer by plant senescence and decay. Macrophytes are abundant throughout Oak Lake so we have not recommended sediment inactivation.

Active lake management has been completed in Ontario (e.g. sediment inactivation - Swan Lake, City of Markham, aeration - Lake Wilcox, City of Richmond Hill), in other provinces and is a common practice in the United States and Europe but it's not common in Ontario and therefore permitting can be challenging. Government authorities in Ontario generally focus on watershed Best Management Practices (BMPs) but BMPs are often inadequate when restoring phosphorus impaired lakes (Osgood, 2017). The number of algal blooms increased significantly in Ontario between 1994 and 2011 (Winter et al. 2011) and will likely continue to increase due to increased nutrient inputs and factors associated with climate change. Active lake management will be required in more lakes moving forward due to the ineffectiveness of watershed BMPs in many situations and the predicted rise in the number of algal blooms so we hope that government authorities will permit active lake management measures in the future, if required to protect recreational opportunities and ecological values.

### 5.8.1 New Recommendations

Average phosphorus concentrations during the open-water season at OL-1 do not exceed Provincial Water Quality Objectives and cyanobacteria (i.e. blue green algae), which are known to scavenge nutrients from sediments, were largely absent during our study so there is insufficient evidence to justify active lake management at this time. Internal loading does however provide a substantial phosphorus load to Oak Lake on an annual basis and options should be researched if phosphorus concentrations increase substantially, or cyanobacteria blooms become prevalent.

We recommend:

• Contact Canadian distributors of line diffusers, bubblers, and water circulation systems, collect information on costs and proven reliability of each system for reducing internal loading. Compare costs, advantages and disadvantages of each system, and applicability for reducing internal loading



### Oak Lake Water Quality Monitoring Report and Lake Management Plan

of nutrients in Oak Lake. Include LTC and MECP in the process to ensure that potential options will be permitted if required in the future.

• If oxygenation or aeration are utilized in the future, assess deep water conditions prior to installation of bubblers to determine appropriate depth of circulation in relation to decaying vegetation and unconsolidated substrates to ensure those materials are not circulated throughout the lake.

### 5.9 Long-term Water Quality Monitoring

A number of water quality monitoring programs have been completed in Oak Lake and we have attempted to assimilate datasets herein.

### 5.9.1 Previous Recommendations

An Evaluation of the On-Site Sewage Disposal Systems for Properties Fronting on Oak Lake (Ontario Lake Assessments, 2002a):

• The Municipality should maintain a water quality sampling program to establish a good baseline water quality data set from which to base planning decisions in the future.

Oak Lake Water Quality Assessment (MECP, 2018):

- Future monitoring should include three sample locations and efforts to ensure that comparisons between basins and sampling years can be made. The City should request that MEPC's Environment Monitoring and Reporting Branch assist or take-over the long-term monitoring program for Oak Lake.
- A study of lake sediments is also recommended for the 2019 sampling season.
- 5.9.2 Existing Policies

City of Quinte West Official Plan (2017):

• The City, in consultation with the Lower Trent Conservation and local Health Unit, shall establish an annual water sampling program for the on-going of the water quality of Oak Lake.

### 5.9.3 New Recommendations

Future sampling should build off of existing datasets to maximize the potential to determine long term trends, assess outstanding issues identified through 2018/19 sampling and evaluate the effectiveness of management recommendations once those measures are implemented. We recommend that:

 Long-term monitoring of phosphorus from OL-1 is continued during spring overturn to provide a high-level indication of the trend in phosphorus in Oak Lake. Sampling can be completed by volunteers through MECP's Lake Partner Program and organized through the Friends of Oak Lake.



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- Winter sampling is completed in 2020 to determine if elevated nutrient concentrations observed in February 2019 (as discussed in Section 4.1) are common or were a "one off".
- Ongoing seasonal sampling of field parameters, nutrients and phytoplankton are collected at the water quality stations to best define water quality conditions and assess the effectiveness of management recommendations as they are completed.

# 6. Conclusions

Oak Lake is a typical kettle lake with moderate nutrient concentrations that are driven by shoreline development practices, septic systems, agricultural inputs and internal loading. Nutrient concentrations have remained stable over time while bacteria concentrations have largely declined compared to 2001 data. Concentrations of nutrients in the tile drain that drains adjacent agricultural lands was high but similar to concentrations measured in other agricultural runoff in Ontario. Lastly, nutrient concentrations were elevated in the winter compared to other seasons, likely as a result of a variety of processes discussed in Section 4.1.

Macrophytes are abundant and algae followed a typical succession pattern until *Mougeotia spp.*, a species of filamentous green algae, spread throughout much of the lake in the summer of 2019. *Mougeotia spp.* are a nuisance for recreational uses but are non-toxic to humans and other aquatic life. Blooms of this species have not been clearly related to nutrient levels, nor is there sufficient evidence to connect this algal bloom to the 2018 manure spill.

Water level management is a challenge in Oak Lake because a) development setbacks are limited and nearshore areas are flat so slight changes in water levels impact residences and water intake lines, b) there is limited inflow or outflow so there isn't much water to work with, and c) there are differing opinions on a water management objective. Culvert #5 was removed in the late winter of 2019, which appeared to help lower water levels in the spring of 2019.

Oak Lake has been well studied and several lake management recommendations have been both made and incorporated into policy, but it is unclear how successful previous recommendations and policies have been. We developed new recommendations that included realigning the adjacent agricultural tile drain so it no longer drains into Oak Lake, developing a bylaw to enforce appropriate sewage treatment system design and maintenance, as well as others related to shoreline development practices, water level management, aquatic vegetation management, waterfowl control, active lake management and long-term monitoring. Successful execution of the management recommendations requires buy-in by shoreline residents and enforcement.



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Appendix A. Mailed Out Questionnaire







P.O. Box 490 7 Creswell Drive Trenton, Ontario K8V 5R6 Telephone: 613-392-2841 www.quintewest.ca

1-5 Chancery Lane Bracebridge ON, P1L 2E3 **Phone:** (705) 645-0021 **Email:** bracebridge@environmentalsciences.ca environmentalsciences.ca

# Oak Lake Water Quality Assessment Survey

Hutchinson Environmental Sciences Ltd. (HESL) is pleased to have been selected by the City of Quinte West to perform a water quality assessment on Oak Lake. The purpose of the project is to analyze existing data and complete a water quality sampling program to inform the development of a lake management plan and prevent further degradation of water quality of Oak Lake. Findings will be documented in a detailed technical report to the City and at several public meetings, including the first public meeting on:

Wednesday, August 15<sup>th</sup> Farmtown Park, Stirling 437 W Front Street Stirling, ON 5:00 p.m. – 7:00 p.m.

The intent of this survey is to introduce Hutchinson Environmental Sciences Ltd. to the residents and cottagers in the Oak Lake area and gather information on the public's lake use and their perception of the severity of water quality issues in the lake. This survey is an important opportunity for lake residents to voice their concerns to HESL and the City so that appropriate management recommendations are developed. Hutchinson Environmental Sciences Ltd. is a small team of highly qualified aquatic scientists with extensive experience working on lakes in Ontario. Brent Parsons will act as Project Manager and client liaison. Dr Kristopher Hadley will lead field collection, data analysis and reporting, and will be supported by Clarke Heitman who will also perform door-to-door septic system inspections.

Completed questionnaires can be mailed to Hutchinson Environmental at 1-5 Chancery Lane, Bracebridge ON, P1L 2E3. Any questions on the project should be directed to Chris Angelo, Director, Public Works and Environmental Services (613) 392-2841 ext. 4406 or <u>chrisa@quintewest.ca</u>.

Thank-you for taking the time to ensure that local knowledge and concerns are incorporated into the Oak Lake Water Quality Assessment.





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## Questions:

- 1. What is your name, address, and email (for future correspondence)
- 2. How long have you owned your cottage or residence at Oak Lake?
- 3. Do you use your cottage or residence:
  - \_ Summer only
  - \_ Summer and occasionally in winter
  - Regularly throughout the year
  - \_ Permanent resident
- 4. Which of the following concerns (if any) have you had about your lake during the past 5 years? (Check one box for each concern)

	No Concern	Some Concern	Great Concern	Don't Know
Dead fish or declining fish population				
Poor or declining quality of the lake				
water for consumption (drinking,				
cooking)				
Poor or declining quality of the lake for				
swimming or other water recreation				
Water level fluctuation				
Agricultural run-off				
Poor or declining aesthetic appearance				
of the lake and shoreline				
Too much recreational activity				
Too much shoreline development				
Other (specify)				

5. Rate your overall satisfaction with the lake

Very dissatisfied 1 2 3 4 5

Very satisfied





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- 6. Please rate the seriousness of the following problems in your lake by identifying the three (3) most serious concerns. Place a 1 next to the most serious concern and so on.
  - \_ Dead fish or declining fish population
  - Poor or declining quality of the lake water for consumption (drinking/cooking)
  - \_ Poor or declining quality of the lake for swimming or other water recreation
  - Water level fluctuation
  - \_ Agricultural run-off
  - Poor or declining aesthetic appearance of the lake and shoreline
  - \_ Too much recreational activity
  - \_ Too much shoreline development
- 7. Lake Level
  - a. What is your opinion on the current water level of Oak Lake
    - \_ Water level is currently too high
    - \_ Water level is currently too low
      - Water level is good as it is
  - b. What impacts (if any) have water levels had on your property (Mark all that apply)?
    - \_ High water encroaching on property
    - \_ Flooding of house/cottage
    - \_ Receding water causing exposure of additional shoreline
    - \_ Other (Please specify)
- 8. Agricultural Run-off

A recent manure spill in early 2018 (reported February 26<sup>th</sup>, 2018) has been documented and investigated by Hastings Prince Edward Public Health and the Ministry of the Environment and Climate Change.

- <u>a.</u> Prior to the recent 2018 spill, have you or you family observed agricultural run-off to Oak Lake
  - \_ Yes
  - No
- b. If Yes, please specify the location where you observed the run-off





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9. How often do you/your family participate in the following activities in Oak Lake?

Activity	Never/Rarely	Occasionally (2-3 time per summer)	Frequently (at least once per week)
Swimming/wading nearshore			
Sitting by water/enjoying the			
view			
Motorboating/waterskiing			
Canoeing/rowing			
Fishing			

- 10. Characterize your waterfront (check all that apply)
  - \_ Sandy beach
  - Wetland
  - \_ Natural vegetation (shrubs, wildflowers, trees)
  - \_ Grass
  - \_ Hardened (concrete, wood retaining wall)
  - \_ Other
- 11. What is the average distance between your house/cottage and water?
  - < 10 metres (30 feet)</pre>
  - \_ 10 20 metres (30 65 feet)
  - 20 30 metres (65 100 feet)
  - >30 metres (100 feet)
- 12. What restrictions are between your house/cottage and the lake that would limit your ability to establish a vegetative buffer?
  - \_ Tile bed for septic system
  - \_ Paved hardened driveway
  - Accessory buildings
  - \_ Other
- 13. What type of septic system do you have?
  - \_ Holding tank
  - \_ Septic tank and filter or leaching bed





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- Composting toilet
- \_ Greywater system
- \_ Other

14. Approximate distance between shoreline and closest portion of septic system \_\_\_\_\_m or \_\_\_\_\_ft

15. Number of years since your septic system was last maintained/pumped \_\_\_\_\_\_

16. What changes have you observed since you moved here?

17. What issues do you think are affecting the water quality of the lake?

18. Other comments:

Appendix B. Water Quality Master Spreadsheet



			<b>.</b>						
Client Sample ID			OL-1	OL-1	OL-1	OL-1	OL-2	OL-2	OL-2
Date Sampled			16-Aug-2018	29-Oct-2018	11-Feb-2019	8-May-2019	16-Aug-2018	29-Oct-2018	11-Feb-2019
ALS Sample ID	Lowest		L2148866-1	L2189621-1	L2232152-1	L2270097-1	L2148866-2	L2189621-2	L2232152-2
Parameter	Detection	Units	Water	Water	Water	Water	Water	Water	Water
Field Measurements	Limit								
		0	25.74	7.71	2.32	12.83	24.94	7.65	2.98
Temperature Conductivity		C uS/cm^c	277	294	2.32	328	24.94	294	305
Condicianty		uS/cm	282	197	156	252	270	196	177
Dissolved Oxygen		%	97.6	91.9	123.3	111.9	88.7	98.9	100.9
,,,		mg/L	7.95	10.95	16.62	11.82	7.35	11.76	13.59
рН			8.25	8.77	8.08	8.47	7.71	8.84	7.95
Physical Tests (Water)									
Hardness (as CaCO3)	10	mg/L	59	73	74	85.6	61	70	78
pH	0.10	pH units	8.60	7.99	7.97	8.29	8.66	8.04	7.95
Total Suspended Solids Anions and Nutrients (Water)	2.0	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Alkalinity, Total (as CaCO3)	10	mg/L	50	62	73	83	49	65	78
Ammonia, Total (as N)	0.020	mg/L	0.130	02	0.071	0.134	0.025	0.539	0.051
Chloride (Cl)	0.50	mg/L	51.6	51.4	51.6	49.6	51.6	51.4	57.9
Nitrate (as N)	0.020	mg/L	<0.020	<0.020	0.080	<0.020	<0.020	<0.020	0.090
Total Kjeldahl Nitrogen	0.15	mg/L	0.50	0.65	0.37	0.53	0.57	0.59	0.74
Phosphorus, Total	0.0030	mg/L	0.0108	0.0086	0.0532	0.0104	0.0106	0.0084	0.0372
Sulfate (SO4)	0.30	mg/L	1.68	1.54	2.04	1.85	1.68	1.55	2.17
Unionized Ammonia									
Organic / Inorganic Carbon (Water)			a (a				0.54		
Dissolved Organic Carbon Bacteriological Tests (Water)	0.50	mg/L	6.19	5.92	5.88	5.91	6.54	5.94	5.76
E. Coli	2	CFU/100mL	1	0	0	0	1	0	1
Fecal Coliforms	2	CFU/100mL	2	0	0	0	4	0	0
Fecal Streptococcus	-	CFU/100mL	3	0.5	1	0.5	4	5	3
Pseudomonas aeruginosa	1	CFU/100mL	4	0.5	0.5	0.5	11	0.5	0.5
Plant Pigments (Water)									
Chlorophyll a	0.10	ug/L	4.40	6.92	1.63	2.68	4.01	6.74	13.50
Total Metals (Water)									
Aluminum (AI)-Total	0.0050	mg/L	0.0196		0.0155	0.0119	0.0101		0.0252
Antimony (Sb)-Total	0.00010	mg/L	0.00010		0.00011	<0.00010	<0.00010		0.00011
Arsenic (As)-Total	0.00010	mg/L	0.00062		0.00054	0.00050	0.00064		0.00054
Barium (Ba)-Total	0.00010	mg/L	0.0147 <0.00010		0.0159 <0.00010	0.0162 <0.00010	0.0144 <0.00010		0.0171
Beryllium (Be)-Total Bismuth (Bi)-Total	0.000050	mg/L mg/L	<0.00010		<0.00010	<0.00010	<0.00010		<0.00010 <0.000050
Boron (B)-Total	0.010	mg/L	<0.010		<0.010	<0.010	<0.010		<0.010
Cadmium (Cd)-Total	0.0000050	mg/L	<0.0000050		0.0000061	<0.0000050	<0.0000050		0.0000169
Calcium (Ca)-Total	0.050	mg/L	18.8	24.7	25.1	29.6	19.6	23.4	26.4
Cesium (Cs)-Total	0.000010	mg/L	<0.000010		<0.000010	<0.000010	<0.000010		<0.000010
Chromium (Cr)-Total	0.00050	mg/L	0.00909		<0.00050	<0.00050	<0.00050		<0.00050
Cobalt (Co)-Total	0.00010	mg/L	<0.00010		<0.00010	<0.00010	<0.00010		<0.00010
Copper (Cu)-Total	0.0010	mg/L	<0.0010		<0.0010	<0.0010	<0.0010		0.0013
Iron (Fe)-Total	0.010	mg/L	0.043	<0.050	0.013	0.033	0.012	<0.050	0.027
Lead (Pb)-Total Lithium (Li)-Total	0.000050	mg/L mg/L	<0.000050 <0.0010		<0.000050 <0.0010	<0.000050 <0.0010	<0.000050 <0.0010		0.000057 <0.0010
Magnesium (Mg)-Total	0.0050	mg/L	2.82	2.85	2.66	2.84	2.84	2.82	2.83
Manganese (Mn)-Total	0.00050	mg/L	0.00599	1.00	0.00374	0.00560	0.00392		0.00341
Molybdenum (Mo)-Total	0.000050	mg/L	0.000207		0.000183	0.000108	0.000086		0.000109
Nickel (Ni)-Total	0.00050	mg/L	0.00238		<0.00050	<0.00050	<0.00050		<0.00050
Phosphorus (P)-Total	0.050	mg/L	<0.050		0.068	<0.050	<0.050		<0.050
Potassium (K)-Total	0.050	mg/L	1.40		2.20	1.75	1.40		1.83
Rubidium (Rb)-Total	0.00020	mg/L	0.00130		0.00168	0.00132	0.00126		0.00151
Selenium (Se)-Total	0.000050	mg/L	< 0.000050		0.000070	<0.000050	<0.000050		0.000053
Silicon (Si)-Total Silver (Ag)-Total	0.10 0.000050	mg/L mg/L	0.12 <0.000050		0.15 <0.000050	<0.10 <0.000050	0.11 <0.000050		<0.10 <0.000050
Solium (Na)-Total	0.000050	mg/L	29.2		28.3	<0.000050 27.9	29.1		32.1
Strontium (Sr)-Total	0.0010	mg/L	0.0578		0.0626	0.0661	0.0583		0.0667
Sulfur (S)-Total	0.50	mg/L	0.71		0.84	0.78	0.77		0.87
Tellurium (Te)-Total	0.00020	mg/L	<0.00020		<0.00020	<0.00020	<0.00020		<0.00020
Thallium (TI)-Total	0.000010	mg/L	<0.000010		<0.000010	<0.000010	<0.000010		<0.000010
Thorium (Th)-Total	0.00010	mg/L	<0.00010		<0.00010	<0.00010	<0.00010		<0.00010
Tin (Sn)-Total	0.00010	mg/L	<0.00010		<0.00010	<0.00010	<0.00010		<0.00010
Titanium (Ti)-Total	0.00030	mg/L	<0.00030		0.00035	< 0.0070	<0.00030		< 0.0080
Tungsten (W)-Total	0.00010	mg/L	< 0.00010		< 0.00010	< 0.00010	< 0.00010		< 0.00010
Uranium (U)-Total Vanadium (V)-Total	0.000010	mg/L mg/L	0.000018 <0.00050		0.000022 <0.00050	0.000027 <0.00050	0.000021		0.000023 <0.00050
Zinc (Zn)-Total	0.0030	mg/L	< 0.00030		< 0.00030	<0.00030	<0.00030		0.0047
Zirconium (Zr)-Total	0.00030	mg/L	< 0.00030		< 0.00030	< 0.00030	<0.00030		< 0.00030
Aggregate Organics (Water)		-							
BOD	2.0	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0

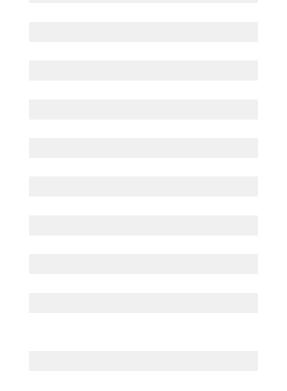
OL-2	OL-4	OL-4	OL-4	OL-4	OL-7	OL-7	OL-7	OL-7	OL-9	OL-9	OL-9
8-May-2019	16-Aug-2018	29-Oct-2018	11-Feb-2019	8-May-2019	16-Aug-2018	29-Oct-2018	11-Feb-2019	8-May-2019	16-Aug-2018	29-Oct-2018	11-Feb-2019
L2270097-2	L2148866-3	L2189621-3	L2232152-3	L2270097-3	L2148866-4	L2189621-4	L2232152-4	L2270097-4	L2148866-5	L2189621-5	L2232152-5
Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
12.98	25.43	7.8	3.47	13.15	24.63	6.21	2.47	13.98	25.04	6.81	2.57
328	269	293	310	330	24.05	294	344	328	264	299	312
253	271	196	182	255	286	188	196	260	264	194	179
113.3	101.6	94.1	124.6	111.8	73.2	98.5	111.4	118	71.8	93.8	113.7
11.96	8.34	11.17	16.4	11.75	6.88	12.19	15.22	12.34	5.93	11.41	15.42
8.29	8.39	8.82	8.02	8.54	8.03	8.84	7.93	8.4	7.97	8.81	8.04
83.6	59	75	70	83.6	54	74	65	83.5	55	77	80
8.33	8.62	8.03	7.92	8.30	8.70	8.07	7.61	8.38	8.81	7.97	7.59
<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	4.3	<2.0	2.4	2.9	3.1
81	46	65	69	81	48	65	64	80	41	64	80
<0.010	0.030	0.212	0.160	0.019	0.030	0.145	0.113	0.372	0.047	0.562	0.210
49.6	51.6	51.6	48.9	49.6	53.4	51.1	53.7	50.2	51.8	51.7	51.5
<0.020	<0.020	<0.020	0.206	<0.020	<0.020	<0.020	0.258	<0.020	<0.020	<0.020	0.299
0.53	0.57	0.46	0.82	0.50	0.64	0.46	0.81	0.71	0.63	0.65	1.02
0.0111	0.0135	0.0097	0.0182	0.0114	0.0157	0.0050	0.0714	0.0133	0.0255	0.0441	0.151
1.84	1.67	1.54	2.04	1.86	1.13	1.62	2.23	1.86	1.61	1.68	2.52
4.89	6.47	5.98	5.56	4.85	7.68	5.87	6.36	5.30	7.31	6.19	8.23
0	10	1	0	0	4	1	0	3	2	3	14
1	6	3	0	0	4	2	0	2	4	3 10	21
0.5	0.5	0.5	4	0.5	12	1	4	1	31	20	59
0.5	49	0.5	0.5	0.5	62	0.5	0.5	14	0.5	0.5	0.5
2.55	3.98	4.30	4.65	2.65	2.76	4.02	10.20	5.72	8.44	7.63	9.23
0.0066	0.0139		0.0101	0.0059	0.0077		0.0350	0.0093	0.0272		0.0658
<0.00010	<0.00010		0.00013	<0.00010	<0.00010		0.00011	<0.00010	<0.00010		0.00016
0.00048	0.00065		0.00069	0.00046	0.00060		0.00047	0.00053	0.00070		0.00059
0.0155	0.0143		0.0151	0.0158	0.0144		0.0149	0.0159	0.0134		0.0187
<0.00010	<0.00010		<0.00010	<0.00010	<0.00010		<0.00010	<0.00010	<0.00010		<0.00010
<0.000050 <0.010	<0.000050 <0.010		<0.000050 <0.010	<0.000050 <0.010	<0.000050 <0.010		<0.000050 <0.010	<0.000050 <0.010	<0.000050 <0.010		<0.000050 0.010
<0.000050	<0.000050		0.0000144	<0.000050	<0.000050		0.0000297	<0.000050	<0.000050		0.0000519
28.9	18.8	25.4	24.1	28.8	16.7	24.7	22.0	28.6	17.2	26.1	27.1
<0.000010	<0.000010		<0.000010	<0.000010	<0.000010		<0.000010	<0.000010	<0.000010		<0.000010
<0.00050	<0.00050		<0.00050	0.00055	<0.00050		<0.00050	0.00139	<0.00050		<0.00050
<0.00010	<0.00010		<0.00010	<0.00010	<0.00010		<0.00010	<0.00010	<0.00010		0.00011
0.0013	<0.0010		0.0014	<0.0010	<0.0010		0.0049	<0.0010	<0.0010		0.0024
0.019	0.012	<0.050	0.012	0.018	0.044	<0.050	0.062	0.044	0.046	<0.050	0.091
0.000051	<0.000050		0.000090	<0.000050	<0.000050		0.000093	<0.000050	<0.000050		0.000162
<0.0010	<0.0010		<0.0010	<0.0010	<0.0010		<0.0010	<0.0010	<0.0010		<0.0010
2.76	3.05	2.85	2.50	2.84	2.91	2.93	2.40	2.90	2.97	2.87	2.92
0.00509 0.000124	0.00412		0.00342	0.00504 0.000102	0.0142 <0.000050		0.0101 0.000141	0.0101 0.000123	0.00609		0.0390 0.000217
< 0.00050	<0.00050		< 0.00050	< 0.00050	<0.00050		< 0.00050	< 0.000123	<0.00050		< 0.00050
< 0.050	< 0.050		< 0.050	< 0.050	< 0.050		0.092	<0.050	< 0.050		0.201
1.86	1.44		1.63	1.74	1.80		2.27	1.70	1.51		4.38
0.00146	0.00128		0.00121	0.00125	0.00136		0.00173	0.00132	0.00129		0.00210
<0.000050	<0.000050		0.000064	<0.000050	<0.000050		0.000066	<0.000050	<0.000050		0.000094
<0.10	0.11		<0.10	<0.10	0.16		0.22	<0.10	0.13		0.43
<0.000050	<0.000050		<0.000050	<0.000050	<0.000050		<0.000050	<0.000050	<0.000050		<0.000050
27.5	30.1		25.7	27.6	31.3		30.7	28.6	30.6		29.8
0.0650	0.0557		0.0579	0.0643	0.0555		0.0527	0.0659	0.0579		0.0638
0.83 <0.00020	0.83 <0.00020		0.79 <0.00020	0.71 <0.00020	0.68 <0.00020		1.11 <0.00020	0.84 <0.00020	0.85 <0.00020		0.96 <0.00020
<0.00020	<0.00020		<0.00020	<0.00020	<0.00020		<0.00020	<0.00020	<0.00020		<0.00020
<0.00010	<0.00010		<0.00010	<0.00010	<0.00010		<0.00010	<0.00010	<0.00010		<0.00010
<0.00010	<0.00010		<0.00010	<0.00010	<0.00010		<0.00010	<0.00010	<0.00010		<0.00010
0.00032	<0.00030		0.00036	<0.00030	<0.00030		0.00128	<0.00030	0.00037		0.00281
<0.00010	<0.00010		<0.00010	<0.00010	<0.00010		<0.00010	<0.00010	<0.00010		<0.00010
0.000029	0.000019		0.000020	0.000030	<0.000010		0.000027	0.000034	0.000027		0.000050
<0.00050	<0.00050		<0.00050	<0.00050	<0.00050		<0.00050	<0.00050	<0.00050		<0.00050
0.0057	<0.0030		0.0035	0.0033	<0.0030		0.0039	<0.0030	<0.0030		0.0103
<0.00030	<0.00030		<0.00030	<0.00030	<0.00030		<0.00030	<0.00030	<0.00030		<0.00030
-0.0	.0.0	.0.0	-0.0	-0.0	.0.0	.0.0	0.0	-0.0	.0.0	.0.0	0.7
<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.9	<2.0	<2.0	<2.0	2.7

OL-9 8-May-2019 L2270097-5	TRIB-2 8-May-2019 L2270097-6	TRIB 4 11-Feb-2019 L2232152-13		TRIB-4 8-May-2019 L2270097-7	TRIB 5 11-Feb-2019 L2232152-14	TRIB 5 28-Mar-2019 L2250927-2	TRIB-5 8-May-2019 L2270097-8	OL-1 BOTTOM 16-Aug-2018 L2148866-12	OL-1- BOTTOME 29-Oct-2018 L2189621-12	OL-1- BOTTOM 11-Feb-2019 L2232152-12	OL-1- BOTTOM 8-May-2019 L2270255-9
Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
12.9	14.85	0.67	1.65	8.32	0.07	2.98	12.62				
330	335	251	254	607	246	311	589				
254	270	134	140	413	128	179	449				
115.3	112.5	44.4	47.2	94	47.5	45.4	132				
12.19 8.35	11.63 8.38	6.41 8.77	6.53 7.95	10.71 8.2	6.79 7.97	6.1 8.15	14.17 8.24				
0.00	0.30	0.77	7.95	0.2	1.97	0.15	0.24				
87.9 8.27	84.8 8.23	97 7.03	287 7.56	280 7.63	96 7.15	256 7.67	279 7.98				
<2.0	<2.0	10.5	10.3	15.3	5.5	4.6	<2.0		2.7	<2.0	<2.0
83	83	108	280	267	109	270	262				
0.738 49.3	0.026 51.1	0.94 6.69	2.21 12.2	1.19 10.1	0.81 6.75	1.58 14.4	0.641 10.2				
0.027	<0.020	0.843	0.786	6.72	0.718	0.491	6.58				
0.78	0.37	2.37	3.45	2.33	2.25	2.71	1.60				
0.0215	0.0197	0.572	0.329	0.153	0.512	0.398	0.148	0.0321	0.0070	0.0193	0.0137
1.88	1.85	3.65	6.59	8.28	3.39	7.21	7.97				
5.02	5.20	22.9	11.3	6.53	22.1	9.01	6.69				
1	22	4	3	19	1	3	12				
0	50	5	7	20	2	8	11				
2	2	66	>200	7	74	>200	6				
16 3.40	3 6.09	<1	16	43 14.2	<1	20	41 16.0				
3.40	0.09			17.2			10.0				
0.0083	0.0108	0.169	0.278	0.0495	0.128	0.0605	0.0224				
<0.00010	< 0.00010	0.00013	0.00014	0.00011	0.00013	0.00012	0.00012				
0.00053 0.0158	0.00053	0.00053 0.0251	0.00139	0.00087	0.00062	0.00121	0.00080				
< 0.0010	0.0157 <0.00010	<0.0251	0.0534 <0.00010	0.0442 <0.00010	0.0218 <0.00010	0.0415 <0.00010	0.0427 <0.00010				
<0.000050	< 0.000050	< 0.000050	<0.000050	<0.000050	<0.000050	<0.000050	< 0.000050				
<0.010	<0.010	0.011	0.031	0.018	0.011	0.023	0.020				
<0.000050	<0.0000050	0.0000294	0.0000313	0.0000110	0.0000238	0.0000150	0.0000122				
30.3	29.2	32.5	100	99.0	32.6	88.9	98.5				
<0.000010 <0.00050	<0.000010 0.00140	0.000011 0.00055	0.000013	<0.000010 0.00053	<0.000010 0.00160	<0.000010 <0.00050	<0.000010 0.00058				
<0.00010	<0.00010	0.00047	0.00126	0.00030	0.00046	0.00115	0.00023				
<0.0010	<0.0010	0.0052	0.0017	0.0015	0.0052	0.0013	0.0015				
0.020	0.065	0.206	0.967	0.246	0.180	0.826	0.133	0.096		0.059	<0.05
<0.000050	<0.000050	0.000167	0.000172	0.000100	0.000137	0.000106	0.000054				
<0.0010 2.99	<0.0010 2.90	<0.0010 3.72	<0.0010 8.93	<0.0010 7.92	<0.0010 3.61	<0.0010 8.28	<0.0010 7.93				
0.00652	0.00965	0.156	0.860	0.194	0.239	1.31	0.112				
0.000103	0.000133	0.000509	0.000690	0.000491	0.000561	0.000589	0.000558				
<0.00050	<0.00050	<0.00050	0.00110	0.00056	0.00056	0.00079	0.00051				
<0.050	<0.050	0.635	0.314	0.146	0.587	0.413	0.136				
1.78	1.72	11.3	7.28	6.38	11.5	7.54	6.48				
0.00130 <0.000050	0.00133 0.000051	0.00236 0.000198	0.00197 0.000218	0.00159 0.000223	0.00255 0.000215	0.00217 0.000168	0.00152 0.000230				
<0.000050	<0.10	2.00	4.51	3.35	1.85	3.72	2.70				
<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050				
28.2	29.3	3.18	6.79	6.75	3.45	8.50	7.10				
0.0671	0.0673	0.0599	0.170	0.183	0.0589	0.158	0.183				
0.82 <0.00020	0.81 <0.00020	1.32 <0.00020	2.48 <0.00020	2.97 <0.00020	1.25 <0.00020	2.54 <0.00020	2.86 <0.00020				
<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020				
<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010				
<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010				
<0.00030	0.00037	0.00680	0.0123	0.00228	0.00484	<0.0030	0.00093				
< 0.00010	<0.00010	<0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	<0.00010				
0.000035 <0.00050	0.000031 <0.00050	0.000289	0.00282	0.000714	0.000245	0.00169	0.000737				
<0.0030	<0.0030	0.0081	0.0116	0.0040	0.0137	0.0189	0.0049				
<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030				
<2.0	<3.0	12.6	4.9	<2.0	11.1	2.9	<3.0				

	OL-3	OL-3	OL-3	OL-3	OL-5	OL-5	OL-5	OL-5	OL-6
	16-Aug-2018	29-Oct-2018	11-Feb-2019	8-May-2019	16-Aug-2018	29-Oct-2018	11-Feb-2019	8-May-2019	16-Aug-2018
	L2148866-6	L2189621-6	L2232152-5	L2270097-10	L2148866-7	L2189621-7	L2232152-5	L2270097-11	L2148866-8
	Water								
Bacteriological Tests (Water)									
E. Coli	2	1	1	1	6	0	2	1	2
Fecal Coliforms	4	0	0.5	1	4	2	0.5	0	2
Fecal Streptococcus	19	0.5	37	0.5	3	3	4	1	4
Pseudomonas aeruginosa	29			0.5	21			4	58

OL-6	OL-6	OL-6	OL-8	OL-8	OL-8	OL-8	OL-10	OL-10	OL-10	OL-10	OL-11
29-Oct-2018	11-Feb-2019	8-May-2019	16-Aug-2018	29-Oct-2018	11-Feb-2019	8-May-2019	16-Aug-2018	29-Oct-2018	11-Feb-2019	8-May-2019	16-Aug-2018
L2189621-8	L2232152-5	L2270097-12	L2148866-9	L2189621-9	L2232152-5	L2270097-13	L2148866-10	L2189621-10	L2232152-5	L2270097-14	L2148866-11
Water											
1	4	0	2	1	6	0	1	0	18	0	14
0	2	0	2	0	<1	1	1	0	7	0	14
15	26	0.5	1	1	51	3	34	13	113	3	4
		4	117			4	12			3	16

OL-11	OL-11	OL-11
29-Oct-2018	11-Feb-2019	8-May-2019
L2189621-11	L2232152-5	L2270097-15
Water	Water	Water
0	1	0
1	0.5	0
2	0.5	0.5
		1



Appendix C. Water Quality Chain of Custody, Sample Receipt Confirmation and Certificate of Analysis





HUTCHINSON ENVIRONMENTAL SCIENCES LTD ATTN: Brent Parsons 501 Krug St. Suite 202 Kitchener ON N2B 1L3 Date Received:17-AUG-18Report Date:12-JAN-19 13:04 (MT)Version:FINAL REV. 2

Client Phone: 519-576-1711

# Certificate of Analysis

Lab Work Order #: L2148874 Project P.O. #: NOT SUBMITTED Job Reference: C of C Numbers: Legal Site Desc:

Comments: ADDITIONAL 05-SEP-18 10:19

Gayle Braun Senior Account Manager

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Environmental 🕽

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L2148874 CONTD.... PAGE 2 of 4 Version: FINAL RE\

# ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2148874-1 OL-1 Sampled By: CLIENT on 16-AUG-18 @ 09:00 Matrix:							
Bacteriological Tests							
Fecal Streptococcus	3		1	CFU/100mL		17-AUG-18	R4176309
Pseudomonas aeruginosa	4		1	CFU/100mL		17-AUG-18	
Taxonomy							
Phytoplankton	See attached.					09-JAN-19	R4434807
Plant Pigments							
Chlorophyll a	4.40		0.10	ug/L	17-AUG-18	17-AUG-18	R4180109
L2148874-2 OL-2 Sampled By: CLIENT on 16-AUG-18 @ 09:00 Matrix:							
Bacteriological Tests							
Fecal Streptococcus	4		1	CFU/100mL		17-AUG-18	R4176309
Pseudomonas aeruginosa	11		1	CFU/100mL		17-AUG-18	R4178007
Plant Pigments							
Chlorophyll a	4.01		0.10	ug/L	17-AUG-18	17-AUG-18	R4180109
L2148874-3 OL-4 Sampled By: CLIENT on 16-AUG-18 @ 09:00 Matrix:							
Bacteriological Tests							
Fecal Streptococcus	<1		1	CFU/100mL		17-AUG-18	R4176309
Pseudomonas aeruginosa	49		1	CFU/100mL		17-AUG-18	R4178007
Plant Pigments							
Chlorophyll a	3.98		0.10	ug/L	17-AUG-18	17-AUG-18	R4180109
L2148874-4 OL-7 Sampled By: CLIENT on 16-AUG-18 @ 09:00 Matrix:							
Bacteriological Tests							
Fecal Streptococcus	12		1	CFU/100mL		17-AUG-18	R4176309
Pseudomonas aeruginosa	62		1	CFU/100mL		17-AUG-18	R4178007
Plant Pigments	_						
Chlorophyll a	2.76		0.10	ug/L	17-AUG-18	17-AUG-18	R4180109
L2148874-5 OL-9 Sampled By: CLIENT on 16-AUG-18 @ 09:00 Matrix:							
Bacteriological Tests							
Fecal Streptococcus	31		1	CFU/100mL		17-AUG-18	R4176309
Pseudomonas aeruginosa	<1		1	CFU/100mL		17-AUG-18	R4178007
Plant Pigments							
Chlorophyll a	8.44		0.10	ug/L	17-AUG-18	17-AUG-18	R4180109
L2148874-6 OL-3 Sampled By: CLIENT on 16-AUG-18 @ 09:00 Matrix:							
Bacteriological Tests							
Fecal Streptococcus	19		1	CFU/100mL		17-AUG-18	R4176309
Pseudomonas aeruginosa	29		1	CFU/100mL		17-AUG-18	R4178007
* Pafer to Paferonand Information for Qualifiera (if any) and							

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

L2148874 CONTD.... PAGE 3 of 4 Version: FINAL RE\

# ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2148874-7 OL-5 Sampled By: CLIENT on 16-AUG-18 @ 09:00 Matrix:							
Bacteriological Tests							
Fecal Streptococcus	3		1	CFU/100mL		17-AUG-18	R4176309
Pseudomonas aeruginosa	21		1	CFU/100mL		17-AUG-18	R4178007
L2148874-8 OL-6 Sampled By: CLIENT on 16-AUG-18 @ 09:00 Matrix:							
Bacteriological Tests							
Fecal Streptococcus	4		1	CFU/100mL		17-AUG-18	R4176309
Pseudomonas aeruginosa	58		1	CFU/100mL		17-AUG-18	R4178007
L2148874-9 OL-8 Sampled By: CLIENT on 16-AUG-18 @ 09:00 Matrix:							
Bacteriological Tests							
Fecal Streptococcus	1		1	CFU/100mL		17-AUG-18	R4176309
Pseudomonas aeruginosa	117		1	CFU/100mL		17-AUG-18	R4178007
L2148874-10 OL-10 Sampled By: CLIENT on 16-AUG-18 @ 09:00 Matrix:							
Bacteriological Tests							
Fecal Streptococcus	34		1	CFU/100mL		17-AUG-18	R4176309
Pseudomonas aeruginosa	12		1	CFU/100mL		17-AUG-18	R4178007
L2148874-11 OL-11 Sampled By: CLIENT on 16-AUG-18 @ 09:00 Matrix:							
Bacteriological Tests							
Fecal Streptococcus	4		1	CFU/100mL		17-AUG-18	R4176309
Pseudomonas aeruginosa	16		1	CFU/100mL		17-AUG-18	R4178007

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

# **Reference Information**

L2148874 CONTD .... PAGE 4 of 4 Version: FINAL RE\

#### Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CHL/A-ACET-FLUORO- WP This analysis is done usir	Water	Chlorophyll a by fluorometry	EPA 445.0 ACET 9. Chlorophyll a is determined by a 90 % acetone extraction followed with
			d is not subject to interferences from chlorophyll b.
incubated at 35°C for 47 results are reported as C adjusted accordingly, with	+/- 1 hour. olony Formin report note the term "F	Colonies exhibiting characteristic mong ong Units (CFU) per 100 mL. The de as as required, when less than 100 n	APHA 9230C (modified) 45 micron membrane filter. The filter is placed on selective media and prphology for the target group on the filter after incubation are counted and tection limit for this test is 1 when 100 mL of sample is processed, and is nL is processed. to include all members of genus names Streptococcus and Enterococcus as
PHYTO-WP Samples are prepared by species where possible a		0 0	APHA 10200 C & F ompound phase contrast inverted microscope. Phytoplankters are identified to
plate and incubated for 7	2 hours at 4	1.5 +/- 0.5 C. Plates are examined u	APHA 9213E icron membrane filter. The filter is placed on the surface of a selective agar under low magnification and colonies exhibiting typical morphology are isa CFU/100 mL. Additional confirmation tests can be performed upon request
ALS test methods may in	corporate m	odifications from specified reference	e methods to improve performance.

Laboratory Definition Code	Laboratory Location
WP	ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA

#### **Chain of Custody Numbers:**

#### **GLOSSARY OF REPORT TERMS**

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid weight of sample

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory. UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION. Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



# **Quality Control Report**

				Qualit	y Contr	ol Report			
			Workorder:	L2148874	4	Report Date:	12-JAN-19		Page 1 of 2
Client: Contact:	501 Krug S	St. Suite 202 ON N2B 1L3	MENTAL SCIENO	CES LTD					
	Dientitais		Deference	Desult	Qualifier	Unite		Lineit	Analyzad
Test		Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CHL/A-ACET-FL	UORO-WP	Water							
	R4180109								
WG2856479-3 Chlorophyll a			<b>L2148700-1</b> 37.8	39.0		ug/L	3.1	35	17-AUG-18
WG2856479-4 Chlorophyll a	-		<b>L2149112-2</b> 16.7	15.6		ug/L	6.3	35	18-AUG-18
WG2856479- Chlorophyll a				107.2		%		80-120	22-AUG-18
WG2856479- <sup>,</sup> Chlorophyll a				<0.10		ug/L		0.1	17-AUG-18
WG2856479-2 Chlorophyll a				<0.10		ug/L		0.1	18-AUG-18
FECALSTREP-N	IF-WP	Water							
Batch WG2852921- Fecal Strepto				<1		CFU/100m	L	1	17-AUG-18
PSA-MF-WP		Water							
Batch WG2852918- Pseudomona		a		<1		CFU/100m	L	1	17-AUG-18

Workorder: L2148874

Report Date: 12-JAN-19

Client:	HUTCHINSON ENVIRONMENTAL SCIENCES LTD
	501 Krug St. Suite 202
	Kitchener ON N2B 1L3
Contact:	Brent Parsons

Contact:

#### Legend:

ALS Control Limit (Data Quality Objectives)
Duplicate
Relative Percent Difference
Not Available
Laboratory Control Sample
Standard Reference Material
Matrix Spike
Matrix Spike Duplicate
Average Desorption Efficiency
Method Blank
Internal Reference Material
Certified Reference Material
Continuing Calibration Verification
Calibration Verification Standard
Laboratory Control Sample Duplicate

#### Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



ALS Environmental 1329 Niakwa Road E - Unit 12 Winnipeg, Manitoba R2J 3T4 (204) 255-9720

# Phytoplankton Sample Results

Lab Number:	L2148874-1	Work Order L2148		Sar	nple Type WA	TER
Date Sampled: Sample ID:	August 16, 2018 OL-1	Submitter:			Biovolume	Biovolume
Class	Genus	Species	Unit:	Units/L	Unit µm3	Total µm3
Bacillariophyceae	Fragilaria	sp.	Single Cell	90000	0	0
Chlorophyceae	Oocystis	sp.	Colony	12000	0	0
Chlorophyceae	Schroederia	sp.	Single Cell	6000	0	0
Chlorophyceae	Tetraedron	minimum	Single Cell	6000	0	0
Chlorophyceae	Unidentified		Colony	9000	0	0
Chlorophyceae	Unidentified		Single Cell	37000	0	0
Chrysophyceae	small chrysophytes		Single Cell	297000	0	0
Cryptophyceae	Cryptomonas	sp.	Single Cell	99000	0	0
Cryptophyceae	Unidentified		Single Cell	396000	0	0
Cyanophyceae	Anabaena	sp.	Filament	118000	0	0
Cyanophyceae	Aphanizomenon	sp.	Filament	12000	0	0
Cyanophyceae	Aphanocapsa	sp.	Colony	6000	0	0
Cyanophyceae	Aphanothece	sp.	Colony	6000	0	0
Cyanophyceae	Chroococcus	sp.	Single Cell	397000	0	0
Cyanophyceae	Gomphosphaeria	sp.	Colony	12000	0	0
Cyanophyceae	Planktolyngbya	sp.	Filament	31000	0	0
Cyanophyceae	Pseudanabaena	sp.	Filament	19000	0	0

**Date Printed:** January 09, 2019

Lab Number:	L2148874-1	Work Orde	er L2148874	Sam	nple Type	WATER	
Date Sampled:	August 16, 2018 OL-1	Submitter:					
Sample ID: Class	Genus	Species	Unit:	Units/L	<u>Biovolu</u> Unit	μm3	Biovolume Total μm3
Dinophyceae	Ceratium	hirundinella	Single Cell	2000	0		0
				4000			



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Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy. 1. If any water samples are taken from aRegulated Drinking Water (DW) System please submit using anAuthorized DW COC form



# Sample Receipt Confirmation

Report DI	stribution:				Invoice	Distribu	ution:				
	Company Name:	HUTCHINSON E SCIENCES LTD	NVIRONMENTAL		Acct Name:	HUTCHI SCIENC	NSON ENVIRON ES LTD	IMENTAL			
	Contact:	Brent Parsons			Contact	ACCOU	NTS PAYABLE				
	Address:	501 Krug St., Sui	te 202		Address	1-5 Char	ncery Lane,				
		Kitchener, ON, N	2B 1L3			Bracebri	dge, ON, P1L 2E	3			
	Phone: Fax:	519-576-1711			Phone:		5				
	Email:	866-205-7766	environmentalscience	6.0.2	Fax:						
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		Hard Copy: N		EDD: N		accounti	ng@environmen	talsciences.ca			
	Distribution.	пага Сору. N	Email: Y Fax: N	N EDD: N	Project #:	N/A					
					Account #:	20126					
Client Inf	ormation:										
	Job Reference #:				Date Sampled	I: 16-AUG	i-18				
	Project PO #:			C	Date Received	I: 17-AUG	i-18				
Legal	Site Description:	N/A			Sampled By						
	Quote #:	Q69690		Chai	in Of Custody	/:					
Workord	er Summary										
L	ab Work Order #:	L2148874	Account Manager:			Gayle Braun					
Estimated completion date:			-18 Estimated samp			mple disposal date: See Sample Disposal Information section					
Estimated		28-DEC-18		Estimated sample	disposal date	: See Sar	nple Disposal Inf	ormation section			
		28-DEC-18 LONDON		Estimated sample	disposal date	See Sar below.	nple Disposal Inf	ormation section			
11 Samples re Lab	completion date: eceived at ALS in Client		Date	Date	Sample	below. Priority	Sample	Client			
11 Samples re	completion date: eceived at ALS in					below.					
11 Samples re Lab	completion date: eceived at ALS in Client		Date Sampled	Date	Sample	below. Priority	Sample	Client			
11 Samples ro Lab Sample ID L2148874-1 L2148874-2	completion date: eceived at ALS in Client Sample ID OL-1 OL-2		Date Sampled 16-AUG-18 09:00	Date Received	Sample Due Date 28-DEC-18 28-DEC-18	below. Priority	Sample	Client			
11 Samples ro Lab Sample ID L2148874-1 L2148874-2 L2148874-3	Client Sample ID OL-1 OL-2 OL-4		Date Sampled 16-AUG-18 09:00 16-AUG-18 09:00 16-AUG-18 09:00	Date Received 17-AUG-18 08:45 17-AUG-18 08:45 17-AUG-18 08:45	Sample Due Date 28-DEC-18 28-DEC-18 28-DEC-18	below. Priority	Sample	Client			
11 Samples ro Lab Sample ID L2148874-1 L2148874-2 L2148874-3 L2148874-4	Client Sample ID OL-1 OL-2 OL-4 OL-7		Date Sampled 16-AUG-18 09:00 16-AUG-18 09:00 16-AUG-18 09:00 16-AUG-18 09:00	Date Received 17-AUG-18 08:45 17-AUG-18 08:45 17-AUG-18 08:45 17-AUG-18 08:45	Sample Due Date 28-DEC-18 28-DEC-18 28-DEC-18 28-DEC-18	below. Priority	Sample	Client			
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ADDRESS 309 Exeter Road, Unit #29, London, ON, Canada N6L 1C1 PHONE +1 519 652 6044 FAX +1 519 652 0671 ALS CANADA LTD. Part of the ALS Group A Campbell Brothers Limited Company



Analysis Requested :	Chlorophyll a by fluorometry	Fecal streptococcus	Phytoplankton	Pseudomonas aeruginosa	Sample Handling and Disposal Fee
OL-1	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
OL-2	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$
OL-4	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$
OL-7	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$
OL-9	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$
OL-3		$\checkmark$		$\checkmark$	$\checkmark$
OL-5		$\checkmark$		$\checkmark$	$\checkmark$
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OL-8		$\checkmark$		$\checkmark$	$\checkmark$
OL-10		$\checkmark$		$\checkmark$	$\checkmark$
OL-11		$\checkmark$		$\checkmark$	$\checkmark$

### Analysis Completion Date (if different than sample due date):

Analysis Requested	Matrix	Due Date	Lab Sample ID
Phytoplankton	Water	16-JAN-19	L2148874-1
Pseudomonas aeruginosa	Water	24-AUG-18	L2148874-1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

### Sample Integrity Observations: No observations were identified for this work order submission.

#### Notice of Sub-contract Laboratory Service

#### Please be advised that the following tests will be subcontracted to the corresponding laboratory:

Phytoplankton subcontracted to: ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA Chlorophyll a by fluorometry subcontracted to: ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA Pseudomonas aeruginosa subcontracted to: ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA Fecal streptococcus subcontracted to: ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA

Please contact your Account Manager immediately should you have questions or concerns regarding this arrangement. Approval of this arrangement shall be implied unless otherwise notified by you.



### Sample Disposal Information:

Where possible, ALS will store samples for the following durations, measured from date of sample submission: 45 days for Soil and Water samples; 6 months for Tissue/Biota samples; 14 days for air samples collected on re-usable media; and 3 days for water samples submitted for microbiological testing. Longer storage times are available upon request.

For information about ALS accreditations and certifications please contact your Account Manager or visit our webpage at www.alsglobal.com (see Canada downloads).

ALS Group strives to deliver on-time results to our clients at all times. However, there are times when due to capacity issues or other unforeseen circumstances we are unable to meet our expected turnaround times. The information above is related to a recent workorder you have submitted to our laboratory. In the event that you have an inquiry, please refer to the Lab Work Order # when calling your Account Manager.

ALS Group appreciates your business. Thank you for the opportunity to work with you.



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Chain of Custody (COC) / Analytical Request Form



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#### ALS Environmental

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Canada Toll Free: 1 800 668 9878

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1. If any water samples are taken from a Regulated Drinking Water (DW): System, please submit using an Authorized DW COC form.



#### Chain of Custody (COC) / Analytical

Request Form

Canada Toll Free: 1 800 668 9878



COC Number: 17 -

Page 2 of Z

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Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC-form.

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HUTCHINSON ENVIRONMENTAL SCIENCES LTD ATTN: Brent Parsons 501 Krug St. Suite 202 Kitchener ON N2B 1L3 Date Received:17-AUG-18Report Date:24-MAY-19 14:22 (MT)Version:FINAL REV. 2

Client Phone: 519-576-1711

# Certificate of Analysis

Lab Work Order #: L2148866 Project P.O. #: NOT SUBMITTED Job Reference: C of C Numbers: Legal Site Desc:

Comments:

24-MAY-2019 Metals added

Gayle Braun Senior Account Manager

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L2148866 CONTD.... PAGE 2 of 14 Version: FINAL RE\

### ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2148866-1 OL-1							
Sampled By: CLIENT on 16-AUG-18 Matrix: WATER							
Matrix: WATER Physical Tests							
Hardness (as CaCO3)	59	нтс	10	mg/L		22-AUG-18	
pH	8.60		0.10	pH units		18-AUG-18	P/176306
Total Suspended Solids	<2.0		2.0	mg/L	21-AUG-18		R4179971
Anions and Nutrients	<2.0		2.0	ing/L	21 400 10	22 400 10	114173371
Alkalinity, Total (as CaCO3)	50		10	mg/L		20-AUG-18	R4177268
Ammonia, Total (as N)	0.130		0.020	mg/L		20-AUG-18	
Chloride (Cl)	51.6		0.50	mg/L		21-AUG-18	
Nitrate (as N)	<0.020		0.020	mg/L		21-AUG-18	
Total Kjeldahl Nitrogen	0.50		0.15	mg/L	21-AUG-18	22-AUG-18	
Phosphorus, Total	0.0108		0.0030	mg/L	21-AUG-18		R4180808
Sulfate (SO4)	1.68		0.30	mg/L		21-AUG-18	R4180266
Organic / Inorganic Carbon							
Dissolved Organic Carbon	6.19		0.50	mg/L		20-AUG-18	R4179909
Bacteriological Tests							
E. Coli	<2	DLM	2	CFU/100mL		18-AUG-18	R4176074
Fecal Coliforms	2	DLM	2	CFU/100mL		18-AUG-18	R4176081
Total Metals							
Aluminum (Al)-Total	0.0196		0.0050	mg/L	21-AUG-18	21-AUG-18	R4179823
Antimony (Sb)-Total	0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Arsenic (As)-Total	0.00062		0.00010	mg/L	21-AUG-18	21-AUG-18	
Barium (Ba)-Total	0.0147		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Boron (B)-Total	<0.010		0.010	mg/L	21-AUG-18	21-AUG-18	R4179823
Cadmium (Cd)-Total	<0.000050		0.0000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Calcium (Ca)-Total	18.8		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	21-AUG-18	21-AUG-18	R4179823
Chromium (Cr)-Total	0.00909		0.00050	mg/L	21-AUG-18	21-AUG-18	R4179823
Cobalt (Co)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Copper (Cu)-Total	<0.0010		0.0010	mg/L	21-AUG-18	21-AUG-18	R4179823
Iron (Fe)-Total	0.043		0.010	mg/L	21-AUG-18	21-AUG-18	R4179823
Lead (Pb)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Lithium (Li)-Total	<0.0010		0.0010	mg/L	21-AUG-18	21-AUG-18	R4179823
Magnesium (Mg)-Total	2.82		0.0050	mg/L	21-AUG-18	21-AUG-18	R4179823
Manganese (Mn)-Total	0.00599		0.00050	mg/L	21-AUG-18	21-AUG-18	R4179823
Molybdenum (Mo)-Total	0.000207		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Nickel (Ni)-Total	0.00238		0.00050	mg/L	21-AUG-18	21-AUG-18	R4179823
Phosphorus (P)-Total	<0.050		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Potassium (K)-Total	1.40		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Rubidium (Rb)-Total	0.00130		0.00020	mg/L	21-AUG-18	21-AUG-18	R4179823
Selenium (Se)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Silicon (Si)-Total	0.12		0.10	mg/L	21-AUG-18	21-AUG-18	R4179823

L2148866 CONTD.... PAGE 3 of 14 Version: FINAL RE\

### ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2148866-1 OL-1							
Sampled By: CLIENT on 16-AUG-18 Matrix: WATER							
Matrix: WATER Total Metals							
Silver (Ag)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Sodium (Na)-Total	29.2		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Strontium (Sr)-Total	0.0578		0.0010	mg/L	21-AUG-18		R4179823
Sulfur (S)-Total	0.71		0.50	mg/L	21-AUG-18	21-AUG-18	
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	21-AUG-18		R4179823
Thallium (TI)-Total	<0.00010		0.000010	mg/L	21-AUG-18		R4179823
Thorium (Th)-Total	<0.00010		0.00010	mg/L	21-AUG-18		R4179823
Tin (Sn)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Titanium (Ti)-Total	<0.00030		0.00030	mg/L	21-AUG-18		R4179823
Tungsten (W)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	
Uranium (U)-Total	0.000018		0.000010	mg/L	21-AUG-18		
Vanadium (V)-Total	<0.00050		0.00050	mg/L	21-AUG-18		R4179823
Zinc (Zn)-Total	< 0.0030		0.0030	mg/L	21-AUG-18		R4179823
Zirconium (Zr)-Total	<0.00030		0.00030	mg/L	21-AUG-18	21-AUG-18	R4179823
Aggregate Organics							
BOD	<2.0		2.0	mg/L	18-AUG-18	23-AUG-18	R4181493
L2148866-2 OL-2							
Sampled By: CLIENT on 16-AUG-18 Matrix: WATER							
Physical Tests							
Hardness (as CaCO3)	61	нтс	10	mg/L		22-AUG-18	
pH	8.66		0.10	pH units		18-AUG-18	P4176206
Total Suspended Solids	<2.0		2.0	mg/L	21-AUG-18	22-AUG-18	R4170300
Anions and Nutrients	<2.0		2.0	iiig/L	21-A00-10	22-700-10	14179971
Alkalinity, Total (as CaCO3)	49		10	mg/L		20-AUG-18	R4177268
Ammonia, Total (as N)	0.025		0.020	mg/L		20-AUG-18	R4178491
Chloride (Cl)	51.6		0.50	mg/L		21-AUG-18	
Nitrate (as N)	<0.020		0.020	mg/L			R4180266
Total Kjeldahl Nitrogen	0.57		0.15	mg/L	21-AUG-18	22-AUG-18	R4181476
Phosphorus, Total	0.0106		0.0030	mg/L	21-AUG-18	22-AUG-18	
Sulfate (SO4)	1.68		0.30	mg/L		21-AUG-18	R4180266
Organic / Inorganic Carbon				-			
Dissolved Organic Carbon	6.54		0.50	mg/L		20-AUG-18	R4179909
Bacteriological Tests							
E. Coli	<2	DLM	2	CFU/100mL		18-AUG-18	
Fecal Coliforms	4	DLM	2	CFU/100mL		18-AUG-18	R4176081
Total Metals			0.00				D (/=====
Aluminum (Al)-Total	0.0101		0.0050	mg/L	21-AUG-18		R4179823
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	
Arsenic (As)-Total	0.00064		0.00010	mg/L	21-AUG-18	21-AUG-18	
Barium (Ba)-Total	0.0144		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Beryllium (Be)-Total	<0.00010	1	0.00010	mg/L	21-AUG-18	21-AUG-18	

L2148866 CONTD.... PAGE 4 of 14 Version: FINAL RE\

### ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2148866-2 OL-2 Sampled By: CLIENT on 16-AUG-18 Matrix: WATER							
Matrix: WATER Total Metals							
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Boron (B)-Total	<0.010		0.000000	mg/L	21-AUG-18		R4179823
Cadmium (Cd)-Total	<0.000050		0.0000050	mg/L	21-AUG-18		R4179823
Calcium (Ca)-Total	19.6		0.050	mg/L	21-AUG-18		R4179823
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	21-AUG-18		R4179823
Chromium (Cr)-Total	<0.00050		0.00050	mg/L	21-AUG-18		R4179823
Cobalt (Co)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Copper (Cu)-Total	<0.0010		0.0010	mg/L	21-AUG-18	21-AUG-18	R4179823
Iron (Fe)-Total	0.012		0.010	mg/L	21-AUG-18	21-AUG-18	R4179823
Lead (Pb)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Lithium (Li)-Total	<0.0010		0.0010	mg/L	21-AUG-18	21-AUG-18	R4179823
Magnesium (Mg)-Total	2.84		0.0050	mg/L	21-AUG-18	21-AUG-18	R4179823
Manganese (Mn)-Total	0.00392		0.00050	mg/L	21-AUG-18	21-AUG-18	R4179823
Molybdenum (Mo)-Total	0.000086		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Nickel (Ni)-Total	<0.00050		0.00050	mg/L	21-AUG-18	21-AUG-18	R4179823
Phosphorus (P)-Total	<0.050		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Potassium (K)-Total	1.40		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Rubidium (Rb)-Total	0.00126		0.00020	mg/L	21-AUG-18	21-AUG-18	R4179823
Selenium (Se)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Silicon (Si)-Total	0.11		0.10	mg/L	21-AUG-18	21-AUG-18	R4179823
Silver (Ag)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Sodium (Na)-Total	29.1		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Strontium (Sr)-Total	0.0583		0.0010	mg/L	21-AUG-18	21-AUG-18	R4179823
Sulfur (S)-Total	0.77		0.50	mg/L	21-AUG-18		R4179823
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	21-AUG-18	21-AUG-18	R4179823
Thallium (TI)-Total	<0.000010		0.000010	mg/L	21-AUG-18	21-AUG-18	R4179823
Thorium (Th)-Total	<0.00010		0.00010	mg/L	21-AUG-18		
Tin (Sn)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	
Titanium (Ti)-Total	<0.00030		0.00030	mg/L	21-AUG-18	21-AUG-18	
Tungsten (W)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	
Uranium (U)-Total	0.000021		0.000010	mg/L	21-AUG-18	21-AUG-18	
Vanadium (V)-Total	<0.00050		0.00050	mg/L	21-AUG-18	21-AUG-18	
Zinc (Zn)-Total	< 0.0030		0.0030	mg/L	21-AUG-18	21-AUG-18	
Zirconium (Zr)-Total Aggregate Organics	<0.00030		0.00030	mg/L	21-AUG-18	21-AUG-18	R4179823
BOD	<2.0		2.0	mg/L	18-AUG-18	23-AUG-18	R4181402
L2148866-3 OL-4 Sampled By: CLIENT on 16-AUG-18 Matrix: WATER			2.0			10,000,00	
Physical Tests							
Hardness (as CaCO3)	59	нтс	10	mg/L		22-AUG-18	
pH	8.62		0.10	pH units		18-AUG-18	R4176306
* Refer to Referenced Information for Qualifiers (if any) a			-	•			

L2148866 CONTD.... PAGE 5 of 14 Version: FINAL RE\

### ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2148866-3 OL-4 Sampled By: CLIENT on 16-AUG-18 Matrix: WATER							
Physical Tests							
Total Suspended Solids	<2.0		2.0	mg/L	21-AUG-18	22-AUG-18	R4179971
Anions and Nutrients	12.0		2.0				
Alkalinity, Total (as CaCO3)	46		10	mg/L		20-AUG-18	R4177268
Ammonia, Total (as N)	0.030		0.020	mg/L		20-AUG-18	R4178491
Chloride (Cl)	51.6		0.50	mg/L		21-AUG-18	R4180266
Nitrate (as N)	<0.020		0.020	mg/L		21-AUG-18	R4180266
Total Kjeldahl Nitrogen	0.57		0.15	mg/L	21-AUG-18	22-AUG-18	R4181476
Phosphorus, Total	0.0135		0.0030	mg/L	21-AUG-18	22-AUG-18	R4180808
Sulfate (SO4)	1.67		0.30	mg/L		21-AUG-18	R4180266
Organic / Inorganic Carbon							
Dissolved Organic Carbon	6.47		0.50	mg/L		20-AUG-18	R4179909
Bacteriological Tests							
E. Coli	10	DLM	2	CFU/100mL		18-AUG-18	R4176074
Fecal Coliforms	6	DLM	2	CFU/100mL		18-AUG-18	R4176081
Total Metals							
Aluminum (Al)-Total	0.0139		0.0050	mg/L	21-AUG-18		R4179823
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Arsenic (As)-Total	0.00065		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Barium (Ba)-Total	0.0143		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Boron (B)-Total	<0.010		0.010	mg/L	21-AUG-18	21-AUG-18	R4179823
Cadmium (Cd)-Total	<0.000050		0.0000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Calcium (Ca)-Total	18.8		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	21-AUG-18	21-AUG-18	R4179823
Chromium (Cr)-Total	<0.00050		0.00050	mg/L	21-AUG-18	21-AUG-18	R4179823
Cobalt (Co)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Copper (Cu)-Total	<0.0010		0.0010	mg/L	21-AUG-18	21-AUG-18	R4179823
Iron (Fe)-Total	0.012		0.010	mg/L	21-AUG-18	21-AUG-18	R4179823
Lead (Pb)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Lithium (Li)-Total	<0.0010		0.0010	mg/L	21-AUG-18	21-AUG-18	R4179823
Magnesium (Mg)-Total	3.05		0.0050	mg/L	21-AUG-18	21-AUG-18	R4179823
Manganese (Mn)-Total	0.00412		0.00050	mg/L	21-AUG-18	21-AUG-18	R4179823
Molybdenum (Mo)-Total	0.000082		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Nickel (Ni)-Total	<0.00050		0.00050	mg/L	21-AUG-18	21-AUG-18	R4179823
Phosphorus (P)-Total	<0.050		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Potassium (K)-Total	1.44		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Rubidium (Rb)-Total	0.00128		0.00020	mg/L	21-AUG-18	21-AUG-18	R4179823
Selenium (Se)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Silicon (Si)-Total	0.11		0.10	mg/L	21-AUG-18	21-AUG-18	R4179823
Silver (Ag)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Sodium (Na)-Total	30.1		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823

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#### ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2148866-3 OL-4							
Sampled By: CLIENT on 16-AUG-18 Matrix: WATER							
Total Metals							
Strontium (Sr)-Total	0.0557		0.0010	mg/L	21-AUG-18	21-AUG-18	R4179823
Sulfur (S)-Total	0.83		0.50	mg/L	21-AUG-18		
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	21-AUG-18	21-AUG-18	
Thallium (TI)-Total	<0.000010		0.000010	mg/L	21-AUG-18	21-AUG-18	
Thorium (Th)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	
Tin (Sn)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	
Titanium (Ti)-Total	<0.00030		0.00030	mg/L	21-AUG-18	21-AUG-18	
Tungsten (W)-Total	<0.00010		0.00010	mg/L	21-AUG-18		
Uranium (U)-Total	0.000019		0.000010	mg/L	21-AUG-18	21-AUG-18	
Vanadium (V)-Total	< 0.00050		0.00050	mg/L	21-AUG-18	21-AUG-18	
Zinc (Zn)-Total	< 0.0030		0.0030	mg/L	21-AUG-18	21-AUG-18	
Zirconium (Zr)-Total	<0.00030		0.00030	mg/L	21-AUG-18	21-AUG-18	
Aggregate Organics				5			
BOD	<2.0		2.0	mg/L	18-AUG-18	23-AUG-18	R4181493
L2148866-4 OL-7 Sampled By: CLIENT on 16-AUG-18 Matrix: WATER							
Physical Tests							
Hardness (as CaCO3)	54	нтс	10	mg/L		22-AUG-18	
pH	8.70		0.10	pH units		18-AUG-18	R4176306
Total Suspended Solids	<2.0		2.0	mg/L	21-AUG-18	22-AUG-18	
Anions and Nutrients	~2.0		2.0		217.0010		11110011
Alkalinity, Total (as CaCO3)	48		10	mg/L		20-AUG-18	R4177268
Ammonia, Total (as N)	0.030		0.020	mg/L		20-AUG-18	R4178491
Chloride (Cl)	53.4		0.50	mg/L		21-AUG-18	R4180266
Nitrate (as N)	<0.020		0.020	mg/L		21-AUG-18	R4180266
Total Kjeldahl Nitrogen	0.64		0.15	mg/L	21-AUG-18	22-AUG-18	R4181476
Phosphorus, Total	0.0157		0.0030	mg/L	21-AUG-18	22-AUG-18	R4180808
Sulfate (SO4)	1.13		0.30	mg/L		21-AUG-18	R4180266
Organic / Inorganic Carbon							
Dissolved Organic Carbon Bacteriological Tests	7.68		0.50	mg/L		20-AUG-18	R4179909
E. Coli	4	DLM	2	CFU/100mL		18-AUG-18	R4176074
Fecal Coliforms	6	DLM	2	CFU/100mL		18-AUG-18	R4176081
Total Metals							
Aluminum (Al)-Total	0.0077		0.0050	mg/L	21-AUG-18	21-AUG-18	R4179823
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Arsenic (As)-Total	0.00060		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Barium (Ba)-Total	0.0144		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823

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### ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2148866-4 OL-7 Sampled By: CLIENT on 16-AUG-18							
Matrix: WATER Total Metals							
Cadmium (Cd)-Total	<0.0000050		0.0000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Calcium (Ca)-Total	16.7		0.0000050	mg/L	21-AUG-18 21-AUG-18		R4179823
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	21-AUG-18		R4179823
Chromium (Cr)-Total	<0.00050		0.00050	mg/L	21-AUG-18		R4179823
Cobalt (Co)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	
Copper (Cu)-Total	<0.0010		0.0010	mg/L	21-AUG-18		R4179823
Iron (Fe)-Total	0.044		0.010	mg/L	21-AUG-18	21-AUG-18	R4179823
Lead (Pb)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Lithium (Li)-Total	<0.0010		0.0010	mg/L	21-AUG-18	21-AUG-18	R4179823
Magnesium (Mg)-Total	2.91		0.0050	mg/L	21-AUG-18	21-AUG-18	R4179823
Manganese (Mn)-Total	0.0142		0.00050	mg/L	21-AUG-18	21-AUG-18	R4179823
Molybdenum (Mo)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Nickel (Ni)-Total	<0.00050		0.00050	mg/L	21-AUG-18	21-AUG-18	R4179823
Phosphorus (P)-Total	<0.050		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Potassium (K)-Total	1.80		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Rubidium (Rb)-Total	0.00136		0.00020	mg/L	21-AUG-18	21-AUG-18	R4179823
Selenium (Se)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Silicon (Si)-Total	0.16		0.10	mg/L	21-AUG-18	21-AUG-18	R4179823
Silver (Ag)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Sodium (Na)-Total	31.3		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Strontium (Sr)-Total	0.0555		0.0010	mg/L	21-AUG-18	21-AUG-18	R4179823
Sulfur (S)-Total	0.68		0.50	mg/L	21-AUG-18	21-AUG-18	R4179823
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	21-AUG-18	21-AUG-18	R4179823
Thallium (TI)-Total	<0.000010		0.000010	mg/L	21-AUG-18	21-AUG-18	R4179823
Thorium (Th)-Total	<0.00010		0.00010	mg/L	21-AUG-18		R4179823
Tin (Sn)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	
Titanium (Ti)-Total	<0.00030		0.00030	mg/L	21-AUG-18		
Tungsten (W)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	
Uranium (U)-Total	<0.000010		0.000010	mg/L	21-AUG-18		R4179823
Vanadium (V)-Total	<0.00050		0.00050	mg/L	21-AUG-18	21-AUG-18	
Zinc (Zn)-Total	<0.0030		0.0030	mg/L	21-AUG-18	21-AUG-18	
Zirconium (Zr)-Total Aggregate Organics	<0.00030		0.00030	mg/L	21-AUG-18	21-AUG-18	R4179823
BOD	<2.0		2.0	mg/L	18-AUG-18	23-AUG-18	R4181402
L2148866-5 OL-9 Sampled By: CLIENT on 16-AUG-18 Matrix: WATER	~2.0		2.0	my/L	10 100-10	20 000-10	101433
Physical Tests							
Hardness (as CaCO3)	55	нтс	10	mg/L		22-AUG-18	
рН	8.81		0.10	pH units		18-AUG-18	R4176306
Total Suspended Solids Anions and Nutrients	2.4		2.0	mg/L	21-AUG-18	22-AUG-18	R4180114

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### ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2148866-5 OL-9 Sampled By: CLIENT on 16-AUG-18							
Matrix: WATER							
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	41		10	mg/L		20-AUG-18	
Ammonia, Total (as N)	0.047		0.020	mg/L		21-AUG-18	
Chloride (CI)	51.8		0.50	mg/L		21-AUG-18	
Nitrate (as N)	<0.020		0.020	mg/L		21-AUG-18	R4180266
Total Kjeldahl Nitrogen	0.63		0.15	mg/L	21-AUG-18	22-AUG-18	R4181476
Phosphorus, Total	0.0255		0.0030	mg/L	21-AUG-18	22-AUG-18	R4180808
Sulfate (SO4)	1.61		0.30	mg/L		21-AUG-18	R4180266
Organic / Inorganic Carbon							
Dissolved Organic Carbon Bacteriological Tests	7.31		0.50	mg/L		20-AUG-18	R4179909
E. Coli	2	DLM	2	CFU/100mL		18-AUG-18	R4176074
Fecal Coliforms	4	DLM	2	CFU/100mL		18-AUG-18	R4176081
Total Metals							
Aluminum (Al)-Total	0.0272		0.0050	mg/L	21-AUG-18	21-AUG-18	
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Arsenic (As)-Total	0.00070		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Barium (Ba)-Total	0.0134		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Boron (B)-Total	<0.010		0.010	mg/L	21-AUG-18	21-AUG-18	R4179823
Cadmium (Cd)-Total	<0.000050		0.0000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Calcium (Ca)-Total	17.2		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	21-AUG-18	21-AUG-18	R4179823
Chromium (Cr)-Total	<0.00050		0.00050	mg/L	21-AUG-18	21-AUG-18	R4179823
Cobalt (Co)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Copper (Cu)-Total	<0.0010		0.0010	mg/L	21-AUG-18	21-AUG-18	R4179823
Iron (Fe)-Total	0.046		0.010	mg/L	21-AUG-18	21-AUG-18	R4179823
Lead (Pb)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Lithium (Li)-Total	<0.0010		0.0010	mg/L	21-AUG-18	21-AUG-18	R4179823
Magnesium (Mg)-Total	2.97		0.0050	mg/L	21-AUG-18	21-AUG-18	R4179823
Manganese (Mn)-Total	0.00609		0.00050	mg/L	21-AUG-18	21-AUG-18	R4179823
Molybdenum (Mo)-Total	0.000083		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Nickel (Ni)-Total	<0.00050		0.00050	mg/L	21-AUG-18	21-AUG-18	R4179823
Phosphorus (P)-Total	<0.050		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Potassium (K)-Total	1.51		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Rubidium (Rb)-Total	0.00129		0.00020	mg/L	21-AUG-18	21-AUG-18	
Selenium (Se)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Silicon (Si)-Total	0.13		0.10	mg/L	21-AUG-18	21-AUG-18	
Silver (Ag)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	
Sodium (Na)-Total	30.6		0.050	mg/L	21-AUG-18	21-AUG-18	
Strontium (Sr)-Total	0.0579		0.0010	mg/L	21-AUG-18	21-AUG-18	
Sulfur (S)-Total	0.85		0.50	mg/L	21-AUG-18	21-AUG-18	
Refer to Referenced Information for Qualifiers (if any) and			0.00	ing/L	21700-10	21 400-10	11 3023

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#### ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2148866-5 OL-9 Sampled By: CLIENT on 16-AUG-18							
Sampled By: CLIENT on 16-AUG-18 Matrix: WATER							
Total Metals							
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	21-AUG-18	21-AUG-18	R4179823
Thallium (TI)-Total	<0.000010		0.000010	mg/L	21-AUG-18	21-AUG-18	R4179823
Thorium (Th)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Tin (Sn)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Titanium (Ti)-Total	0.00037		0.00030	mg/L	21-AUG-18	21-AUG-18	R4179823
Tungsten (W)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Uranium (U)-Total	0.000027		0.000010	mg/L	21-AUG-18	21-AUG-18	R4179823
Vanadium (V)-Total	<0.00050		0.00050	mg/L	21-AUG-18	21-AUG-18	R4179823
Zinc (Zn)-Total	<0.0030		0.0030	mg/L	21-AUG-18	21-AUG-18	R4179823
Zirconium (Zr)-Total	<0.00030		0.00030	mg/L	21-AUG-18	21-AUG-18	R4179823
Aggregate Organics							
BOD	<2.0		2.0	mg/L	18-AUG-18	23-AUG-18	R4181493
L2148866-6 OL-3 Sampled By: CLIENT on 16-AUG-18 Matrix: WATER							
Bacteriological Tests							
E. Coli	2	DLM	2	CFU/100mL		18-AUG-18	R4176074
Fecal Coliforms	4	DLM	2	CFU/100mL		18-AUG-18	R4176081
L2148866-7 OL-5 Sampled By: CLIENT on 16-AUG-18 Matrix: WATER							
Bacteriological Tests							
E. Coli	6	DLM	2	CFU/100mL		18-AUG-18	R4176074
Fecal Coliforms	4	DLM	2	CFU/100mL		18-AUG-18	R4176081
L2148866-8 OL-6 Sampled By: CLIENT on 16-AUG-18 Matrix: WATER							
Bacteriological Tests							
E. Coli	2	DLM	2	CFU/100mL		18-AUG-18	R4176074
Fecal Coliforms	2	DLM	2	CFU/100mL		18-AUG-18	R4176081
L2148866-9 OL-8 Sampled By: CLIENT on 16-AUG-18 Matrix: WATER							
Bacteriological Tests							
E. Coli	2	DLM	2	CFU/100mL		18-AUG-18	R4176074
Fecal Coliforms	2	DLM	2	CFU/100mL		18-AUG-18	R4176081
L2148866-10 OL-10 Sampled By: CLIENT on 16-AUG-18 Matrix: WATER							
Bacteriological Tests							
E. Coli	<2	DLM	2	CFU/100mL		18-AUG-18	R4176074
Fecal Coliforms	<2	DLM	2	CFU/100mL		18-AUG-18	R4176081
L2148866-11 OL-11 Sampled By: CLIENT on 16-AUG-18							

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#### ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2148866-11 OL-11							
Sampled By: CLIENT on 16-AUG-18 Matrix: WATER							
Bacteriological Tests							
E. Coli	14	DLM	2	CFU/100mL		18-AUG-18	R4176074
Fecal Coliforms	14	DLM	2	CFU/100mL		18-AUG-18	
L2148866-12 OL-1 BOTTOM							
Sampled By: CLIENT on 16-AUG-18 Matrix: WATER							
Anions and Nutrients							
Phosphorus, Total	0.0321		0.0030	mg/L	21-AUG-18	22-AUG-18	R4180808
Total Metals							
Iron (Fe)-Total	0.096		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
L2148866-13 SED-1 Sampled By: CLIENT on 16-AUG-18 Matrix: SOIL							
Leachable Anions & Nutrients							
Total Kjeldahl Nitrogen	2.34	DLHC	0.40	%	22-AUG-18	23-AUG-18	R4181590
Metals							
Aluminum (Al)	18000		50	ug/g	22-AUG-18	22-AUG-18	R4180734
Antimony (Sb)	1.14		0.10	ug/g	22-AUG-18	22-AUG-18	R4180734
Arsenic (As)	8.59		0.10	ug/g	22-AUG-18	22-AUG-18	R4180734
Barium (Ba)	128		0.50	ug/g	22-AUG-18	22-AUG-18	R4180734
Beryllium (Be)	0.65		0.10	ug/g	22-AUG-18		
Bismuth (Bi)	0.49		0.20	ug/g	22-AUG-18	22-AUG-18	
Boron (B)	12.9		5.0	ug/g	22-AUG-18	22-AUG-18	R4180734
Cadmium (Cd)	1.70		0.020	ug/g	22-AUG-18	22-AUG-18	R4180734
Calcium (Ca)	8960		50	ug/g	22-AUG-18	22-AUG-18	
Chromium (Cr)	25.2		0.50	ug/g	22-AUG-18	22-AUG-18	R4180734
Cobalt (Co)	7.20		0.10	ug/g	22-AUG-18	22-AUG-18	
Copper (Cu)	25.5		0.50	ug/g	22-AUG-18	22-AUG-18	
Iron (Fe) Lead (Pb)	21800		50	ug/g	22-AUG-18	22-AUG-18	
Lithium (Li)	126 15.4		0.50 2.0	ug/g	22-AUG-18 22-AUG-18	22-AUG-18 22-AUG-18	R4180734
Magnesium (Mg)	4350		2.0 20	ug/g ug/g	22-AUG-18 22-AUG-18	22-AUG-18 22-AUG-18	R4180734
Manganese (Mn)	283		1.0	ug/g	22-AUG-18	22-AUG-18	R4180734
Molybdenum (Mo)	1.29		0.10	ug/g	22-AUG-18	22-AUG-18	
Nickel (Ni)	17.2		0.50	ug/g	22-AUG-18	22-AUG-18	R4180734
Phosphorus (P)	1990		50	ug/g	22-AUG-18	22-AUG-18	
Potassium (K)	1630		100	ug/g	22-AUG-18	22-AUG-18	
Selenium (Se)	2.27		0.20	ug/g	22-AUG-18	22-AUG-18	R4180734
Silver (Ag)	0.27		0.10	ug/g	22-AUG-18	22-AUG-18	
Sodium (Na)	996		50	ug/g	22-AUG-18	22-AUG-18	
Strontium (Sr)	25.8		0.50	ug/g	22-AUG-18	22-AUG-18	R4180734
Sulfur (S)	13300		1000	ug/g	22-AUG-18	22-AUG-18	
Thallium (TI)	0.275		0.050	ug/g	22-AUG-18	22-AUG-18	B4190724

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#### ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2148866-13 SED-1							
Sampled By: CLIENT on 16-AUG-18 Matrix: SOIL							
Metals							
Tin (Sn)	4.9		2.0	ug/g	22-AUG-18	22-AUG-18	R4180734
Titanium (Ti)	404		1.0	ug/g	22-AUG-18	22-AUG-18	
Tungsten (W)	<0.50		0.50	ug/g	22-AUG-18	22-AUG-18	
Uranium (U)	0.963		0.050	ug/g	22-AUG-18	22-AUG-18	
Vanadium (V)	35.7		0.20	ug/g	22-AUG-18	22-AUG-18	
Zinc (Zn)	180		2.0	ug/g	22-AUG-18	22-AUG-18	
Zirconium (Zr)	1.5		1.0	ug/g	22-AUG-18	22-AUG-18	R4180734

#### **Reference Information**

L2148866 CONTD.... PAGE 12 of 14 Version: FINAL RE\

#### **QC Samples with Qualifiers & Comments:**

QC Type Descr	iption	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate		E. Coli	DUP-H,J	L2148866-1, -10, -11, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike		Barium (Ba)-Tota	MS-B	L2148866-1, -12, -2, -3, -4, -5
Matrix Spike		Boron (B)-Total	MS-B	L2148866-1, -12, -2, -3, -4, -5
Matrix Spike		Calcium (Ca)-To	al MS-B	L2148866-1, -12, -2, -3, -4, -5
Matrix Spike		Cobalt (Co)-Tota	MS-B	L2148866-1, -12, -2, -3, -4, -5
Matrix Spike		Copper (Cu)-Tota	al MS-B	L2148866-1, -12, -2, -3, -4, -5
Vatrix Spike		Iron (Fe)-Total	MS-B	L2148866-1, -12, -2, -3, -4, -5
Vatrix Spike		Lithium (Li)-Total	MS-B	L2148866-1, -12, -2, -3, -4, -5
Vatrix Spike		Magnesium (Mg)	-Total MS-B	L2148866-1, -12, -2, -3, -4, -5
Vatrix Spike		Manganese (Mn)	-Total MS-B	L2148866-1, -12, -2, -3, -4, -5
Vatrix Spike		Nickel (Ni)-Total	MS-B	L2148866-1, -12, -2, -3, -4, -5
Vatrix Spike		Potassium (K)-To	otal MS-B	L2148866-1, -12, -2, -3, -4, -5
Matrix Spike		Rubidium (Rb)-T	otal MS-B	L2148866-1, -12, -2, -3, -4, -5
Matrix Spike		Silicon (Si)-Total	MS-B	L2148866-1, -12, -2, -3, -4, -5
Matrix Spike		Sodium (Na)-Tot	al MS-B	L2148866-1, -12, -2, -3, -4, -5
Matrix Spike		Strontium (Sr)-To	otal MS-B	L2148866-1, -12, -2, -3, -4, -5
Vatrix Spike		Sulfur (S)-Total	MS-B	L2148866-1, -12, -2, -3, -4, -5
Vatrix Spike		Uranium (U)-Tota	al MS-B	L2148866-1, -12, -2, -3, -4, -5
ample Param	neter Qualifier	r kev listed:		
Qualifier	Description			
DLHC	Detection Lim	it Raised: Dilution required du	e to high concentration of test ar	nalyte(s).
DLM		•	trix effects (e.g. chemical interfer	
DUP-H,J				results and limits are expressed in terms of absolute
HTC	Hardness was	s calculated from Total Ca and	l/or Mg concentrations and may I	be biased high (dissolved Ca/Mg results unavailable).
MS-B	Matrix Spike r	ecovery could not be accurate	ely calculated due to high analyte	background in sample.
est Method R	oforonooo			
ALS Test Code		rix Test Description	Method Refe	rence**
ALK-WT This analysis is colourimetric n		er Alkalinity, Total (as	,	otal Alkalinity is determined using the methyl orange
BOD-WT	Wat	er BOD	APHA 5210 E	3
This analysis is oxygen deman dissolved oxyg	s carried out usi id (BOD) are de jen meter. Disso	ng procedures adapted from a termined by diluting and incub plved BOD (SOLUBLE) is dete	APHA Method 5210B - "Biochem ating a sample for a specified tin	ical Oxygen Demand (BOD)". All forms of biochemical ne period, and measuring the oxygen depletion using a rough a glass fibre filter prior to dilution. Carbonaceous
	red through a 0. the organic carl	45um filter, then injected into	a heated reaction chamber which	n is packed with an oxidative catalyst. The water is orted in a carrier gas and is measured by a non-dispersive
CL-IC-N-WT Inorganic anior	Wat ns are analyzed	<b>,</b>	EPA 300.1 (n conductivity and/or UV detection.	,
Analysis condu Protection Act		ance with the Protocol for Ana	ytical Methods Used in the Asse	ssment of Properties under Part XV.1 of the Environment
EC-MF-WT A 100 mL volu Method ID: W1			SM 9222D the membrane is placed on mF	C-BCIG agar and incubated at 44.5 –0 .2 °C for 24 – 2 h.
			CM 0000D	
FC-MF-WT A 100mL volur WT-TM-1200	Wat ne of sample is		SM 9222D the membrane is placed on mFC	C agar and incubated at 24–2h@44.5–0.2°C. Method ID:

 MET-200.2-CCMS-WT
 Soil
 Metals in Soil by CRC ICPMS
 EPA 200.2/6020A (mod)

 Soil/sediment is dried, disaggregated, and sieved (2 mm).
 For tests intended to support Ontario regulations, the <2mm fraction is ground to pass</td>

#### **Reference Information**

through a 0.355 mm sieve. Strong Acid Leachable Metals in the <2mm fraction are solubilized by heated digestion with nitric and hydrochloric acids. Instrumental analysis is by Collision / Reaction Cell ICPMS.

Limitations: This method is intended to liberate environmentally available metals. Silicate minerals are not solubilized. Some metals may be only partially recovered (matrix dependent), including Al, Ba, Be, Cr, S, Sr, Ti, Tl, V, W, and Zr. Elemental Sulfur may be poorly recovered by this method. Volatile forms of sulfur (e.g. sulfide, H2S) may be excluded if lost during sampling, storage, or digestion.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

MET-T-CCMS-WT Water Total Metals in Water by CRC EPA 200.2/6020A (mod) ICPMS Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

N-TOTKJ-COL-SK Soil Total Kjeldahl Nitrogen CSSS (2008) 22.2.3

The soil is digested with sulfuric acid in the presence of CuSO4 and K2SO4 catalysts. Ammonia in the soil extract is determined colrimetrically at 660 nm.

NH3-WT Water Ammonia, Total as N EPA 350.1 Sample is measured colorimetrically. When sample is turbid a distillation step is required, sample is distilled into a solution of boric acid and measured colorimetrically.

Total Ammonia (as N), refers to the

sum of the un-ionized (NH3) and ionized (NH4

+) ammonia species in the sample, expressed in units of milligrams of nitrogen per litre of sample.

NO3-IC-WT Water Nitrate in Water by IC EPA 300.1 (mod) Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-COL-WT Water Total P in Water by Colour APHA 4500-P PHOSPHORUS

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is deteremined colourimetrically after persulphate digestion of the sample.

PH-WT Water pH Water samples are analyzed directly by a calibrated pH meter.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011). Holdtime for samples under this regulation is 28 days

APHA 4500 H-Electrode

SO4-IC-N-WT Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

 SOLIDS-TSS-WT
 Water
 Suspended solids
 APHA 2540 D-Gravimetric

 A well-mixed sample is filtered through a weighed standard glass fibre filter and the residue retained is dried in an oven at 104–1°C for a minimum of four hours or until a constant weight is achieved.
 APHA 2540 D-Gravimetric

 TKN-WT
 Water
 Total Kjeldahl Nitrogen
 APHA 4500-Norg D

 This analysis is carried out using procedures adapted from APHA Method 4500-Norg "Nitrogen (Organic)". Total Kjeldahl Nitrogen is determined by sample digestion at 380 Celsius with analysis using an automated colorimetric method.

\*\* ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

#### Chain of Custody Numbers:

#### **Reference Information**

#### **GLOSSARY OF REPORT TERMS**

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid weight of sample

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory. UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION. Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



		Workorder:	L214886	6 R	eport Date: 2	24-MAY-19		Page 1 of 15
Client: Contact:	HUTCHINSON ENVIRON 501 Krug St. Suite 202 Kitchener ON N2B 1L3 Brent Parsons	MENTAL SCIENC	ES LTD					-
Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALK-WT	Water							
Batch	R4177268							
WG285413		WT-ALK-CRM	94.8		%		80-120	20-AUG-18
WG285413 Alkalinity, T	<b>2-4 DUP</b> Fotal (as CaCO3)	<b>L2149039-1</b> 251	253		mg/L	0.8	20	20-AUG-18
WG2854132 Alkalinity, T	<b>2-2 LCS</b> Fotal (as CaCO3)		99.0		%		85-115	20-AUG-18
WG2854132 Alkalinity, T	<b>2-1 MB</b> Fotal (as CaCO3)		<10		mg/L		10	20-AUG-18
BOD-WT	Water							
Batch WG2853524 BOD	R4181493 4-2 DUP	<b>L2148866-1</b> <2.0	<2.0	RPD-NA	mg/L	N/A	20	23-AUG-18
WG2853524 BOD	4-6 DUP	<b>L2148866-4</b>	<2.0	RPD-NA	mg/L	N/A	20	23-AUG-18
WG2853524 BOD	4-3 LCS		85.9		%		85-115	23-AUG-18
WG2853524 BOD	4-7 LCS		92.4		%		85-115	23-AUG-18
WG2853524 BOD	4-1 MB		<2.0		mg/L		2	23-AUG-18
WG2853524 BOD	4-5 MB		<2.0		mg/L		2	23-AUG-18
C-DIS-ORG-W	T Water							
Batch WG285493	R4179909 6-3 DUP	L2149254-2						
	Organic Carbon	1.81	1.89		mg/L	4.3	20	20-AUG-18
	Organic Carbon		106.6		%		80-120	20-AUG-18
	Organic Carbon		<0.50		mg/L		0.5	20-AUG-18
WG2854930 Dissolved (	<b>6-4 MS</b> Organic Carbon	L2149254-2	107.4		%		70-130	20-AUG-18
CL-IC-N-WT	Water							
Batch WG2855199 Chloride (C		<b>WG2855195-8</b> 51.7	51.6		mg/L	0.2	20	21-AUG-18
WG285519	5-7 LCS							



				Quality	/ Contr	ol Report			
			Workorder:	L2148866		Report Date: 24-	MAY-19		Page 2 of 15
Client:	501 Krug	ISON ENVIRON St. Suite 202 ON N2B 1L3	MENTAL SCIENC	ES LTD					
Contact:	Brent Par	sons							
Test		Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CL-IC-N-WT		Water							
Batch WG2855195- Chloride (Cl)				100.9		%		90-110	21-AUG-18
WG2855195- Chloride (Cl)				<0.50		mg/L		0.5	21-AUG-18
WG2855195- Chloride (Cl)			WG2855195-8	105.7		%		75-125	21-AUG-18
EC-MF-WT		Water							
Batch WG2852907- E. Coli	R4176074 3 DUP		<b>L2148866-7</b> 6	2	DUP-H,J	CFU/100mL	4	4	18-AUG-18
<b>WG2852907-</b> E. Coli	1 MB			0		CFU/100mL		1	18-AUG-18
FC-MF-WT		Water							
Batch	R4176081								
WG2852951- Fecal Colifor			<b>L2148866-4</b> 6	4		CFU/100mL	40	65	18-AUG-18
WG2852951- Fecal Colifor				0		CFU/100mL		1	18-AUG-18
MET-T-CCMS-W	/т	Water							
Batch	R4179823								
<b>WG2854938-</b> Aluminum (A	-		WG2854938-3 0.072	0.073		mg/L	1.6	20	21-AUG-18
Antimony (SI			<0.0010	<0.0010	RPD-NA	-	N/A	20	21-AUG-18
Arsenic (As)			<0.0010	<0.0010	RPD-NA		N/A	20	21-AUG-18
Barium (Ba)-	Total		0.0220	0.0223		mg/L	1.3	20	21-AUG-18
Beryllium (Be	e)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	21-AUG-18
Bismuth (Bi)	-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	21-AUG-18
Boron (B)-To	otal		<0.10	<0.10	RPD-NA	mg/L	N/A	20	21-AUG-18
Cadmium (C	d)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	21-AUG-18
Calcium (Ca	)-Total		365	360		mg/L	1.5	20	21-AUG-18
Chromium (C	Cr)-Total		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	21-AUG-18
Cesium (Cs)	-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	21-AUG-18
Cobalt (Co)-	Total		0.0348	0.0360		mg/L	3.3	20	21-AUG-18
Copper (Cu)	-Total		0.027	0.027		mg/L	0.9	20	21-AUG-18
Iron (Fe)-Tot	al		2.71	2.80		mg/L	3.4	20	21-AUG-18



Report Date: 24-MAY-19

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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD 501 Krug St. Suite 202

Workorder: L2148866

Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT	Water							
Batch R4179823 WG2854938-4 DUP		WG2854938-3						
Lead (Pb)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	21-AUG-18
Lithium (Li)-Total		0.063	0.056		mg/L	12	20	21-AUG-18
Magnesium (Mg)-Total		986	987		mg/L	0.2	20	21-AUG-18
Manganese (Mn)-Total		10.5	10.8		mg/L	2.1	20	21-AUG-18
Molybdenum (Mo)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	21-AUG-18
Nickel (Ni)-Total		0.0402	0.0408		mg/L	1.5	20	21-AUG-18
Phosphorus (P)-Total		<0.50	<0.50	RPD-NA	mg/L	N/A	20	21-AUG-18
Potassium (K)-Total		5.60	5.65		mg/L	0.8	20	21-AUG-18
Rubidium (Rb)-Total		0.0095	0.0101		mg/L	6.0	20	21-AUG-18
Selenium (Se)-Total		0.0100	0.0102		mg/L	1.4	20	21-AUG-18
Silicon (Si)-Total		<1.0	<1.0	RPD-NA	mg/L	N/A	20	21-AUG-18
Silver (Ag)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	21-AUG-18
Sodium (Na)-Total		5.81	5.78		mg/L	0.4	20	21-AUG-18
Strontium (Sr)-Total		0.751	0.750		mg/L	0.2	20	21-AUG-18
Sulfur (S)-Total		1780	1770		mg/L	0.6	25	21-AUG-18
Thallium (TI)-Total		0.00017	0.00017		mg/L	1.7	20	21-AUG-18
Tellurium (Te)-Total		<0.0020	<0.0020	RPD-NA	mg/L	N/A	20	21-AUG-18
Thorium (Th)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	25	21-AUG-18
Tin (Sn)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	21-AUG-18
Titanium (Ti)-Total		<0.0030	<0.0030	RPD-NA	mg/L	N/A	20	21-AUG-18
Tungsten (W)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	21-AUG-18
Uranium (U)-Total		0.00061	0.00061		mg/L	0.8	20	21-AUG-18
Vanadium (V)-Total		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	21-AUG-18
Zinc (Zn)-Total		<0.030	<0.030	RPD-NA	mg/L	N/A	20	21-AUG-18
Zirconium (Zr)-Total		<0.0030	<0.0030	RPD-NA	mg/L	N/A	20	21-AUG-18
WG2854938-2 LCS			00.7		0/			
Aluminum (Al)-Total			99.7		%		80-120	21-AUG-18
Antimony (Sb)-Total			100.6		%		80-120	21-AUG-18
Arsenic (As)-Total			99.5 101 2		%		80-120	21-AUG-18
Barium (Ba)-Total			104.2		%		80-120	21-AUG-18
Beryllium (Be)-Total			96.6		%		80-120	21-AUG-18
Bismuth (Bi)-Total			98.0 90.5		%		80-120	21-AUG-18
Boron (B)-Total			90.5		%		80-120	21-AUG-18



Workorder: L2148866

Report Date: 24-MAY-19

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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD 501 Krug St. Suite 202 Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT	Water							
Batch R4179823								
WG2854938-2 LCS			404 5		0/			
Cadmium (Cd)-Total			101.5		%		80-120	21-AUG-18
Calcium (Ca)-Total			96.8		%		80-120	21-AUG-18
Chromium (Cr)-Total			101.1		%		80-120	21-AUG-18
Cesium (Cs)-Total			97.6		%		80-120	21-AUG-18
Cobalt (Co)-Total			98.8		%		80-120	21-AUG-18
Copper (Cu)-Total			100.4		%		80-120	21-AUG-18
Iron (Fe)-Total			95.0		%		80-120	21-AUG-18
Lead (Pb)-Total			94.8		%		80-120	21-AUG-18
Lithium (Li)-Total			90.2		%		80-120	21-AUG-18
Magnesium (Mg)-Total			110.0		%		80-120	21-AUG-18
Manganese (Mn)-Total			98.8		%		80-120	21-AUG-18
Molybdenum (Mo)-Tota	I		97.0		%		80-120	21-AUG-18
Nickel (Ni)-Total			99.4		%		80-120	21-AUG-18
Phosphorus (P)-Total			98.8		%		70-130	21-AUG-18
Potassium (K)-Total			103.1		%		80-120	21-AUG-18
Rubidium (Rb)-Total			101.4		%		80-120	21-AUG-18
Selenium (Se)-Total			99.2		%		80-120	21-AUG-18
Silicon (Si)-Total			99.2		%		60-140	21-AUG-18
Silver (Ag)-Total			97.6		%		80-120	21-AUG-18
Sodium (Na)-Total			105.7		%		80-120	21-AUG-18
Strontium (Sr)-Total			101.1		%		80-120	21-AUG-18
Sulfur (S)-Total			102.3		%		80-120	21-AUG-18
Thallium (TI)-Total			93.5		%		80-120	21-AUG-18
Tellurium (Te)-Total			97.4		%		80-120	21-AUG-18
Thorium (Th)-Total			95.5		%		70-130	21-AUG-18
Tin (Sn)-Total			95.6		%		80-120	21-AUG-18
Titanium (Ti)-Total			97.4		%		80-120	21-AUG-18
Tungsten (W)-Total			90.9		%		80-120	21-AUG-18
Uranium (U)-Total			95.5		%		80-120	21-AUG-18
Vanadium (V)-Total			102.4		%		80-120	21-AUG-18
Zinc (Zn)-Total			91.1		%		80-120	21-AUG-18
Zirconium (Zr)-Total			92.9		%		80-120	21-AUG-18
WG2854938-1 MB Aluminum (Al)-Total			<0.0050		mg/L		0.005	21-AUG-18



Workorder:L2148866Report Date:24-MAY-19Page5of15HUTCHINSON ENVIRONMENTAL SCIENCES LTD501 Krug St. Suite 202Kitchener ON N2B 1L3

Contact: Brent Parsons

Client:

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT	Water							
Batch R4179823								
WG2854938-1 MB			0.00040				0.0001	
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	21-AUG-18
Arsenic (As)-Total			<0.00010		mg/L		0.0001	21-AUG-18
Barium (Ba)-Total			<0.00010		mg/L		0.0001	21-AUG-18
Beryllium (Be)-Total			<0.00010	2	mg/L		0.0001	21-AUG-18
Bismuth (Bi)-Total			<0.000050	J	mg/L		0.00005	21-AUG-18
Boron (B)-Total			<0.010		mg/L		0.01	21-AUG-18
Cadmium (Cd)-Total			<0.00000	50	mg/L		0.000005	21-AUG-18
Calcium (Ca)-Total			<0.050		mg/L		0.05	21-AUG-18
Chromium (Cr)-Total			<0.00050	-	mg/L		0.0005	21-AUG-18
Cesium (Cs)-Total			<0.000010	)	mg/L		0.00001	21-AUG-18
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	21-AUG-18
Copper (Cu)-Total			<0.0010		mg/L		0.001	21-AUG-18
Iron (Fe)-Total			<0.010	_	mg/L		0.01	21-AUG-18
Lead (Pb)-Total			<0.000050	0	mg/L		0.00005	21-AUG-18
Lithium (Li)-Total			<0.0010		mg/L		0.001	21-AUG-18
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	21-AUG-18
Manganese (Mn)-Total			<0.00050		mg/L		0.0005	21-AUG-18
Molybdenum (Mo)-Total			<0.000050	0	mg/L		0.00005	21-AUG-18
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	21-AUG-18
Phosphorus (P)-Total			<0.050		mg/L		0.05	21-AUG-18
Potassium (K)-Total			<0.050		mg/L		0.05	21-AUG-18
Rubidium (Rb)-Total			<0.00020		mg/L		0.0002	21-AUG-18
Selenium (Se)-Total			<0.000050	0	mg/L		0.00005	21-AUG-18
Silicon (Si)-Total			<0.10		mg/L		0.1	21-AUG-18
Silver (Ag)-Total			<0.000050	0	mg/L		0.00005	21-AUG-18
Sodium (Na)-Total			<0.050		mg/L		0.05	22-AUG-18
Strontium (Sr)-Total			<0.0010		mg/L		0.001	21-AUG-18
Sulfur (S)-Total			<0.50		mg/L		0.5	21-AUG-18
Thallium (TI)-Total			<0.000010	C	mg/L		0.00001	21-AUG-18
Tellurium (Te)-Total			<0.00020		mg/L		0.0002	21-AUG-18
Thorium (Th)-Total			<0.00010		mg/L		0.0001	21-AUG-18
Tin (Sn)-Total			<0.00010		mg/L		0.0001	21-AUG-18
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	21-AUG-18



Workorder: L2148866 Report Date: 24-MAY-19 Page 6 of 15 HUTCHINSON ENVIRONMENTAL SCIENCES LTD Client: 501 Krug St. Suite 202 Kitchener ON N2B 1L3 Contact: Brent Parsons alifi PDD .... Def ~ Link

Test		Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS	-wT	Water							
Batch	R4179823								
WG285493				0.00040				0.0004	
Tungsten	. ,			<0.00010		mg/L		0.0001	21-AUG-18
Uranium (				<0.000010	)	mg/L		0.00001	21-AUG-18
Vanadium				<0.00050		mg/L		0.0005	21-AUG-18
Zinc (Zn)-				<0.0030		mg/L		0.003	21-AUG-18
Zirconium			W00054000 0	<0.00030		mg/L		0.0003	21-AUG-18
WG285493 Aluminum			WG2854938-3	91.2		%		70-130	21-AUG-18
Antimony				97.9		%		70-130	21-AUG-18
Arsenic (A				101.2		%		70-130	21-AUG-18
Barium (B	a)-Total			N/A	MS-B	%		-	21-AUG-18
Beryllium	(Be)-Total			92.3		%		70-130	21-AUG-18
Bismuth (E	Bi)-Total			91.4		%		70-130	21-AUG-18
Boron (B)-	Total			N/A	MS-B	%		-	21-AUG-18
Cadmium	(Cd)-Total			96.0		%		70-130	21-AUG-18
Calcium (0	Ca)-Total			N/A	MS-B	%		-	21-AUG-18
Chromium	(Cr)-Total			103.0		%		70-130	21-AUG-18
Cesium (C	s)-Total			98.6		%		70-130	21-AUG-18
Cobalt (Co	o)-Total			N/A	MS-B	%		-	21-AUG-18
Copper (C	u)-Total			N/A	MS-B	%		-	21-AUG-18
Iron (Fe)-1	Total			N/A	MS-B	%		-	21-AUG-18
Lead (Pb)	Total			90.0		%		70-130	21-AUG-18
Lithium (Li	)-Total			N/A	MS-B	%		-	21-AUG-18
Magnesiur	m (Mg)-Total			N/A	MS-B	%		-	21-AUG-18
Manganes	e (Mn)-Total			N/A	MS-B	%		-	21-AUG-18
Molybdenu	um (Mo)-Total			102.8		%		70-130	21-AUG-18
Nickel (Ni)	-Total			N/A	MS-B	%		-	21-AUG-18
Phosphoru	us (P)-Total			103.2		%		70-130	21-AUG-18
Potassium	(K)-Total			N/A	MS-B	%		-	21-AUG-18
Rubidium	(Rb)-Total			N/A	MS-B	%		-	21-AUG-18
Selenium	(Se)-Total			105.3		%		70-130	21-AUG-18
Silicon (Si	)-Total			N/A	MS-B	%		-	21-AUG-18
Silver (Ag)	-Total			92.4		%		70-130	21-AUG-18
Sodium (N	la)-Total			N/A	MS-B	%		-	21-AUG-18
Strontium	(Sr)-Total			N/A	MS-B	%		-	21-AUG-18



Workorder: L2148866 Report Date: 24-MAY-19 Page 7 of 15 HUTCHINSON ENVIRONMENTAL SCIENCES LTD 501 Krug St. Suite 202

Client: Kitchener ON N2B 1L3 Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT	Water							
Batch R4179823								
WG2854938-5 MS		WG2854938-3						
Sulfur (S)-Total			N/A	MS-B	%		-	21-AUG-18
Thallium (TI)-Total			89.6		%		70-130	21-AUG-18
Tellurium (Te)-Total			97.0		%		70-130	21-AUG-18
Thorium (Th)-Total			93.1		%		70-130	21-AUG-18
Tin (Sn)-Total			95.7		%		70-130	21-AUG-18
Titanium (Ti)-Total			98.3		%		70-130	21-AUG-18
Tungsten (W)-Total			92.8		%		70-130	21-AUG-18
Uranium (U)-Total			N/A	MS-B	%		-	21-AUG-18
Vanadium (V)-Total			106.4		%		70-130	21-AUG-18
Zinc (Zn)-Total			91.0		%		70-130	21-AUG-18
Zirconium (Zr)-Total			95.5		%		70-130	21-AUG-18
NH3-WT	Water							
Batch R4178491								
WG2854571-7 DUP		L2148546-6						
Ammonia, Total (as N)		0.098	0.104		mg/L	5.6	20	20-AUG-18
WG2854571-6 LCS Ammonia, Total (as N)			97.3		%		85-115	20-AUG-18
WG2854571-5 MB Ammonia, Total (as N)			<0.020		mg/L		0.02	20-AUG-18
WG2854571-8 MS Ammonia, Total (as N)		L2148546-6	90.5		%		75-125	20-AUG-18
Batch R4180268								
WG2855954-3 DUP		L2148866-5						
Ammonia, Total (as N)		0.047	0.038	J	mg/L	0.010	0.04	21-AUG-18
WG2855954-2 LCS Ammonia, Total (as N)			93.1		%		85-115	21-AUG-18
WG2855954-1 MB								
Ammonia, Total (as N)			<0.020		mg/L		0.02	21-AUG-18
WG2855954-4 MS Ammonia, Total (as N)		L2148866-5	89.4		%		75-125	21-AUG-18
NO3-IC-WT	Water						-	-
Batch R4180266								
WG2855195-9 DUP Nitrate (as N)		<b>WG2855195-8</b> <0.020	<0.020	RPD-NA	mg/L	N/A	25	21-AUG-18
WG2855195-7 LCS								-



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enerit. E	501 Krug S Kitchener	St. Suite 202 ON N2B 1L3	IENTAL SCIENC	ES LTD							
Contact:	Brent Pars	sons									
Test		Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed		
NO3-IC-WT		Water									
Batch R4 WG2855195-7 Nitrate (as N)	4180266 LCS			100.6		%		70-130	21-AUG-18		
WG2855195-6 Nitrate (as N)	MB			<0.020		mg/L		0.02	21-AUG-18		
WG2855195-10 Nitrate (as N)	MS		WG2855195-8	103.2		%		70-130	21-AUG-18		
P-T-COL-WT		Water									
	4180808										
WG2855686-3 Phosphorus, T	<b>DUP</b> otal		<b>L2148546-6</b> 0.0058	0.0048		mg/L	19	20	22-AUG-18		
WG2855916-3 Phosphorus, T	<b>DUP</b> otal		<b>L2149169-1</b> 0.0064	0.0061	J	mg/L	0.0017	0.006	22-AUG-18		
<b>WG2855686-2</b> Phosphorus, T	LCS otal			95.4		%		80-120	22-AUG-18		
<b>WG2855916-2</b> Phosphorus, Te				91.5		%		80-120	22-AUG-18		
WG2855686-1 Phosphorus, Te	MB otal			<0.0030		mg/L		0.003	22-AUG-18		
<b>WG2855916-1</b> Phosphorus, Te	MB otal			<0.0030		mg/L		0.003	22-AUG-18		
WG2855686-4 Phosphorus, Te	MS otal		L2148546-6	94.3		%		70-130	22-AUG-18		
WG2855916-4 Phosphorus, Te	MS otal		L2149169-1	98.8		%		70-130	22-AUG-18		
PH-WT		Water									
	4176306										
<b>WG2853284-8</b> рН	DUP		<b>WG2853284-7</b> 7.96	8.01	J	pH units	0.05	0.2	18-AUG-18		
<b>WG2853284-6</b> рН	LCS			7.00		pH units		6.9-7.1	18-AUG-18		
SO4-IC-N-WT		Water									
	4180266		WOODEE40E O								
<b>WG2855195-9</b> Sulfate (SO4)	DUP		<b>WG2855195-8</b> 1.68	1.68		mg/L	0.4	20	21-AUG-18		
WG2855195-7 Sulfate (SO4)	LCS			101.8		%		90-110	21-AUG-18		
WG2855195-6	MB										



Quality Control Report												
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501 Kru	IINSON ENVIRON Ig St. Suite 202 er ON N2B 1L3	MENTAL SCIENC	ES LTD									
Contact: Brent P												
Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed				
SO4-IC-N-WT	Water											
Batch R418026	6											
<b>WG2855195-6 MB</b> Sulfate (SO4)			<0.30		mg/L		0.3	21-AUG-18				
WG2855195-10 MS Sulfate (SO4)		WG2855195-8	106.5		%		75-125	21-AUG-18				
SOLIDS-TSS-WT	Water											
Batch R417997	1											
WG2855057-3 DUP		L2148846-16										
Total Suspended Solid	ds	2620	2590		mg/L	1.2	20	22-AUG-18				
WG2855057-2 LCS Total Suspended Solid			98.8		%		85-115	22-AUG-18				
WG2855057-1 MB Total Suspended Solid	ds		<2.0		mg/L		2	22-AUG-18				
Batch R418011	4											
WG2855061-3 DUP		L2149062-2										
Total Suspended Solid	ds	1560	1710		mg/L	9.3	20	22-AUG-18				
WG2855061-2 LCS Total Suspended Solid			99.7		%		85-115	22-AUG-18				
WG2855061-1 MB												
Total Suspended Solic	ds		<2.0		mg/L		2	22-AUG-18				
TKN-WT	Water											
Batch R418147	6											
WG2855928-3 DUP		L2148866-1	0.54									
Total Kjeldahl Nitroge		0.50	0.51		mg/L	1.4	20	22-AUG-18				
WG2855928-2 LCS Total Kjeldahl Nitroge			96.3		%		75-125	22-AUG-18				
WG2855928-1 MB												
Total Kjeldahl Nitroge	า		<0.15		mg/L		0.15	22-AUG-18				
WG2855928-4 MS Total Kjeldahl Nitroger	n	L2148866-1	102.4		%		70-130	22-AUG-18				
MET-200.2-CCMS-WT	Soil						10 100	22 700 10				
Batch R418073												
WG2856089-2 CRM		WT-CANMET-	TII I 1									
Aluminum (Al)	-		90.2		%		70-130	22-AUG-18				
Antimony (Sb)			101.7		%		70-130	22-AUG-18				
Arsenic (As)			95.2		%		70-130	22-AUG-18				
Barium (Ba)			96.6		%		70-130	22-AUG-18				
Beryllium (Be)			92.6		%		70-130	22-AUG-18				



# **Quality Control Report**

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 HUTCHINSON ENVIRONMENTAL SCIENCES LTD
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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD 501 Krug St. Suite 202 Kitchener ON N2B 1L3 Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	Soil							
Batch R4180734								
WG2856089-2 CRM		WT-CANMET-						
Bismuth (Bi)			97.0		%		70-130	22-AUG-18
Boron (B)			2.9		mg/kg		0-8.2	22-AUG-18
Cadmium (Cd)			104.6		%		70-130	22-AUG-18
Calcium (Ca)			89.3		%		70-130	22-AUG-18
Chromium (Cr)			94.5		%		70-130	22-AUG-18
Cobalt (Co)			93.9		%		70-130	22-AUG-18
Copper (Cu)			95.6		%		70-130	22-AUG-18
Iron (Fe)			97.6		%		70-130	22-AUG-18
Lead (Pb)			95.8		%		70-130	22-AUG-18
Lithium (Li)			96.8		%		70-130	22-AUG-18
Magnesium (Mg)			89.9		%		70-130	22-AUG-18
Manganese (Mn)			95.3		%		70-130	22-AUG-18
Molybdenum (Mo)			95.4		%		70-130	22-AUG-18
Nickel (Ni)			95.3		%		70-130	22-AUG-18
Phosphorus (P)			96.8		%		70-130	22-AUG-18
Potassium (K)			92.6		%		70-130	22-AUG-18
Selenium (Se)			0.29		mg/kg		0.11-0.51	22-AUG-18
Silver (Ag)			0.24		mg/kg		0.13-0.33	22-AUG-18
Sodium (Na)			93.9		%		70-130	22-AUG-18
Strontium (Sr)			92.0		%		70-130	22-AUG-18
Thallium (TI)			0.108		mg/kg		0.077-0.18	22-AUG-18
Tin (Sn)			1.1		mg/kg		0-3.1	22-AUG-18
Titanium (Ti)			93.6		%		70-130	22-AUG-18
Tungsten (W)			0.15		mg/kg		0-0.66	22-AUG-18
Uranium (U)			94.0		%		70-130	22-AUG-18
Vanadium (V)			94.8		%		70-130	22-AUG-18
Zinc (Zn)			93.7		%		70-130	22-AUG-18
Zirconium (Zr)			0.7		mg/kg		0-1.8	22-AUG-18
WG2856089-4 DUP Aluminum (Al)		<b>L2150100-1</b> 5720	6070		ug/g	5.8	40	22-AUG-18
Antimony (Sb)		0.21	0.22		ug/g	4.5	30	22-AUG-18
Arsenic (As)		2.97	3.03		ug/g	2.0	30	22-AUG-18
Barium (Ba)		35.1	34.7		ug/g	1.1	40	22-AUG-18
Beryllium (Be)		0.29	0.29				-	
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HUTCHINSON ENVIRONMENTAL SCIENCES LTD Client: 501 Krug St. Suite 202 Kitchener ON N2B 1L3 Brent Parsons

Contact:

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	Soil							
Batch R4180734	1							
WG2856089-4 DUP		L2150100-1	0.00					
Beryllium (Be)		0.29	0.29		ug/g	0.0	30	22-AUG-18
Bismuth (Bi) Boron (B)		<0.20 6.0	<0.20 6.3	RPD-NA	ug/g	N/A	30	22-AUG-18
		0.152	0.3 0.161		ug/g	5.1	30	22-AUG-18
Cadmium (Cd)		114000	115000		ug/g	5.6	30	22-AUG-18
Calcium (Ca)					ug/g	0.9	30	22-AUG-18
Chromium (Cr)		10.6	10.6		ug/g	0.3	30	22-AUG-18
Cobalt (Co)		3.84	3.89		ug/g	1.3	30	22-AUG-18
Copper (Cu)		10.3	10.3		ug/g	0.0	30	22-AUG-18
Iron (Fe)		12800	12800		ug/g	0.2	30	22-AUG-18
Lead (Pb)		5.24	5.43		ug/g	3.6	40	22-AUG-18
Lithium (Li)		7.1	7.0		ug/g	1.2	30	22-AUG-18
Magnesium (Mg)		38100	39800		ug/g	4.5	30	22-AUG-18
Manganese (Mn)		388	376		ug/g	3.1	30	22-AUG-18
Molybdenum (Mo)		0.21	0.20		ug/g	5.8	40	22-AUG-18
Nickel (Ni)		8.64	8.80		ug/g	1.8	30	22-AUG-18
Phosphorus (P)		560	578		ug/g	3.2	30	22-AUG-18
Potassium (K)		890	940		ug/g	6.3	40	22-AUG-18
Selenium (Se)		<0.20	<0.20	RPD-NA	ug/g	N/A	30	22-AUG-18
Silver (Ag)		<0.10	<0.10	RPD-NA	ug/g	N/A	40	22-AUG-18
Sodium (Na)		232	263		ug/g	12	40	22-AUG-18
Strontium (Sr)		102	101		ug/g	0.6	40	22-AUG-18
Sulfur (S)		<1000	<1000	RPD-NA	ug/g	N/A	30	22-AUG-18
Thallium (TI)		0.064	0.068		ug/g	6.9	30	22-AUG-18
Tin (Sn)		<2.0	<2.0	RPD-NA	ug/g	N/A	40	22-AUG-18
Titanium (Ti)		268	295		ug/g	9.6	40	22-AUG-18
Tungsten (W)		<0.50	<0.50	RPD-NA	ug/g	N/A	30	22-AUG-18
Uranium (U)		0.480	0.500		ug/g	4.0	30	22-AUG-18
Vanadium (V)		20.5	21.6		ug/g	5.0	30	22-AUG-18
Zinc (Zn)		27.6	28.2		ug/g	1.9	30	22-AUG-18
Zirconium (Zr)		7.0	7.1		ug/g	1.4	30	22-AUG-18
WG2856089-3 LCS			07.4		0/.		00.400	
Aluminum (Al)			97.4		%		80-120	22-AUG-18
Antimony (Sb)			108.9		%		80-120	22-AUG-18



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HUTCHINSON ENVIRONMENTAL SCIENCES LTD Client: 501 Krug St. Suite 202 Kitchener ON N2B 1L3 Brent Parsons

Contact:

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	Soil							
Batch R4180734								
WG2856089-3 LCS			00.0		%		00.400	
Arsenic (As)			98.9				80-120	22-AUG-18
Barium (Ba)			109.2		%		80-120	22-AUG-18
Beryllium (Be)			103.4		%		80-120	22-AUG-18
Bismuth (Bi)			102.1		%		80-120	22-AUG-18
Boron (B)			97.8		%		80-120	22-AUG-18
Cadmium (Cd)			105.9		%		80-120	22-AUG-18
Calcium (Ca)			101.3		%		80-120	22-AUG-18
Chromium (Cr)			95.6		%		80-120	22-AUG-18
Cobalt (Co)			95.8		%		80-120	22-AUG-18
Copper (Cu)			96.5		%		80-120	22-AUG-18
Iron (Fe)			99.6		%		80-120	22-AUG-18
Lead (Pb)			99.8		%		80-120	22-AUG-18
Lithium (Li)			108.9		%		80-120	22-AUG-18
Magnesium (Mg)			93.3		%		80-120	22-AUG-18
Manganese (Mn)			96.7		%		80-120	22-AUG-18
Molybdenum (Mo)			104.0		%		80-120	22-AUG-18
Nickel (Ni)			97.0		%		80-120	22-AUG-18
Phosphorus (P)			105.6		%		80-120	22-AUG-18
Potassium (K)			105.9		%		80-120	22-AUG-18
Selenium (Se)			100.3		%		80-120	22-AUG-18
Silver (Ag)			102.0		%		80-120	22-AUG-18
Sodium (Na)			96.2		%		80-120	22-AUG-18
Strontium (Sr)			100.7		%		80-120	22-AUG-18
Sulfur (S)			104.7		%		80-120	22-AUG-18
Thallium (TI)			89.0		%		80-120	22-AUG-18
Tin (Sn)			106.2		%		80-120	22-AUG-18
Titanium (Ti)			95.6		%		80-120	22-AUG-18
Tungsten (W)			95.3		%		80-120	22-AUG-18
Uranium (U)			97.0		%		80-120	22-AUG-18
Vanadium (V)			101.1		%		80-120	22-AUG-18
Zinc (Zn)			91.3		%		80-120	22-AUG-18
Zirconium (Zr)			100.7		%		80-120	22-AUG-18
WG2856089-1 MB Aluminum (Al)			<50		mg/kg		50	22-AUG-18



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Report Date: 24-MAY-19

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HUTCHINSON ENVIRONMENTAL SCIENCES LTD Client: 501 Krug St. Suite 202 Kitchener ON N2B 1L3 Brent Parsons

Contact:

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	Soil							
Batch R4180734								
WG2856089-1 MB								
Antimony (Sb)			<0.10		mg/kg		0.1	22-AUG-18
Arsenic (As)			<0.10		mg/kg		0.1	22-AUG-18
Barium (Ba)			<0.50		mg/kg		0.5	22-AUG-18
Beryllium (Be)			<0.10		mg/kg		0.1	22-AUG-18
Bismuth (Bi)			<0.20		mg/kg		0.2	22-AUG-18
Boron (B)			<5.0		mg/kg		5	22-AUG-18
Cadmium (Cd)			<0.020		mg/kg		0.02	22-AUG-18
Calcium (Ca)			<50		mg/kg		50	22-AUG-18
Chromium (Cr)			<0.50		mg/kg		0.5	22-AUG-18
Cobalt (Co)			<0.10		mg/kg		0.1	22-AUG-18
Copper (Cu)			<0.50		mg/kg		0.5	22-AUG-18
Iron (Fe)			<50		mg/kg		50	22-AUG-18
Lead (Pb)			<0.50		mg/kg		0.5	22-AUG-18
Lithium (Li)			<2.0		mg/kg		2	22-AUG-18
Magnesium (Mg)			<20		mg/kg		20	22-AUG-18
Manganese (Mn)			<1.0		mg/kg		1	22-AUG-18
Molybdenum (Mo)			<0.10		mg/kg		0.1	22-AUG-18
Nickel (Ni)			<0.50		mg/kg		0.5	22-AUG-18
Phosphorus (P)			<50		mg/kg		50	22-AUG-18
Potassium (K)			<100		mg/kg		100	22-AUG-18
Selenium (Se)			<0.20		mg/kg		0.2	22-AUG-18
Silver (Ag)			<0.10		mg/kg		0.1	22-AUG-18
Sodium (Na)			<50		mg/kg		50	22-AUG-18
Strontium (Sr)			<0.50		mg/kg		0.5	22-AUG-18
Sulfur (S)			<1000		mg/kg		1000	22-AUG-18
Thallium (TI)			<0.050		mg/kg		0.05	22-AUG-18
Tin (Sn)			<2.0		mg/kg		2	22-AUG-18
Titanium (Ti)			<1.0		mg/kg		1	22-AUG-18
Tungsten (W)			<0.50		mg/kg		0.5	22-AUG-18
Uranium (U)			<0.050		mg/kg		0.05	22-AUG-18
Vanadium (V)			<0.20		mg/kg		0.2	22-AUG-18
Zinc (Zn)			<2.0		mg/kg		2	22-AUG-18
Zirconium (Zr)			<1.0		mg/kg		1	22-AUG-18



			Workorder:	L2148866	i i	Report Date:	24-MAY-19		Page 14 of 15
Client: HUTCHINSON E 501 Krug St. Suit Kitchener ON N		St. Suite 202	MENTAL SCIEN	CES LTD					
Contact:	Brent Par	sons							
Test		Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
N-TOTKJ-COL-SK		Soil							
Batch WG2855572- Total Kjeldah			<b>L2148514-5</b> 2.74	2.69		%	1.9	20	23-AUG-18
WG2855572- Total Kjeldah			08-109_SOIL	96.5		%		80-120	23-AUG-18
WG2855572-	3 MB			<0.020		%		0.02	23-AUG-18

Workorder: L2148866

Report Date: 24-MAY-19

Client:	HUTCHINSON ENVIRONMENTAL SCIENCES LTD
	501 Krug St. Suite 202
	Kitchener ON N2B 1L3
Contact:	Brent Parsons

#### Contact:

#### Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

#### Sample Parameter Qualifier Definitions:

Qualifier	Description
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
DUP-H,J	Duplicate results outside ALS DQO, due to sample heterogeneity. Duplicate results and limits are expressed in terms of absolute difference.
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

#### Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Chain of Custody (COC) / Analytical Request Form



DC Number: 17 -

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#### ALS Environmental

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Canada Toll Free: 1 800 668 9878

	www.aisglobal.com				<u> </u>					<b>-</b>													
Report To	Contact and company name below will app	ear on the final report		Report Format				Sele	t Sen	rice Lev	vel Below - Contact your AM to confirm all E&P TATs (surcharges may apply)												
Company:	HUTCHINSON ESL		Select Report F	ormat: 🗌 PDF [	JEXCEL DEDU	O (DIGITAL)		Re	gula	(R) 🛛	2 Star	vdard T	'AT if re	ceived	by 3 p	m - bus	iness da	ays-no	surchar	es apply			
Contact:	BRENT PARSONS		Quality Control	(QC) Report with R	eport 🛛 YES	□ NO	2		-	-20%]			NCY	호 1 Business day [E1 - 100%]									
Phone:	519-576-1711		Compare Result	s to Criteria on Report -			Picos	3 da	y (P3	-25%]			Same Day, Weekend or Statutory holiday [E2 -200%										
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ALS Sample #	Sample Identification	n and/or Coordinates	-	Date	Time	Describe Trees	ALKALINITY		0		CI, NO3,	E.COLIFECAL	METALS	<b>NH3/ТКN/TP</b>				1			SAMPLI	Sample	B
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	OL-7			16-Aug-18		Water	R	R	R		R	R	R	R	R	R							5
····	OL-9	•		16-Aug-18		Water	R	R	R		R	R	R	R	R	R					-		5
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Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW): System, please submit using an Authorized DW COC form.



#### Chain of Custody (COC) / Analytical

Request Form

Canada Toll Free: 1 800 668 9878



COC Number: 17 -

Page 2 of Z

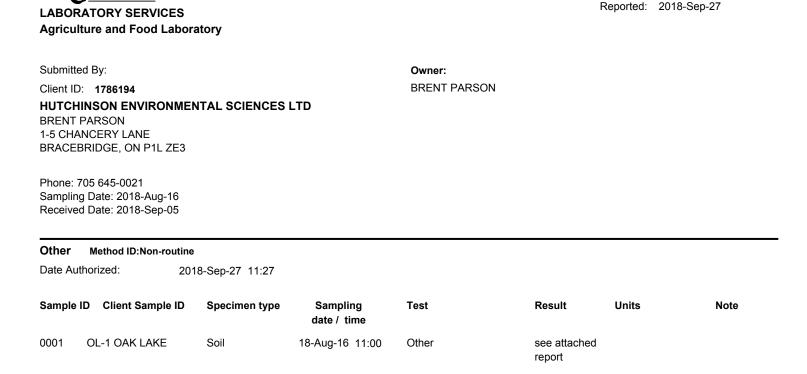
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Phone: 519-576-1711			Compare Results to Criteria on Report - provide details below if box checked					Image: Second state         3 day [P3-25%]         Image: Second state         Image: Second state				IERGI	Same Day, Weekend or Statutory holiday [E2 -200%												
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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC-form.

1



Supervisor: Nicolaas Schrier MSc, Animal Health Laboratory 519 823 1268 ext. 57215 nschrier@uoguelph.ca

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Submission#

Report

18-069644



HUTCHINSON ENVIRONMENTAL SCIENCES LTD ATTN: Brent Parsons 501 Krug St. Suite 202 Kitchener ON N2B 1L3 Date Received:31-OCT-18Report Date:14-NOV-18 07:37 (MT)Version:FINAL

Client Phone: 519-576-1711

# Certificate of Analysis

Lab Work Order #: L2189633 Project P.O. #: NOT SUBMITTED Job Reference: C of C Numbers: Legal Site Desc:

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Hua Wo Chemistry Laboratory Manager

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L2189633 CONTD.... PAGE 2 of 4 Version: FINAL

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2189633-1 OL-1 Sampled By: CLIENT on 29-OCT-18 @ 01:30 Matrix: WATER							
Bacteriological Tests							
Fecal Streptococcus	<1	PEHR	1	CFU/100mL		31-OCT-18	R4313337
Pseudomonas aeruginosa	<1		1	CFU/100mL		31-OCT-18	R4316210
Plant Pigments							
Chlorophyll a	6.92		0.10	ug/L	31-OCT-18	31-OCT-18	R4330309
L2189633-2 OL-2 Sampled By: CLIENT on 29-OCT-18 @ 12:45 Matrix: WATER							
Bacteriological Tests							
Fecal Streptococcus	5	PEHR	1	CFU/100mL		31-OCT-18	R4313337
Pseudomonas aeruginosa	<1		1	CFU/100mL		31-OCT-18	R4316210
Plant Pigments							
Chlorophyll a	6.74		0.10	ug/L	31-OCT-18	31-OCT-18	R4330309
L2189633-3 OL-4 Sampled By: CLIENT on 29-OCT-18 @ 01:22 Matrix: WATER							
Bacteriological Tests							
Fecal Streptococcus	<1	PEHR	1	CFU/100mL		31-OCT-18	R4313337
Pseudomonas aeruginosa Plant Pigments	<1		1	CFU/100mL		31-OCT-18	R4316210
Chlorophyll a	4.30		0.10	ug/L	31-OCT-18	31-OCT-18	R4330309
L2189633-4         OL-7           Sampled By:         CLIENT on 29-OCT-18 @ 01:10           Matrix:         WATER							
Bacteriological Tests							
Fecal Streptococcus	1	PEHR	1	CFU/100mL		31-OCT-18	R4313337
Pseudomonas aeruginosa	<1		1	CFU/100mL		31-OCT-18	R4316210
Plant Pigments							
Chlorophyll a	4.02		0.10	ug/L	31-OCT-18	31-OCT-18	R4330309
L2189633-5 OL-9 Sampled By: CLIENT on 29-OCT-18 @ 13:00 Matrix: WATER							
Bacteriological Tests							
Fecal Streptococcus	20	PEHR	1	CFU/100mL		31-OCT-18	R4313337
Pseudomonas aeruginosa	<1		1	CFU/100mL		31-OCT-18	R4316210
Plant Pigments							
Chlorophyll a	7.63		0.10	ug/L	31-OCT-18	31-OCT-18	R4330309
L2189633-6 OL-3 Sampled By: CLIENT on 29-OCT-18 @ 01:24 Matrix: WATER							
Bacteriological Tests							
Fecal Streptococcus	<1	PEHR	1	CFU/100mL		31-OCT-18	R4313337
L2189633-7 OL-5 Sampled By: CLIENT on 29-OCT-18 @ 01:20 Matrix: WATER							
Bacteriological Tests							

L2189633 CONTD.... PAGE 3 of 4 Version: FINAL

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2189633-7 OL-5 Sampled By: CLIENT on 29-OCT-18 @ 01:20 Matrix: WATER							
Bacteriological Tests							
Fecal Streptococcus	3	PEHR	1	CFU/100mL		31-OCT-18	R4313337
L2189633-8         OL-6           Sampled By:         CLIENT on 29-OCT-18 @ 01:15           Matrix:         WATER							
Bacteriological Tests							
Fecal Streptococcus	15	PEHR	1	CFU/100mL		31-OCT-18	R4313337
L2189633-9 OL-8 Sampled By: CLIENT on 29-OCT-18 @ 01:05 Matrix: WATER							
Bacteriological Tests							
Fecal Streptococcus	1	PEHR	1	CFU/100mL		31-OCT-18	R4313337
L2189633-10 OL-10 Sampled By: CLIENT on 29-OCT-18 @ 12:55 Matrix: WATER							
Bacteriological Tests							
Fecal Streptococcus	13	PEHR	1	CFU/100mL		31-OCT-18	R4313337
L2189633-11 OL-11 Sampled By: CLIENT on 29-OCT-18 @ 12:50 Matrix: WATER							
Bacteriological Tests							
Fecal Streptococcus	2	PEHR	1	CFU/100mL		31-OCT-18	R4313337

## **Reference Information**

#### Sample Parameter Qualifier key listed:

Qualifier	Description		
PEHR	Parameter Exceeded	d Recommended Holding Time	e On Receipt: Proceed With Analysis As Requested.
est Method	References:		
ALS Test Cod	e Matrix	Test Description	Method Reference**
CHL/A-ACET-F WP This analysis		Chlorophyll a by fluorometry	y EPA 445.0 ACET 445.0. Chlorophyll a is determined by a 90 % acetone extraction followed with
analysis by flu	uorometry using the nor	n-acidification procedure. This	method is not subject to interferences from chlorophyll b.
incubated at 3 results are rep adjusted accord Due to taxono	sample water (usually 1 35°C for 47 +/- 1 hour. ported as Colony Formi ordingly, with report note	Colonies exhibiting characteris ng Units (CFU) per 100 mL. T es as required, when less than	APHA 9230C (modified) erile .45 micron membrane filter. The filter is placed on selective media and stic morphology for the target group on the filter after incubation are counted and he detection limit for this test is 1 when 100 mL of sample is processed, and is 100 mL is processed. I here to include all members of genus names Streptococcus and Enterococcus as
PSA-MF-WP	Water	Pseudomonas aeruginosa	APHA 9213E
A known volu plate and incu	me of sample (typically ubated for 72 hours at 4	100 mL) is filtered through a 0 1.5 +/- 0.5 C. Plates are exam	0.45 micron membrane filter. The filter is placed on the surface of a selective agar nined under low magnification and colonies exhibiting typical morphology are ruginosa CFU/100 mL. Additional confirmation tests can be performed upon reques
			that performed analytical analysis for that test. Refer to the list below:
Laboratory De			
WP	ALS	ENVIRONMENTAL - WINNIP	EG, MANITOBA, CANADA
Chain of Custo	dy Numbers:		
Surrogates are applicable tests objectives for s mg/kg - milligra mg/kg wwt - mill mg/L - unit of o < - Less than. D.L The repo	s, su <sup>'</sup> rrogates are added surrogates are listed the ms per kilogram based illigrams per kilogram ba ligrams per kilogram ba concentration based on vrting limit.	l to samples prior to analysis a	alyte(s), but that do not normally occur in environmental samples. For s a check on recovery. In reports that display the D.L. column, laboratory xplanation.
Test results rep UNLESS OTHERW	ported relate only to the		horston/



				Quanty		ornepon			
			Workorder:	L2189633	5	Report Date: 14-N	NOV-18		Page 1 of 3
Client:	501 Krug S	SON ENVIRONI St. Suite 202 ON N2B 1L3	MENTAL SCIENC	CES LTD					
Contact:	Brent Pars	sons							
Test		Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CHL/A-ACET-FL Batch WG2929404-2 Chlorophyll a	R4330309 2 DUP	Water	<b>L2189938-1</b> 1.06	1.04		ug/L	1.1	35	31-OCT-18
WG2929404-3 Chlorophyll a	B LCS		1.00	108.3		%	1.1	80-120	13-NOV-18
WG2929404-1 Chlorophyll a				<0.10		ug/L		0.1	31-OCT-18
FECALSTREP-M	IF-WP	Water							
Batch WG2919299-2 Fecal Strepto	-		<b>L2189633-7</b> З	3		CFU/100mL	0.0	65	31-OCT-18
WG2919299-1 Fecal Strepto				<1		CFU/100mL		1	31-OCT-18
PSA-MF-WP Batch WG2919301-1	R4316210 I MB	Water							
Pseudomona	is aeruginos	a		<1		CFU/100mL		1	31-OCT-18

Workorder: L2189633

Report Date: 14-NOV-18

HUTCHINSON ENVIRONMENTAL SCIENCES LTD Client: 501 Krug St. Suite 202 Kitchener ON N2B 1L3 **Brent Parsons** 

Contact:

#### Legend:

Limit	ALS Control Limit (Data Quality Objectives)	
DUP	Duplicate	
RPD	Relative Percent Difference	
N/A	Not Available	
LCS	Laboratory Control Sample	
SRM	Standard Reference Material	
MS	Matrix Spike	
MSD	Matrix Spike Duplicate	
ADE	Average Desorption Efficiency	
MB	Method Blank	
IRM	Internal Reference Material	
CRM	Certified Reference Material	
CCV	Continuing Calibration Verification	
CVS	Calibration Verification Standard	

LCSD Laboratory Control Sample Duplicate

Workorder: L2189633

Report Date: 14-NOV-18

HUTCHINSON ENVIRONMENTAL SCIENCES LTD Client: 501 Krug St. Suite 202 Kitchener ON N2B 1L3 **Brent Parsons** 

Contact:

Hold Time Exceedances:

	Sample						
ALS Product Description	ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Bacteriological Tests							
Fecal streptococcus							
	1	29-OCT-18 01:30	31-OCT-18 12:35	30	59	hours	EHTR
	2	29-OCT-18 12:45	31-OCT-18 12:35	30	48	hours	EHTR
	3	29-OCT-18 01:22	31-OCT-18 12:35	30	59	hours	EHTR
	4	29-OCT-18 01:10	31-OCT-18 12:35	30	60	hours	EHTR
	5	29-OCT-18 13:00	31-OCT-18 12:35	30	48	hours	EHTR
	6	29-OCT-18 01:24	31-OCT-18 12:35	30	59	hours	EHTR
	7	29-OCT-18 01:20	31-OCT-18 12:35	30	59	hours	EHTR
	8	29-OCT-18 01:15	31-OCT-18 12:35	30	59	hours	EHTR
	9	29-OCT-18 01:05	31-OCT-18 12:35	30	60	hours	EHTR
	10	29-OCT-18 12:55	31-OCT-18 12:35	30	48	hours	EHTR
	11	29-OCT-18 12:50	31-OCT-18 12:35	30	48	hours	EHTR
Pseudomonas aeruginosa							
	1	29-OCT-18 01:30	31-OCT-18 12:35	30	59	hours	EHTR
	2	29-OCT-18 12:45	31-OCT-18 12:35	30	48	hours	EHTR
	3	29-OCT-18 01:22	31-OCT-18 12:35	30	59	hours	EHTR
	4	29-OCT-18 01:10	31-OCT-18 12:35	30	60	hours	EHTR
	5	29-OCT-18 13:00	31-OCT-18 12:35	30	48	hours	EHTR
Plant Pigments							
Chlorophyll a by fluorometry							
	1	29-OCT-18 01:30	31-OCT-18 14:12	48	61	hours	EHTR
	2	29-OCT-18 12:45	31-OCT-18 14:12	48	49	hours	EHTL
	3	29-OCT-18 01:22	31-OCT-18 14:12	48	61	hours	EHTR
	4	29-OCT-18 01:10	31-OCT-18 14:12	48	61	hours	EHTR
	5	29-OCT-18 13:00	31-OCT-18 14:12	48	49	hours	EHTL

#### Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended. EHTR: Exceeded ALS recommended hold time prior to sample receipt. EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry. Exceeded ALS recommended hold time prior to analysis. EHT: Rec. HT: ALS recommended hold time (see units).

#### Notes\*:

Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes. Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2189633 were received on 31-OCT-18 09:00.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



#### Chain of Custody (COC) / Analytical **Request Form**



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# COC Number: 17 - 0050 Page ( of / L2189633

Canada Toll Free: 1 800 668 9878

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Report To	Contact and company name below will ap	pear on the final report		Report Format	/ Distribution			Selec	t Serv	ice Le	vel Be	low - (	Conta	t your	AM to	inroo c	irm afl	E&P T	ATs (s	surchar	iges m	ay apply	)
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Phone:	519-576-1711	· · · <u>· · · · · · · · · · · · · · · · </u>		ts to Criteria on Report -			ROR	1		-25%]			MERO								ay (E2	2 -200%	
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ALS Sample #	Sample Identificatio	n and/or Coordinates		Date	Time	Secola Trees	13	FECAL	<u>Š</u>	Ř								- i				<	١Å
(lab use only)	(This description will	appear on the report)		(dd-mmm-yy)	(hh:mm)	Sample Type	Ī	ЪĘ	PSE	E	E.											Ŝ	<u>ای</u>
	OL-1			29.10-13	13:30	WATER	3	R	R	R	R										Т		
н. 4 <u>0</u>	OL-2 ,				12:45	WATER	2	R	R	R	1	:											
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en. Andre States	OL-7 •				13:10	WATER	2	R	R	R											-		t
	OL-9				13:00	WATER	2	R	R	R												_	
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Drinking	Water (DW) Samples <sup>1</sup> (client use)	Special Instructions / S		add on report by clic ctronic COC only)	king on the drop	-down list below	-				SA						_	(lab u	50 OF		- Rec		
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	K PAGE FOR ALS LOCATIONS AND SAMPLIN		<u> </u>	WH	TE - LABORATOR		Lgw-	~ ~	IT CO	PY		_								-	L	OCT 2	INCOME STREET

Failure to complete all portions of this form may delay analysis, Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy. 1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



HUTCHINSON ENVIRONMENTAL SCIENCES LTD ATTN: Brent Parsons 501 Krug St. Suite 202 Kitchener ON N2B 1L3 Date Received:31-OCT-18Report Date:07-NOV-18 13:24 (MT)Version:FINAL

Client Phone: 519-576-1711

# Certificate of Analysis

Lab Work Order #: L2189621 Project P.O. #: NOT SUBMITTED Job Reference: C of C Numbers: Legal Site Desc:

Gayle Braun Senior Account Manager

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L2189621 CONTD.... PAGE 2 of 8 Version: FINAL

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2189621-1 OL-1 Sampled By: CLIENT on 29-OCT-18 @ 13:30							
Matrix: WATER							
Physical Tests							
Hardness (as CaCO3)	73	HTC	10	mg/L		31-OCT-18	
рН	7.99		0.10	pH units		01-NOV-18	R4312622
Total Suspended Solids	<2.0		2.0	mg/L	01-NOV-18	02-NOV-18	R4312609
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	62		10	mg/L		01-NOV-18	R4310407
Chloride (Cl)	51.4		0.50	mg/L		01-NOV-18	R4314670
Nitrate (as N)	<0.020		0.020	mg/L		01-NOV-18	R4314670
Total Kjeldahl Nitrogen	0.65	RRV	0.15	mg/L	01-NOV-18	02-NOV-18	R4315710
Phosphorus, Total	0.0086		0.0030	mg/L	31-OCT-18	02-NOV-18	R4312508
Sulfate (SO4)	1.54		0.30	mg/L		01-NOV-18	R4314670
Organic / Inorganic Carbon							
Dissolved Carbon Filtration Location	LAB					01-NOV-18	R4310750
Dissolved Organic Carbon	5.92		0.50	mg/L	01-NOV-18	06-NOV-18	R4323022
Bacteriological Tests							
E. Coli	0		0	CFU/100mL		01-NOV-18	R4309936
Fecal Coliforms	0		0	CFU/100mL		01-NOV-18	R4309947
Total Metals							
Calcium (Ca)-Total	24.7		0.50	mg/L	31-OCT-18	31-OCT-18	R4308238
Iron (Fe)-Total	<0.050		0.050	mg/L	31-OCT-18	31-OCT-18	R4308238
Magnesium (Mg)-Total	2.85		0.050	mg/L	31-OCT-18	31-OCT-18	R4308238
Aggregate Organics							
BOD	<2.0		2.0	mg/L	31-OCT-18	05-NOV-18	R4319070
L2189621-2         OL-2           Sampled By:         CLIENT on 29-OCT-18 @ 12:45           Matrix:         WATER							
Physical Tests							
Hardness (as CaCO3)	70	нтс	10	mg/L		31-OCT-18	
pH	8.04		0.10	pH units		01-NOV-18	R4312622
Total Suspended Solids	<2.0		2.0	mg/L	01-NOV-18	02-NOV-18	
Anions and Nutrients				3			
Alkalinity, Total (as CaCO3)	65		10	mg/L		01-NOV-18	R4310407
Ammonia, Total (as N)	0.539		0.020	mg/L		05-NOV-18	
Chloride (Cl)	51.4		0.50	mg/L		01-NOV-18	
Nitrate (as N)	<0.020		0.020	mg/L		01-NOV-18	
Total Kjeldahl Nitrogen	0.59	RRV	0.15	mg/L	01-NOV-18	02-NOV-18	
Phosphorus, Total	0.0084		0.0030	mg/L	31-OCT-18	02-NOV-18	
Sulfate (SO4)	1.55		0.30	mg/L		01-NOV-18	
Organic / Inorganic Carbon	1.00		0.00	ing/L			
Dissolved Carbon Filtration Location	LAB					01-NOV-18	R4310750
Dissolved Organic Carbon	5.94		0.50	mg/L	01-NOV-18	06-NOV-18	R4323022
Bacteriological Tests	5.34		0.00	ing/L			117020022
E. Coli	0		0	CFU/100mL		01-NOV-18	R4309936
Fecal Coliforms	0		0	CFU/100mL		01-NOV-18	
* Refer to Referenced Information for Qualifiers (if any) a	-		U			01-100-10	114303347

L2189621 CONTD.... PAGE 3 of 8 Version: FINAL

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2189621-2 OL-2 Sampled By: CLIENT on 29-OCT-18 @ 12:45 Matrix: WATER							
Bacteriological Tests Total Metals							
Calcium (Ca)-Total	23.4		0.50	mg/L	31-OCT-18	31-OCT-18	R4308238
Iron (Fe)-Total	<0.050		0.050	mg/L	31-OCT-18	31-OCT-18	R4308238
Magnesium (Mg)-Total	2.82		0.050	mg/L	31-OCT-18	31-OCT-18	R4308238
Aggregate Organics							
BOD	<2.0		2.0	mg/L	31-OCT-18	05-NOV-18	R4319070
L2189621-3 OL-4 Sampled By: CLIENT on 29-OCT-18 @ 13:22 Matrix: WATER							
Physical Tests							
Hardness (as CaCO3)	75	HTC	10	mg/L		31-OCT-18	
рН	8.03		0.10	pH units		01-NOV-18	
Total Suspended Solids Anions and Nutrients	<2.0		2.0	mg/L	01-NOV-18	02-NOV-18	R4312609
	05		40			01-NOV-18	D 4040 407
Alkalinity, Total (as CaCO3) Ammonia, Total (as N)	65 0.212		10	mg/L			R4310407 R4308451
	51.6		0.020 0.50	mg/L		01-NOV-18	
Chloride (Cl) Nitrate (as N)	<0.020		0.50	mg/L mg/L		01-NOV-18	
Total Kjeldahl Nitrogen	<0.020 0.46		0.020	mg/L	01-NOV-18		
Phosphorus, Total	0.46		0.15	mg/L	31-OCT-18	02-NOV-18	
Sulfate (SO4)	1.54		0.30	mg/L	31-001-10	02-NOV-18	
Organic / Inorganic Carbon	1.54		0.50	ing/∟			K4314070
Dissolved Carbon Filtration Location	LAB					01-NOV-18	R4310750
Dissolved Organic Carbon Bacteriological Tests	5.98		0.50	mg/L	01-NOV-18	06-NOV-18	R4323022
E. Coli	1		0	CFU/100mL		01-NOV-18	R4309936
Fecal Coliforms	3		0	CFU/100mL		01-NOV-18	R4309947
Total Metals			-				
Calcium (Ca)-Total	25.4		0.50	mg/L	31-OCT-18	31-OCT-18	R4308238
Iron (Fe)-Total	<0.050		0.050	mg/L	31-OCT-18	31-OCT-18	R4308238
Magnesium (Mg)-Total	2.85		0.050	mg/L	31-OCT-18	31-OCT-18	R4308238
Aggregate Organics							
BOD	<2.0		2.0	mg/L	31-OCT-18	05-NOV-18	R4319070
L2189621-4 OL-7 Sampled By: CLIENT on 29-OCT-18 @ 13:10 Matrix: WATER							
Physical Tests							
Hardness (as CaCO3)	74	нтс	10	mg/L		31-OCT-18	
рН	8.07		0.10	pH units		01-NOV-18	R4312622
Total Suspended Solids	<2.0		2.0	mg/L	01-NOV-18	02-NOV-18	R4312609
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	65		10	mg/L		01-NOV-18	R4310407

L2189621 CONTD.... PAGE 4 of 8 Version: FINAL

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2189621-4 OL-7 Sampled By: CLIENT on 29-OCT-18 @ 13:10 Matrix: WATER							
Anions and Nutrients							
Chloride (CI)	51.1		0.50	mg/L		01-NOV-18	R4314670
Nitrate (as N)	<0.020		0.020	mg/L		01-NOV-18	R4314670
Total Kjeldahl Nitrogen	0.46		0.15	mg/L	02-NOV-18	02-NOV-18	R4314469
Phosphorus, Total	0.0050		0.0030	mg/L	31-OCT-18	02-NOV-18	
Sulfate (SO4)	1.62		0.30	mg/L		01-NOV-18	R4314670
Organic / Inorganic Carbon	1.02		0.00				
Dissolved Carbon Filtration Location	LAB					01-NOV-18	R4310750
Dissolved Organic Carbon	5.87		0.50	mg/L	01-NOV-18	06-NOV-18	R4323022
Bacteriological Tests							
E. Coli	1		0	CFU/100mL		01-NOV-18	R4309936
Fecal Coliforms	2		0	CFU/100mL		01-NOV-18	R4309947
Total Metals							
Calcium (Ca)-Total	24.7		0.50	mg/L	31-OCT-18	31-OCT-18	R4308238
Iron (Fe)-Total	<0.050		0.050	mg/L	31-OCT-18	31-OCT-18	R4308238
Magnesium (Mg)-Total	2.93		0.050	mg/L	31-OCT-18	31-OCT-18	R4308238
Aggregate Organics							
BOD	<2.0		2.0	mg/L	31-OCT-18	05-NOV-18	R4319070
L2189621-5 OL-9 Sampled By: CLIENT on 29-OCT-18 @ 13:00 Matrix: WATER							
Physical Tests							
Hardness (as CaCO3)	77	HTC	10	mg/L		31-OCT-18	
рН	7.97		0.10	pH units		01-NOV-18	R4312622
Total Suspended Solids Anions and Nutrients	2.9		2.0	mg/L	01-NOV-18	02-NOV-18	R4312609
Alkalinity, Total (as CaCO3)	64		10	mg/L		01-NOV-18	R4310407
Ammonia, Total (as N)	0.562		0.020	mg/L		05-NOV-18	R4322287
Chloride (CI)	51.7		0.50	mg/L		01-NOV-18	R4314670
Nitrate (as N)	<0.020		0.020	mg/L		01-NOV-18	R4314670
Total Kjeldahl Nitrogen	0.65		0.15	mg/L	05-NOV-18	06-NOV-18	R4322883
Phosphorus, Total	0.0441		0.0030	mg/L	31-OCT-18	02-NOV-18	R4312508
Sulfate (SO4)	1.68		0.30	mg/L		01-NOV-18	R4314670
Organic / Inorganic Carbon							
Dissolved Carbon Filtration Location	LAB					01-NOV-18	R4310750
Dissolved Organic Carbon	6.19		0.50	mg/L	01-NOV-18	06-NOV-18	R4323022
Bacteriological Tests							
E. Coli	3		0	CFU/100mL		01-NOV-18	
Fecal Coliforms	10		0	CFU/100mL		01-NOV-18	R4309947
Total Metals				~			
Calcium (Ca)-Total	26.1		0.50	mg/L	31-OCT-18	31-OCT-18	R4308238
Iron (Fe)-Total	<0.050		0.050	mg/L	31-OCT-18	31-OCT-18	R4308238
Magnesium (Mg)-Total Aggregate Organics	2.87		0.050	mg/L	31-OCT-18	31-OCT-18	R4308238

L2189621 CONTD.... PAGE 5 of 8 Version: FINAL

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details	s/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2189621-5 Sampled By: Matrix:	OL-9 CLIENT on 29-OCT-18 @ 13:00 WATER							
Aggregate (	Organics							
BOD		<2.0		2.0	mg/L	31-OCT-18	05-NOV-18	R4319070
Report Ren	narks : re-run for TKN, results confirmed			2.0				
L2189621-6 Sampled By: Matrix:	OL-3 CLIENT on 29-OCT-18 @ 13:24 WATER							
Bacteriolog								
E. Coli		1		0	CFU/100mL		01-NOV-18	R4309936
Fecal Colifo	orms	0		0	CFU/100mL		01-NOV-18	
L2189621-7 Sampled By:	OL-5 CLIENT on 29-OCT-18 @ 13:20							
Matrix: Bacteriolog	WATER nical Tests							
E. Coli	,	0		0	CFU/100mL		01-NOV-18	R4300026
E. Coll Fecal Colife	orme	2		0	CFU/100mL		01-NOV-18	
		2		0			01-110/-10	K4309947
L2189621-8 Sampled By: Matrix:	OL-6 CLIENT on 29-OCT-18 @ 13:15 WATER							
Bacteriolog	lical Tests							
E. Coli		1		0	CFU/100mL		01-NOV-18	R4309936
Fecal Colifo	orms	0		0	CFU/100mL		01-NOV-18	
L2189621-9 Sampled By: Matrix:	OL-8 CLIENT on 29-OCT-18 @ 13:05 WATER							
Bacteriolog								
-				0				D 4000000
E. Coli		1		0	CFU/100mL		01-NOV-18	
Fecal Colifo		0		0	CFU/100mL		01-NOV-18	R4309947
L2189621-10 Sampled By: Matrix:	OL-10 CLIENT on 29-OCT-18 @ 12:55 WATER							
Bacteriolog	jical Tests							
E. Coli		0		0	CFU/100mL		01-NOV-18	R4309936
Fecal Colifo	orms	0		0	CFU/100mL		01-NOV-18	R4309947
L2189621-11 Sampled By: Matrix:	OL-11 CLIENT on 29-OCT-18 @ 12:50 WATER							
Bacteriolog								
E. Coli		0		0	CFU/100mL		01-NOV-18	R4309936
Fecal Colifo	orms	1		0	CFU/100mL		01-NOV-18	
L2189621-12 Sampled By: Matrix:	OL-1-BOTTOME CLIENT on 29-OCT-18 @ 13:30 WATER							
Physical Te	ests							
-	ended Solids	2.7		2.0	mg/L	01-NOV-18	02-NOV-18	R4313367
Anions and					-			
		1	1		1	1	1	1

L2189621 CONTD.... PAGE 6 of 8 Version: FINAL

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2189621-12 OL-1-BOTTOME Sampled By: CLIENT on 29-OCT-18 @ 13:30 Matrix: WATER Anions and Nutrients							
Total Metals							
Iron (Fe)-Total	<0.050		0.050	mg/L	31-OCT-18	31-OCT-18	R4308238
	<0.050		0.050	mg/L	31-OCT-18	31-OCT-18	R4308238

## **Reference Information**

#### **QC Samples with Qualifiers & Comments:**

QC Type Des	cription	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike		Calcium (Ca)-Total	MS-B	L2189621-1, -2, -3, -4, -5
Matrix Spike		Magnesium (Mg)-Total	MS-B	L2189621-1, -2, -3, -4, -5
Sample Para	ameter Qualifier I	kev listed:		
Sample Para Qualifier	ameter Qualifier I Description	key listed:		
•	Description	-	ntrations and may b	e biased high (dissolved Ca/Mg results unavailable

RRV Reported Result Verified By Repeat Analysis

#### Test Method References

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-WT This analysis is carried colourimetric method.	Water d out using pro	Alkalinity, Total (as CaCO3) cedures adapted from EPA Method 3	EPA 310.2 10.2 "Alkalinity". Total Alkalinity is determined using the methyl orange
oxygen demand (BOD dissolved oxygen meter	) are determiner. Dissolved B	ed by diluting and incubating a sample	APHA 5210 B 5210B - "Biochemical Oxygen Demand (BOD)". All forms of biochemical e for a specified time period, and measuring the oxygen depletion using a ering the sample through a glass fibre filter prior to dilution. Carbonaceous sample prior to incubation.
CL-IC-N-WT Inorganic anions are a	Water nalyzed by Ion	Chloride by IC Chromatography with conductivity ar	EPA 300.1 (mod) nd/or UV detection.
Analysis conducted in Protection Act (July 1,		ith the Protocol for Analytical Methods	s Used in the Assessment of Properties under Part XV.1 of the Environmenta
			APHA 5310B tion chamber which is packed with an oxidative catalyst. The water is n dioxide is transported in a carrier gas and is measured by a non-dispersive
EC-MF-WT A 100 mL volume of sa Method ID: WT-TM-12		E. coli d through a membrane, the membran	SM 9222D the is placed on mFC-BCIG agar and incubated at 44.5 –0 .2 °C for 24 – 2 h.
FC-MF-WT A 100mL volume of sa WT-TM-1200	Water Imple is filtered	Fecal Coliforms d through a membrane, the membrane	SM 9222D e is placed on mFC agar and incubated at 24–2h@44.5–0.2°C. Method ID:
	as Total Hard	Hardness ness) is calculated from the sum of C concentrations are preferentially used	APHA 2340 B alcium and Magnesium concentrations, expressed in CaCO3 equivalents. for the hardness calculation.
MET-T-CCMS-WT Water samples are dig	Water gested with nitr	Total Metals in Water by CRC ic ac Management of the second states and analyzed to the second states and analyzed states analyzed states analyzed states and analyzed states and analyzed	EPA 200.2/6020A (mod) ed by CRC ICPMS.
Method Limitation (re:	Sulfur): Sulfide	e and volatile sulfur species may not b	be recovered by this method.
Analysis conducted in Protection Act (July 1,		ith the Protocol for Analytical Methods	s Used in the Assessment of Properties under Part XV.1 of the Environmenta
NH3-WT Sample is measured c colorimetrically.	Water olorimetrically	Ammonia, Total as N When sample is turbid a distillation s	EPA 350.1 step is required, sample is distilled into a solution of boric acid and measured
NO3-IC-WT Inorganic anions are a	Water nalyzed by Ion	Nitrate in Water by IC Chromatography with conductivity ar	EPA 300.1 (mod) nd/or UV detection.
P-T-COL-WT	Water	Total P in Water by Colour	APHA 4500-P PHOSPHORUS
This analysis is carried after persulphate diges			4500-P "Phosphorus". Total Phosphorus is deteremined colourimetrically
PH-WT Water samples are an	Water alyzed directly	pH by a calibrated pH meter.	APHA 4500 H-Electrode
		ith the Protocol for Analytical Methods ne for samples under this regulation is	s Used in the Assessment of Properties under Part XV.1 of the Environmenta s 28 days
SO4-IC-N-WT	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

## **Reference Information**

SOLIDS-TSS-WT APHA 2540 D-Gravimetric Water Suspended solids A well-mixed sample is filtered through a weighed standard glass fibre filter and the residue retained is dried in an oven at 104–1°C for a minimum of four hours or until a constant weight is achieved.

TKN-WT Water Total Kjeldahl Nitrogen APHA 4500-Norg D This analysis is carried out using procedures adapted from APHA Method 4500-Norg "Nitrogen (Organic)". Total Kjeldahl Nitrogen is determined by sample digestion at 380 Celsius with analysis using an automated colorimetric method.

\*\* ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

#### Chain of Custody Numbers:

#### GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there. mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid weight of sample

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory. UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



			Quum		ricport			
		Workorder:	L218962	21 R	eport Date: (	07-NOV-18		Page 1 of 6
Client:	HUTCHINSON ENVIRON 501 Krug St. Suite 202 Kitchener ON N2B 1L3	MENTAL SCIENC	CES LTD					
Contact:	Brent Parsons							
Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALK-WT	Water							
Batch F	R4310407							
WG2920162-3 Alkalinity, Tota	<b>B CRM</b> al (as CaCO3)	WT-ALK-CRM	89.5		%		80-120	01-NOV-18
WG2920162-4		L2189638-2					00.10	
Alkalinity, Tota	al (as CaCO3)	70	73		mg/L	3.7	20	01-NOV-18
WG2920162-2 Alkalinity, Tota	2 LCS al (as CaCO3)		97.7		%		85-115	01-NOV-18
WG2920162-1 Alkalinity, Tota	l <b>MB</b> al (as CaCO3)		<10		mg/L		10	01-NOV-18
BOD-WT	Water							
Batch F	R4319070							
WG2919669-6 BOD	6 DUP	<b>L2189527-1</b> <2.0	<2.0	RPD-NA	mg/L	N/A	20	05-NOV-18
WG2919669-7 BOD	LCS		99.5		%		85-115	05-NOV-18
WG2919669-5 BOD	5 MB		<2.0		mg/L		2	05-NOV-18
CL-IC-N-WT	Water							
Batch F	R4314670							
WG2920678-1 Chloride (Cl)	9 DUP	<b>L2189468-1</b> <0.50	<0.50	RPD-NA	mg/L	N/A	20	01-NOV-18
WG2920678-1 Chloride (Cl)	17 LCS		100.8		%		90-110	01-NOV-18
WG2920678-1 Chloride (Cl)	6 MB		<0.50		mg/L		0.5	01-NOV-18
WG2920678-2 Chloride (Cl)	20 MS	L2189468-1	103.0		%		75-125	01-NOV-18
DOC-WT	Water							
Batch F	R4323022							
WG2920421-3 Dissolved Org		<b>L2189621-1</b> 5.92	5.79		mg/L	2.3	25	06-NOV-18
WG2920421-2 Dissolved Org			107.0		%		70-130	06-NOV-18
WG2920421-1 Dissolved Org			<0.50		mg/L		0.5	06-NOV-18
WG2920421-4 Dissolved Org		L2189621-1	103.1		%		70-130	06-NOV-18
EC-MF-WT	Water							



			Quant	y contro	JINEPOIL			
		Workorder:	L218962 <sup>-</sup>	1	Report Date: 07-I	NOV-18		Page 2 of 6
501 Kru	HNSON ENVIRON ug St. Suite 202 ier ON N2B 1L3	MENTAL SCIENC	ES LTD					
Contact: Brent P	Parsons							
Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
EC-MF-WT	Water							
Batch R430993	6							
WG2919207-1 MB			_		0511/100			
E. Coli			0		CFU/100mL		1	01-NOV-18
FC-MF-WT	Water							
Batch R430994	7							
WG2919195-1 MB								
Fecal Coliforms			0		CFU/100mL		1	01-NOV-18
MET-T-CCMS-WT	Water							
Batch R430823	8							
WG2919062-4 DUP	•	WG2919062-3						
Calcium (Ca)-Total		29.6	30.4		mg/L	2.7	20	31-OCT-18
Iron (Fe)-Total		0.797	0.781		mg/L	2.1	20	31-OCT-18
Magnesium (Mg)-Tota	al	8.81	8.87		mg/L	0.7	20	31-OCT-18
WG2919062-2 LCS Calcium (Ca)-Total	;		99.5		%		80-120	31-OCT-18
Iron (Fe)-Total			99.2		%		80-120	31-OCT-18
Magnesium (Mg)-Tota	al		98.6		%		80-120	31-OCT-18
WG2919062-1 MB								
Calcium (Ca)-Total			<0.050		mg/L		0.05	31-OCT-18
Iron (Fe)-Total			<0.010		mg/L		0.01	31-OCT-18
Magnesium (Mg)-Tota	al		<0.0050		mg/L		0.005	31-OCT-18
WG2919062-5 MS Calcium (Ca)-Total		WG2919062-6	N/A	MS-B	%		-	31-OCT-18
Iron (Fe)-Total			96.8		%		70-130	31-OCT-18
Magnesium (Mg)-Tota	al		N/A	MS-B	%		-	31-OCT-18
NH3-WT	Water							
Batch R430845	51							
WG2918875-11 DUF Ammonia, Total (as N		<b>L2188939-6</b> <0.020	<0.020	RPD-NA	mg/L	N/A	20	31-OCT-18
WG2918875-10 LCS	- -						-	
Ammonia, Total (as N	))		101.4		%		85-115	31-OCT-18
WG2918875-9 MB Ammonia, Total (as N	l)		<0.020		mg/L		0.02	31-OCT-18
<b>WG2918875-12 MS</b> Ammonia, Total (as N	I)	L2188939-6	97.5		%		75-125	31-OCT-18



			-	-	-			
		Workorder:	L2189621	Re	eport Date: 07-	NOV-18		Page 3 of 6
501 Krug	NSON ENVIRON 9 St. Suite 202 r ON N2B 1L3	MENTAL SCIENC	ES LTD					
Contact: Brent Pa	rsons							
Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NH3-WT Batch R4322287	Water							
WG2923738-8 DUP Ammonia, Total (as N)		<b>L2192254-1</b> <0.020	<0.020	RPD-NA	mg/L	N/A	20	06-NOV-18
WG2923738-6 LCS Ammonia, Total (as N)			96.8		%		85-115	06-NOV-18
WG2923738-5 MB Ammonia, Total (as N)			<0.020		mg/L		0.02	06-NOV-18
WG2923738-7 MS Ammonia, Total (as N)		L2192254-1	102.1		%		75-125	06-NOV-18
NO3-IC-WT	Water							
Batch R4314670 WG2920678-19 DUP Nitrate (as N)		<b>L2189468-1</b> <0.020	<0.020	RPD-NA	mg/L	N/A	25	01-NOV-18
WG2920678-17 LCS Nitrate (as N)			100.2		%		70-130	01-NOV-18
WG2920678-16 MB Nitrate (as N)			<0.020		mg/L		0.02	01-NOV-18
WG2920678-20 MS Nitrate (as N)		L2189468-1	101.2		%		70-130	01-NOV-18
P-T-COL-WT	Water							
Batch R4312508 WG2919729-3 DUP	1	L2189621-4						
Phosphorus, Total		0.0050	0.0068	J	mg/L	0.0018	0.006	02-NOV-18
WG2919729-2 LCS Phosphorus, Total			83.4		%		80-120	02-NOV-18
WG2919729-1 MB Phosphorus, Total			<0.0030		mg/L		0.003	02-NOV-18
WG2919729-4 MS Phosphorus, Total		L2189621-4	90.0		%		70-130	02-NOV-18
PH-WT	Water							
Batch R4312622	!							
<b>WG2919986-4 DUP</b> рН		<b>WG2919986-3</b> 7.41	7.39	J	pH units	0.02	0.2	01-NOV-18
<b>WG2919986-2 LCS</b> рН			7.00		pH units		6.9-7.1	01-NOV-18
SO4-IC-N-WT	Water							

SO4-IC-N-WT

Water



			- aum	y control	report			
		Workorder:	L218962	1 Re	eport Date:	07-NOV-18		Page 4 of 6
50	TCHINSON E I Krug St. Suit chener ON N		ES LTD					
Contact: Bre	ent Parsons							
Test	Matrix	x Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SO4-IC-N-WT	Wate	r						
Batch R43 <sup>-</sup> WG2920678-19 Sulfate (SO4)	14670 DUP	<b>L2189468-1</b> <0.30	<0.30	RPD-NA	mg/L	N/A	20	01-NOV-18
WG2920678-17 Sulfate (SO4)	LCS		98.3		%		90-110	01-NOV-18
WG2920678-16 Sulfate (SO4)	MB		<0.30		mg/L		0.3	01-NOV-18
WG2920678-20 Sulfate (SO4)	MS	L2189468-1	99.8		%		75-125	01-NOV-18
SOLIDS-TSS-WT	Wate	r						
	12609 DUP Solids	<b>L2189291-1</b> 2950	3070		mg/L	4.0	20	02-NOV-18
WG2920008-2 Total Suspended			100.1		%		85-115	02-NOV-18
WG2920008-1 Total Suspended	MB Solids		<2.0		mg/L		2	02-NOV-18
	13367							
Total Suspended		<b>L2189260-7</b> 5200	5380		mg/L	3.4	20	02-NOV-18
Total Suspended			101.7		%		85-115	02-NOV-18
WG2920448-1 Total Suspended	MB Solids		<2.0		mg/L		2	02-NOV-18
TKN-WT	Wate	r						
	14469 DUP <sup>r</sup> ogen	<b>L2189465-1</b> <0.15	0.17	RPD-NA	mg/L	N/A	20	02-NOV-18
<b>WG2921071-6</b> Total Kjeldahl Nitr			86.0		%		75-125	02-NOV-18
<b>WG2921071-5</b> Total Kjeldahl Niti	<b>MB</b> rogen		<0.15		mg/L		0.15	02-NOV-18
<b>WG2921071-8</b> Total Kjeldahl Niti	-	L2189465-1	108.2		%		70-130	02-NOV-18
	1 <b>5710</b> DUP rogen	<b>L2188939-3</b> 0.67	0.66		mg/L	1.8	20	02-NOV-18
4								

WG2920880-2 LCS



		Workorder	: L218962	:1	Report Date: (	07-NOV-18		Page 5	of 6
Client:	HUTCHINSON ENVIR 501 Krug St. Suite 202 Kitchener ON N2B 1L		ICES LTD						
Contact:	Brent Parsons								
Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed	
TKN-WT	Water								
Batch	R4315710								

WG2920880-2 LCS						
Total Kjeldahl Nitrogen		98.8	%		75-125	02-NOV-18
WG2920880-1 MB Total Kjeldahl Nitrogen		<0.15	mg/L		0.15	02-NOV-18
WG2920880-4 MS Total Kjeldahl Nitrogen	L2188939-3	84.0	%		70-130	02-NOV-18
Batch R4322883						
WG2923477-3 DUP Total Kjeldahl Nitrogen	<b>L2190310-6</b> 0.72	0.71	mg/L	1.4	20	06-NOV-18
WG2923477-2 LCS Total Kjeldahl Nitrogen		107.6	%		75-125	06-NOV-18
WG2923477-1 MB Total Kjeldahl Nitrogen		<0.15	mg/L		0.15	06-NOV-18
WG2923477-4 MS Total Kjeldahl Nitrogen	L2190310-6	117.1	%		70-130	06-NOV-18

Workorder: L2189621

Report Date: 07-NOV-18

Client:	HUTCHINSON ENVIRONMENTAL SCIENCES LTD
	501 Krug St. Suite 202
	Kitchener ON N2B 1L3
Contact:	Brent Parsons

Contact:

#### Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

#### Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

#### Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

	~																						
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(ALS)	www.aisglobal.com	Canada Tol	Free: 1 800 66	8 9878					╢╢		III -		開発				14		•				
Report To	Contact and company name below will appe	ar on the final record		Report F	ormal	Ļ	2189621-C	OFC	)				<u>⊵≊</u> -C	ontac	t your	AM to	Confi	irm all	E&P T/	Ts (su	urcharge	s may apply	0
Company:			Select Report Fo													_	· · · ·				ges apply		
Contact:	BRENT PARSONS	· · ·	Quality Control (		-			ľ. El	4 Uay	·[] ·····		_	Т	δį			-	[E - 1					
Phone:	519-576-1711					provide details below		UR D	3 day					age .			-	-		itory	holidav	(E2 -200%	
none.	Company address below will appear on the fina	al report	Select Distributio					P-Ring	2 day	-	-	_		No.	(Labo	ratory	y ope	ning f	ees ma	ay app	oly)]	1 200,0	
Street:	501 KRUG ST ST 202		Email 1 or Fax		ndair@	environmentalsci	ences ca			-	-		ati E&P	TATS	THE.				dd-mn		hh:mm		
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Contact:	Project Information			and Gae R	omilire	d Fields (client )	180) W	I₹															-
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ALS Account #	1 Quote #. Qososo		Major/Minor Code:			Routing Code:		8	5					HARDNESS									ŝ
Job #:		<u> </u>	Requisitioner:			Intodating Obac:		ш	ъ.					Ê.								<u>လ</u>	ő
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LSD:	· Maria and a California Sector Sector		Location:			1		Ľ.	ŏ					ŝ								1 2	Ξ
ALS Lab Wor	* Order # (lab use only): La 8	<u>9621</u>	ALS Contact:	Gay	le	Sampler:		MBE	IFECA	YTIN			3, SO4	. METAL	NH3/TKN/TP			TSS				AMPI	SUSPECTED HAZARD (see Special Instructions)
ALS Sample # (lab use only)	Sample Identification (This description will			Dat (dd-mmr		Time (hh:mm)	Sample Type	NUMBI	E.COLIFE	ALKALINIT	BOD	DOC	c, NO3,	TOTAL	NH3/T	pH/TSS		TP, Fe,				l S	SUSP
- L first	OL-1			29-10	-18	13'30	WATER	5	R	R	R	R	R	R	R	R		R					
	OL-2			T	_	12:45	WATER	4	R	R	R	R	R	R	R	R							
à	OL-4	• •	414 MM			12.22	WATER	4	R	R	Ŗ	R	R	R	R	R							
TU.	OL-7					13:10	WATER	4	R	R	R	R	R	R	R	R					_		
E	OL-9					13.00	WATER	4	R	R	R	R	R	R	R	R						1	
7	OL-3		· · · · ·			13:24	WATER	1	Z.R											-	_	1	
	OL-5					13:20	WATER	1	R											$\uparrow$			
- 5-	OL-6					13:15	WATER	1	R								_						
à	OL-8					17:05	WATER	1	R								_						
10_	OL-10		•	1 - 1		12:55	WATER	1	R										•				
11	OL-11					12:50	WATER	1	R														
	OL-1-BOTTOM			- V		13:20	WATER	3					-					R					
	I	Special Instructions / S	Specify Criteria to	add on repo	rt by cli		-down list below	<u>.</u>	<u> </u>			SAI	<u></u>						) (lab u	se on	ly)		· ···
Drinking	Water (DW) Samples <sup>1</sup> (client use)		(elei	ctronic COC	only}			Froz	en 🤻		. Yest	- 18 M.	· · · · ·	1 N2.5a	Dbser			Yes	·····	) J	No.	) ≁∰ ∛	
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Are samples for	human consumption/ use?							·		IIITIAL I	cooti	RTE	APERA	TURES	3°C	200-14 	-7 -74	7-7		OLER.		ATURES °C	
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	SHIPMENT RELEASE (client us			INITIAL SI	HIPME	NT RECEPTION	(lab use only)	-1						INAL	SHI	MEN	TRE	CEPTI	ON (la	b use	only) 🕷		in air ar
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	K PAGE FOR ALS LOCATIONS AND SAMPLIN		- <b>.</b>		W	HITE - LABORATO	RY COPY YE	LLOW	- CLIE	IT CO	PY												T 2018 PRONT

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Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



## Sample Receipt Confirmation

Report Di	istribution:					Invoice	Distrib	ution:	
	Company Name:	HUTCHINSON E SCIENCES LTD	NVIRONMENTAL	L		Acct Name	HUTCHI SCIENC	NSON ENVIRON ES LTD	NMENTAL
	Contact:	Brent Parsons				Contact	ACCOU	NTS PAYABLE	
	Address:	501 Krug St., Sui				Address	: 1-5 Cha	ncery Lane,	
		Kitchener, ON, N	I2B 1L3				Bracebr	idge, ON, P1L 2E	3
	Phone: Fax:	519-576-1711 866-205-7766				Phone:	705-645	-0021	
		deborah.sinclair@	@environmentalsc	ciences	s ca	Fax:	705-457	-5811	
	Eman.		environmentalscie		_	voice Email:	deborah	sinclair@enviro	nmentalsciences.
	EDD Email:						ca		
	Distribution	Hard Copy: N	Email: Y F	Fax: N	EDD: N		account	ing@environmer	talsciences.ca
	Diotribution			u. 11	LDD. IV	Project #:	N/A		
						Account #:	20126		
Client Inf	ormation:								
	Job Reference #:				1	Date Sampled	1: 29-OCT	Г-18	
	Project PO #:				Γ	Date Received		-	
Legal	Site Description:	N/A				Sampled By	CLIEN	Г	
34.	<b>•</b> • • •				01-1				
<b>3</b> 4.	Quote #:	Q69690			Chai	in Of Custody	/:		
Workord	ler Summary	Q69690				in Of Custody			
Workord	ler Summary _ab Work Order #:	Q69690 : L2189621			Acco	in Of Custody	: Gayle B		
Workord L Estimated	er Summary _ab Work Order #: I completion date:	Q69690 : L2189621 07-NOV-18		E		in Of Custody	: Gayle B : See Sai		ormation section
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ADDRESS 309 Exeter Road, Unit #29, London, ON, Canada N6L 1C1 PHONE +1 519 652 6044 FAX +1 519 652 0671 ALS CANADA LTD. Part of the ALS Group A Campbell Brothers Limited Company

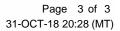
### www.alsglobal.com



Analysis Requested :	Alkalinity, Total [as CaCO3]	BOD	Chloride by IC	Dissolved Organic Carbon	E. coli	Fecal Coliforms	Hardness	One Metal in Water by ICPMS [Total]	Total Metals in Water by CRC ICPMS	Ammonia, Total as N	Nitrate in Water by IC	Total P in Water by Colour	Hd	Sulfate in Water by IC	Suspended solids	TKN and Total Phosphorus	Sample Handling and Disposal Fee
OL-1	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
OL-2	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
OL-4	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
OL-7	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
OL-9	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
OL-3					$\checkmark$	$\checkmark$											$\checkmark$
OL-5					$\checkmark$	$\checkmark$											$\checkmark$
OL-6					$\checkmark$	$\checkmark$											$\checkmark$
OL-8					$\checkmark$	$\checkmark$											$\checkmark$
OL-10					$\checkmark$	$\checkmark$											$\checkmark$
OL-11					$\checkmark$	$\checkmark$											$\checkmark$
OL-1-BOTTOME								$\checkmark$				$\checkmark$			$\checkmark$		$\checkmark$

**Login Comments:** Your samples were at 7.4 °C when unpacked at the laboratory.

Sample Integrity Observations: No observations were identified for this work order submission.





#### Notice of Sub-contract Laboratory Service

#### Please be advised that the following tests will be subcontracted to the corresponding laboratory:

E. coli subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Alkalinity, Total (as CaCO3) subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Suspended solids subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Total P in Water by Colour subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA pH subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Nitrate in Water by IC subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Hardness subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Total Kjeldahl Nitrogen subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Fecal Coliforms subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Ammonia, Total as N subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Chloride by IC subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Sulfate in Water by IC subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Chloride by IC subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Sulfate in Water by IC subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Sulfate in Water by IC subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA BOD subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Dissolved Organic Carbon subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Please contact your Account Manager immediately should you have questions or concerns regarding this arrangement. Approval of this arrangement shall be implied unless otherwise notified by you.

#### Sample Disposal Information:

Where possible, ALS will store samples for the following durations, measured from date of sample submission: 45 days for Soil and Water samples; 6 months for Tissue/Biota samples; 14 days for air samples collected on re-usable media; and 3 days for water samples submitted for microbiological testing. Longer storage times are available upon request.

For information about ALS accreditations and certifications please contact your Account Manager or visit our webpage at www.alsglobal.com (see Canada downloads).

ALS Group strives to deliver on-time results to our clients at all times. However, there are times when due to capacity issues or other unforeseen circumstances we are unable to meet our expected turnaround times. The information above is related to a recent workorder you have submitted to our laboratory. In the event that you have an inquiry, please refer to the Lab Work Order # when calling your Account Manager.

ALS Group appreciates your business. Thank you for the opportunity to work with you.

	~																						
		Chain of Custo Rec	ody (COC) / juest Form	Analytic	cal							interne Ur se Annere ent		coc	Numt	er; Pag			of				
(ALS)	www.aisglobal.com	Canada Tol	Free: 1 800 66	8 9878					╢╢		III -		開発				14		•				
Report To	Contact and company name below will appe	ar on the final record		Report F	ormal	Ļ	2189621-C	OFC	)				<u>ף≋</u> -C	ontac	t your	AM to	Confl	irm all	E&P T/	Ts (su	urcharge	s may apply	0
Company:			Select Report Fo													_	· · · ·				ges apply		
Contact:	BRENT PARSONS	· · ·	Quality Control (		-			ľ. El	4 Uay	·[] ·····		_	Т	δį			-	[E • 1					
Phone:	519-576-1711					provide details below		UR D	3 day					age .			-	-		itory	holidav	(E2 -200%	
none.	Company address below will appear on the fina	al report	Select Distributio					P-Ring	2 day	-	-	_		No.	(Labo	ratory	y ope	ning f	ees ma	ay app	oly)]	1 200,0	
Street:	501 KRUG ST ST 202		Email 1 or Fax		ndair@	environmentalsci	ences ca			-	-		ati E&P	TATS	THE.				dd-mn		hh:mm		
	KTICHENER, ON					vironmentalscier		For tes	ts that c	in not l	e perfo	med ac	cording	to the	service	ovel so	lected.	YOU WIII	be contac	cted.			-
	N2B 1L3		Email 3								•					ysis	_						
	Same as Report To VES			invo	nice Di	stribution				in	dicate	iltered	(F), Pn	serve		<u> </u>			ed (F/P)	below			
Invoice To			Select Invoice D					RS					<u> </u>		<u> </u>	T			<u> </u>			1 3	S LO
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ALS Account #	1 Quote #. Qososo		Major/Minor Code:			Routing Code:		8	5					HARDNESS									ŝ
Job #:		<u> </u>	Requisitioner:			Intodating Obac:		ш	ъ.					Ê.								<u>လ</u>	ő
PO / AFE:			+ <i>`</i>					ō	COLIFORM					Ŧ					1			ļЩ	1 Š
LSD:	· Maria and a California Sector Sector		Location:			1		Ľ.	ŏ					ŝ								1 2	Ξ
ALS Lab Wor	* Order # (lab use only): La 8	<u>9621</u>	ALS Contact:	Gay	le	Sampler:		MBE	IFECA	YTIN			3, SO4	. METAL	NH3/TKN/TP			TSS				AMP	SUSPECTED HAZARD (see Special Instructions)
ALS Sample # (lab use only)	Sample Identification (This description will			Dat (dd-mmr		Time (hh:mm)	Sample Type	NUMBI	E.COLIFE	ALKALINIT	BOD	DOC	c, NO3,	TOTAL	NH3/T	pH/TSS		TP, Fe,				l S	SUSP
- L first	OL-1			29-10	-18	13'30	WATER	5	R	R	R	R	R	R	R	R		R					
	OL-2			T	_	12:45	WATER	4	R	R	R	R	R	R	R	R							
à	OL-4	• •	414 MM			12.22	WATER	4	R	R	Ŗ	R	R	R	R	R							
TU.	OL-7					13:10	WATER	4	R	R	R	R	R	R	R	R					_		
E	OL-9					13.00	WATER	4	R	R	R	R	R	R	R	R						1	
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	OL-5					13:20	WATER	1	R											$\uparrow$			
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à	OL-8					17:05	WATER	1	R								_		_				
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Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



## Sample Receipt Confirmation

Report Di	istribution:				Invoice l			
•	Company Name:	HUTCHINSON E	NVIRONMENTAL		Acct Name:		INSON ENVIRON ES LTD	NMENTAL
	Contact:	Brent Parsons			Contact:	ACCOU	NTS PAYABLE	
	Address:	501 Krug St., Suit			Address:	1-5 Cha	ncery Lane,	
		Kitchener, ON, N	2B 1L3			Bracebr	idge, ON, P1L 2E	3
	Phone: Fax:	519-576-1711 866-205-7766			Phone:	705-645	5-0021	
	Email:			60 24	Fax:	705-457	-5811	
	Eman.		nvironmentalsciences.		nvoice Email:	deborat	n.sinclair@enviror	mentalsciences
	EDD Email:				Noice Linaii.	ca		interitaisolenees.
	Distribution:	Hard Copy: N	Email: Y Fax:	N EDD: N		account	ing@environmen	talsciences.ca
	Distribution.				Project #:	N/A		
					Account #:	20126		
Client Inf	ormation:							
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ADDRESS 309 Exeter Road, Unit #29, London, ON, Canada N6L 1C1 PHONE +1 519 652 6044 FAX +1 519 652 0671 ALS CANADA LTD. Part of the ALS Group A Campbell Brothers Limited Company



Page 2 of 3 31-OCT-18 20:26 (MT)

Analysis Requested :	Chlorophyll a by fluorometry	Fecal streptococcus	Pseudomonas aeruginosa	Sample Handling and Disposal Fee
OL-1	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
OL-2	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
OL-4	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
OL-7	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
OL-9	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
OL-3		$\checkmark$		$\checkmark$
OL-5		$\checkmark$		$\checkmark$
OL-6		$\checkmark$		$\checkmark$
OL-8		$\checkmark$		$\checkmark$
OL-10		$\checkmark$		$\checkmark$
OL-11		$\checkmark$		$\checkmark$

Hold Time Exceedences: The following samples have exceeded recommended holding times prior to sample receipt.

Analysis Requested	Lab Sample ID	Recommended Hold Time	Date Sampled	Date Received
Chlorophyll a by fluorometry	L2189633-1, 3, 4	48 hours	29-OCT-18	31-OCT-18
Fecal streptococcus	L2189633-1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11	30 hours	29-OCT-18	31-OCT-18
Pseudomonas aeruginosa	L2189633-1, 2, 3, 4, 5	30 hours	29-OCT-18	31-OCT-18

Sample Integrity Observations: No observations were identified for this work order submission.

#### Notice of Sub-contract Laboratory Service

Please be advised that the following tests will be subcontracted to the corresponding laboratory:

Pseudomonas aeruginosa subcontracted to: ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA Chlorophyll a by fluorometry subcontracted to: ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA Fecal streptococcus subcontracted to: ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA

Please contact your Account Manager immediately should you have questions or concerns regarding this arrangement. Approval of this arrangement shall be implied unless otherwise notified by you.



#### Sample Disposal Information:

Where possible, ALS will store samples for the following durations, measured from date of sample submission: 45 days for Soil and Water samples; 6 months for Tissue/Biota samples; 14 days for air samples collected on re-usable media; and 3 days for water samples submitted for microbiological testing. Longer storage times are available upon request.

For information about ALS accreditations and certifications please contact your Account Manager or visit our webpage at www.alsglobal.com (see Canada downloads).

ALS Group strives to deliver on-time results to our clients at all times. However, there are times when due to capacity issues or other unforeseen circumstances we are unable to meet our expected turnaround times. The information above is related to a recent workorder you have submitted to our laboratory. In the event that you have an inquiry, please refer to the Lab Work Order # when calling your Account Manager.

ALS Group appreciates your business. Thank you for the opportunity to work with you.



#### Chain of Custody (COC) / Analytical **Request Form**



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# COC Number: 17 - 0050 Page ( of / L2189633

Canada Toll Free: 1 800 668 9878

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Phone:	519-576-1711	· · · <u>· · · · · · · · · · · · · · · · </u>		ts to Criteria on Report -			ROR	1		-25%]			MERO								ay (E2	2 -200%	
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er. Artistica e anti-	OL-7 •				13:10	WATER	2	R	R	R											-		t
	OL-9				13:00	WATER	2	R	R	R												_	
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Failure to complete all portions of this form may delay analysis, Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy. 1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

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ALS Lab Wor	* Order # (lab use only): La 8	<u>9621</u>	ALS Contact:	Gay	le	Sampler:		MBE	IFECA	YTIN			3, SO4	. METAL	NH3/TKN/TP			TSS				AMP	SUSPECTED HAZARD (see Special Instructions)
ALS Sample # (lab use only)	Sample Identification (This description will			Dat (dd-mmr		Time (hh:mm)	Sample Type	NUMBI	E.COLIFE	ALKALINIT	BOD	DOC	c, NO3,	TOTAL	NH3/T	pH/TSS		TP, Fe,				l S	SUSP
- L first	OL-1			29-10	-18	13'30	WATER	5	R	R	R	R	R	R	R	R		R					
	OL-2			T	_	12:45	WATER	4	R	R	R	R	R	R	R	R							
à	OL-4	• •	414 MM			12.22	WATER	4	R	R	Ŗ	R	R	R	R	R							
TU.	OL-7					13:10	WATER	4	R	R	R	R	R	R	R	R					_		
E	OL-9					13.00	WATER	4	R	R	R	R	R	R	R	R						1	
7	OL-3		· · · · ·			13:24	WATER	1	Z.R											-	_	1	
	OL-5					13:20	WATER	1	R											$\uparrow$			
- 5-	OL-6					13:15	WATER	1	R														
à	OL-8					17:05	WATER	1	R								_						
10_	OL-10		•	1 - 1		12:55	WATER	1	R										•				
11	OL-11					12:50	WATER	1	R														
	OL-1-BOTTOM			- V		13:20	WATER	3					<b>—</b>					R					
	I	Special Instructions / S	Specify Criteria to	add on repo	rt by cli		-down list below	<u>.</u>	<u> </u>			SAI	<u> </u>						) (lab u	se on	ly)		· ···
Drinking	Water (DW) Samples <sup>1</sup> (client use)		(elei	ctronic COC	only}			Froz	en 🤻		. Yest	- 1 <sup>2</sup>	· · · · ·	1 N2.5a	Dbser			Yes	·····	) J	No.	) ≁∰ ∛	
-	ten from a Regulated DW System?							lce l	Packs	Q	lce (	ubes		Cust	ody se	al int	act	Yes	*, L'	. 4	≋್ಷ ≈ No	) 	U (
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Are samples for	human consumption/ use?							·		IIITIAL I	cooti	RTE	APERA	TURES	3°C	200-14 	-7 -74	7-7		OLER.		ATURES °C	
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Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



HUTCHINSON ENVIRONMENTAL SCIENCES LTD ATTN: Brent Parsons 501 Krug St. Suite 202 Kitchener ON N2B 1L3 Date Received:14-FEB-19Report Date:27-FEB-19 13:03 (MT)Version:FINAL

Client Phone: 519-576-1711

# Certificate of Analysis

Lab Work Order #: L2232740 Project P.O. #: NOT SUBMITTED Job Reference: C of C Numbers: Legal Site Desc:

Comments: ADDITIONAL 14-FEB-19 11:39

Connor Cattani Account Manager

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L2232740 CONTD.... PAGE 2 of 3 Version: FINAL

## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2232740-1 TRIB 4 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER							
Bacteriological Tests							
Fecal Streptococcus	66	PEHR	1	CFU/100mL		14-FEB-19	R4511527
Pseudomonas aeruginosa	<1		1	CFU/100mL		14-FEB-19	R4511940
Plant Pigments							
Chlorophyll a	<0.10		0.10	ug/L	14-FEB-19	14-FEB-19	R4530568
L2232740-2 TRIB 5 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER							
Bacteriological Tests							
Fecal Streptococcus	74	PEHR	1	CFU/100mL		14-FEB-19	R4511527
Pseudomonas aeruginosa	<1		1	CFU/100mL		14-FEB-19	R4511940
Plant Pigments							
Chlorophyll a	0.90		0.10	ug/L	14-FEB-19	14-FEB-19	R4530568

### **Reference Information**

#### **Qualifiers for Individual Samples Listed:**

-	Client ID	1	Qualifier	Description
L2232740-1	TRIB 4		UIC	Unreliable: Improper Container
L2232740-2	TRIB 5		UIC	Unreliable: Improper Container
Sample Parame	eter Qual	lifier key li	sted:	
Qualifier	Descript	ion		
PEHR	Paramete	er Exceeded	Recommended Holding	g Time On Receipt: Proceed With Analysis As Requested.
est Method Re	eference	s:		
ALS Test Code		Matrix	Test Description	Method Reference**
CHL/A-ACET-FL WP This analysis is		Water g procedure	Chlorophyll a by fluoro	ethod 445.0. Chlorophyll a is determined by a 90 % acetone extraction followed with
analysis by fluo	rometry us	sing the non	-acidification procedure.	This method is not subject to interferences from chlorophyll b.
FECALSTREP-N		Water	Fecal streptococcus	
incubated at 35 results are repo adjusted accord	°C for 47 + orted as Co dingly, with nic fluidity,	H-1 hour. Colony Formir report note the term "Fo	00 mL) is passed throug Colonies exhibiting chara ng Units (CFU) per 100 n s as required, when less	APHA 9230C (modified) h a sterile .45 micron membrane filter. The filter is placed on selective media and acteristic morphology for the target group on the filter after incubation are counted and nL. The detection limit for this test is 1 when 100 mL of sample is processed, and is a than 100 mL is processed. pplied here to include all members of genus names Streptococcus and Enterococcus as
incubated at 35 results are repo adjusted accord Due to taxonom described in the PSA-MF-WP A known volume plate and incuba	°C for 47 + orted as Co dingly, with nic fluidity, e reference e of sampl ated for 72	<ul> <li>H/- 1 hour. ( plony Formir report note the term "Fo e method.</li> <li>Water e (typically 2 hours at 4<sup>2</sup></li> </ul>	00 mL) is passed throug Colonies exhibiting chara ing Units (CFU) per 100 m s as required, when less ecal Streptococcus" is a Pseudomonas aerugin 100 mL) is filtered throug 1.5 +/- 0.5 C. Plates are	h a sterile .45 micron membrane filter. The filter is placed on selective media and acteristic morphology for the target group on the filter after incubation are counted and nL. The detection limit for this test is 1 when 100 mL of sample is processed, and is a than 100 mL is processed. pplied here to include all members of genus names Streptococcus and Enterococcus as APHA 9213E gh a 0.45 micron membrane filter. The filter is placed on the surface of a selective agar examined under low magnification and colonies exhibiting typical morphology are
incubated at 35 results are repo adjusted accord Due to taxonom described in the PSA-MF-WP A known volum plate and incub counted. Resul	°C for 47 + orted as Co dingly, with hic fluidity, e reference e of sampl ated for 72 Its are repo	<ul> <li>H/- 1 hour. ( lony Formir report note the term "Fo method.</li> <li>Water e (typically hours at 4" orted as the</li> </ul>	00 mL) is passed throug Colonies exhibiting chara ing Units (CFU) per 100 m s as required, when less ecal Streptococcus" is a Pseudomonas aerugin 100 mL) is filtered throug 1.5 +/- 0.5 C. Plates are number of presumptive	h a sterile .45 micron membrane filter. The filter is placed on selective media and acteristic morphology for the target group on the filter after incubation are counted and nL. The detection limit for this test is 1 when 100 mL of sample is processed, and is a than 100 mL is processed. pplied here to include all members of genus names Streptococcus and Enterococcus as APHA 9213E gh a 0.45 micron membrane filter. The filter is placed on the surface of a selective agar examined under low magnification and colonies exhibiting typical morphology are
incubated at 35 results are repo adjusted accord Due to taxonom described in the PSA-MF-WP A known volum- plate and incub counted. Resul	°C for 47 + orted as Co dingly, with hic fluidity, e reference e of sampl ated for 72 lts are repo	<ul> <li>H- 1 hour. ( lony Formir report note the term "Fo method.</li> <li>Water e (typically hours at 4' borted as the corporate mod     </li> </ul>	00 mL) is passed throug Colonies exhibiting chara ing Units (CFU) per 100 m s as required, when less ecal Streptococcus" is a Pseudomonas aerugin 100 mL) is filtered throug 1.5 +/- 0.5 C. Plates are number of presumptive	h a sterile .45 micron membrane filter. The filter is placed on selective media and acteristic morphology for the target group on the filter after incubation are counted and nL. The detection limit for this test is 1 when 100 mL of sample is processed, and is a than 100 mL is processed. pplied here to include all members of genus names Streptococcus and Enterococcus as nosa APHA 9213E gh a 0.45 micron membrane filter. The filter is placed on the surface of a selective agar examined under low magnification and colonies exhibiting typical morphology are P. aeruginosa CFU/100 mL. Additional confirmation tests can be performed upon reques

WP

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#### Chain of Custody Numbers:

#### **GLOSSARY OF REPORT TERMS**

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid weight of sample

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory. UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION. Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



				•					
			Workorder:	L223274	10	Report Date: 27-F	EB-19		Page 1 of 3
Client:	501 Krug	ISON ENVIRON St. Suite 202 ON N2B 1L3	IMENTAL SCIEN	CES LTD					
Contact:	Brent Par	sons							
Test		Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CHL/A-ACET-FI	LUORO-WP	Water							
Batch WG2996476 Chlorophyll a			<b>L2232473-1</b> 20.8	20.9		ug/L	0.5	35	14-FEB-19
WG2996476 Chlorophyll a				101.1		%		80-120	27-FEB-19
WG2996476 Chlorophyll a				<0.10		ug/L		0.1	14-FEB-19
FECALSTREP-I	MF-WP	Water							
Batch WG2989022 Fecal Strept				<1		CFU/100mL		1	14-FEB-19
PSA-MF-WP		Water							
Batch WG2989035 Pseudomon		sa		<1		CFU/100mL		1	14-FEB-19

Workorder: L2232740

Report Date: 27-FEB-19

HUTCHINSON ENVIRONMENTAL SCIENCES LTD Client: 501 Krug St. Suite 202 Kitchener ON N2B 1L3 **Brent Parsons** 

Contact:

## Legend:

Limit	ALS Control Limit (Data Quality Objectives)	
DUP	Duplicate	
RPD	Relative Percent Difference	
N/A	Not Available	
LCS	Laboratory Control Sample	
SRM	Standard Reference Material	
MS	Matrix Spike	
MSD	Matrix Spike Duplicate	
ADE	Average Desorption Efficiency	
MB	Method Blank	
IRM	Internal Reference Material	
CRM	Certified Reference Material	
CCV	Continuing Calibration Verification	
CVS	Calibration Verification Standard	

LCSD Laboratory Control Sample Duplicate

Workorder: L2232740

Report Date: 27-FEB-19

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD 501 Krug St. Suite 202 Kitchener ON N2B 1L3 Contact: Brent Parsons

Page 3 of 3

## Hold Time Exceedances:

	Sample						
ALS Product Description	ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Bacteriological Tests							
Fecal streptococcus							
	1	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	2	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
Pseudomonas aeruginosa							
	1	11-FEB-19	14-FEB-19 14:50	30	75	hours	EHTR
	2	11-FEB-19	14-FEB-19 14:50	30	75	hours	EHTR
Plant Pigments							
Chlorophyll a by fluorometry							
	1	11-FEB-19	14-FEB-19 13:05	48	73	hours	EHTR
	2	11-FEB-19	14-FEB-19 13:05	48	73	hours	EHTR

## Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.

EHTR: Exceeded ALS recommended hold time prior to sample receipt.

EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.

EHT: Exceeded ALS recommended hold time prior to analysis.

Rec. HT: ALS recommended hold time (see units).

Notes\*:

Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes. Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2232740 were received on 14-FEB-19 09:00.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

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ALS Lab Wor	rk Order # (lab use only)		ALS Contact:		Sampler:		-	3	Chlorophy						2 5. <b>Q</b> *					~
ALS Sample #	Sample Identificati	on and/or Coordinates		Date	Time	Sample Type	teres 1	2	12					:			i			J
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	Trib 5			11-02-19		Water	1		1	1										
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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



HUTCHINSON ENVIRONMENTAL SCIENCES LTD ATTN: Brent Parsons 501 Krug St. Suite 202 Kitchener ON N2B 1L3 Date Received:13-FEB-19Report Date:20-FEB-19 12:50 (MT)Version:FINAL

Client Phone: 519-576-1711

# Certificate of Analysis

Gayle Braun Senior Account Manager

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Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2232152-1 OL-1 Sampled By: CLIENT on 11-FEB-19 @ 16:04 Matrix: WATER							
Physical Tests							
Hardness (as CaCO3)	74	нтс	10	mg/L		14-FEB-19	
pH	7.97		0.10	pH units		14-FEB-19	R4508730
Total Suspended Solids	<2.0		2.0	mg/L	15-FEB-19	16-FEB-19	R4511468
Anions and Nutrients	~2.0		2.0	iiig/L	101 2010	IOI ED IO	114011400
Alkalinity, Total (as CaCO3)	73		10	mg/L		14-FEB-19	R4508730
Ammonia, Total (as N)	0.071		0.010	mg/L		14-FEB-19	R4508876
Chloride (Cl)	51.6		0.50	mg/L		14-FEB-19	R4509769
Nitrate (as N)	0.080		0.020	mg/L		14-FEB-19	R4509769
Total Kjeldahl Nitrogen	0.37		0.15	mg/L	14-FEB-19	15-FEB-19	R4509192
Phosphorus, Total	0.0532		0.0030	mg/L	15-FEB-19	19-FEB-19	R4512420
Sulfate (SO4)	2.04		0.30	mg/L	101 20 10	14-FEB-19	R4509769
Organic / Inorganic Carbon	2.04		0.00	ing/E			114000700
Dissolved Carbon Filtration Location	LAB					13-FEB-19	R4505827
Dissolved Organic Carbon	5.88		0.50	mg/L	13-FEB-19	19-FEB-19	R4515112
Bacteriological Tests				0			
E. Coli	0		0	CFU/100mL		14-FEB-19	R4507107
Fecal Coliforms	0		0	CFU/100mL		14-FEB-19	R4507113
Total Metals							
Aluminum (Al)-Total	0.0155		0.0050	mg/L	14-FEB-19	14-FEB-19	R4506908
Antimony (Sb)-Total	0.00011		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Arsenic (As)-Total	0.00054		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Barium (Ba)-Total	0.0159		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Boron (B)-Total	<0.010		0.010	mg/L	14-FEB-19	14-FEB-19	R4506908
Cadmium (Cd)-Total	0.0000061		0.0000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Calcium (Ca)-Total	25.1		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908
Chromium (Cr)-Total	<0.00050		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Cobalt (Co)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Copper (Cu)-Total	<0.0010		0.0010	mg/L	14-FEB-19	14-FEB-19	R4506908
Iron (Fe)-Total	0.013		0.010	mg/L	14-FEB-19	14-FEB-19	R4506908
Lead (Pb)-Total	<0.000050		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Lithium (Li)-Total	<0.0010		0.0010	mg/L	14-FEB-19	14-FEB-19	R4506908
Magnesium (Mg)-Total	2.66		0.0050	mg/L	14-FEB-19	14-FEB-19	R4506908
Manganese (Mn)-Total	0.00374		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Molybdenum (Mo)-Total	0.000183		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Nickel (Ni)-Total	<0.00050		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Phosphorus (P)-Total	0.068		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Potassium (K)-Total	2.20		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Rubidium (Rb)-Total	0.00168		0.00020	mg/L	14-FEB-19	14-FEB-19	R4506908
Selenium (Se)-Total	0.00168		0.00020	mg/L	14-FEB-19 14-FEB-19	14-FEB-19 14-FEB-19	R4506908
Refer to Referenced Information for Qualifiers (if any)			0.000050	ilig/∟		14-160-19	17400908

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2232152-1 OL-1 Sampled By: CLIENT on 11-FEB-19 @ 16:04 Matrix: WATER							
Total Metals							
Silicon (Si)-Total	0.15		0.10	mg/L	14-FEB-19	14-FEB-19	R4506908
Silver (Ag)-Total	<0.000050		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Sodium (Na)-Total	28.3		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Strontium (Sr)-Total	0.0626		0.0010	mg/L	14-FEB-19	14-FEB-19	R4506908
Sulfur (S)-Total	0.84		0.50	mg/L	14-FEB-19	14-FEB-19	R4506908
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	14-FEB-19	14-FEB-19	R4506908
Thallium (TI)-Total	<0.00020		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908
Thorium (Th)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Tin (Sn)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Titanium (Ti)-Total	0.00035		0.00030	mg/L	14-FEB-19	14-FEB-19	R4506908
Tungsten (W)-Total	<0.00033		0.00030	mg/L	14-FEB-19	14-FEB-19	R4506908
Uranium (U)-Total	0.000022		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908
Vanadium (V)-Total	< 0.00050		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Zinc (Zn)-Total	<0.0030		0.0030	mg/L	14-FEB-19	14-FEB-19	R4506908
Zirconium (Zr)-Total	<0.00030		0.00030	mg/L	14-FEB-19	14-FEB-19	R4506908
Aggregate Organics	<0.00050		0.00050	iiig/L			114300300
BOD	<2.0		2.0	mg/L	13-FEB-19	18-FEB-19	R4513593
L2232152-2 OL-2 Sampled By: CLIENT on 11-FEB-19 @ 13:35 Matrix: WATER							
Physical Tests							
Hardness (as CaCO3)	78	HTC	10	mg/L		14-FEB-19	
рН	7.95		0.10	pH units		14-FEB-19	R4508730
Total Suspended Solids	<2.0		2.0	mg/L	14-FEB-19	15-FEB-19	R4509378
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	78		10	mg/L		14-FEB-19	R4508730
Ammonia, Total (as N)	0.051		0.010	mg/L		14-FEB-19	R4508876
Chloride (Cl)	57.9		0.50	mg/L		14-FEB-19	R4509769
Nitrate (as N)	0.090		0.020	mg/L		14-FEB-19	R4509769
Total Kjeldahl Nitrogen	0.74		0.15	mg/L	14-FEB-19	15-FEB-19	R4509192
Phosphorus, Total	0.0372		0.0030	mg/L	15-FEB-19	19-FEB-19	R4512420
Sulfate (SO4)	2.17		0.30	mg/L		14-FEB-19	R4509769
Organic / Inorganic Carbon							
Dissolved Carbon Filtration Location	LAB					13-FEB-19	R4505827
Dissolved Organic Carbon	5.76		0.50	mg/L	13-FEB-19	19-FEB-19	R4515112
Bacteriological Tests		DELIT	_				
E. Coli	1	PEHT	0	CFU/100mL		14-FEB-19	R4507107
Fecal Coliforms Total Metals	0	PEHT	0	CFU/100mL		14-FEB-19	R4507113
Aluminum (Al)-Total	0.0252			ma/l	14-FEB-19	14-FEB-19	R4506908
Aluminum (Al)-Total Antimony (Sb)-Total	0.0252		0.0050 0.00010	mg/L	14-FEB-19 14-FEB-19	14-FEB-19	
				mg/L			R4506908
Arsenic (As)-Total	0.00054		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2232152-2 OL-2 Sampled By: CLIENT on 11-FEB-19 @ 13:35 Matrix: WATER							
Total Metals							
Barium (Ba)-Total	0.0171		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Boron (B)-Total	<0.010		0.010	mg/L	14-FEB-19	14-FEB-19	R4506908
Cadmium (Cd)-Total	0.0000169		0.0000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Calcium (Ca)-Total	26.4		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908
Chromium (Cr)-Total	<0.00050		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Cobalt (Co)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Copper (Cu)-Total	0.0013		0.0010	mg/L	14-FEB-19	14-FEB-19	R4506908
Iron (Fe)-Total	0.027		0.010	mg/L	14-FEB-19	14-FEB-19	R4506908
Lead (Pb)-Total	0.000057		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Lithium (Li)-Total	<0.0010		0.0010	mg/L	14-FEB-19	14-FEB-19	R4506908
Magnesium (Mg)-Total	2.83		0.0050	mg/L	14-FEB-19	14-FEB-19	R4506908
Manganese (Mn)-Total	0.00341		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Molybdenum (Mo)-Total	0.000109		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Nickel (Ni)-Total	<0.00050		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Phosphorus (P)-Total	<0.050		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Potassium (K)-Total	1.83		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Rubidium (Rb)-Total	0.00151		0.00020	mg/L	14-FEB-19	14-FEB-19	R4506908
Selenium (Se)-Total	0.000053		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Silicon (Si)-Total	<0.10		0.10	mg/L	14-FEB-19	14-FEB-19	R4506908
Silver (Ag)-Total	<0.000050		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Sodium (Na)-Total	32.1		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Strontium (Sr)-Total	0.0667		0.0010	mg/L	14-FEB-19	14-FEB-19	R4506908
Sulfur (S)-Total	0.87		0.50	mg/L	14-FEB-19	14-FEB-19	R4506908
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	14-FEB-19	14-FEB-19	R4506908
Thallium (TI)-Total	<0.000010		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908
Thorium (Th)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Tin (Sn)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Titanium (Ti)-Total	<0.0080	DLUI	0.0080	mg/L	14-FEB-19	14-FEB-19	R4506908
Tungsten (W)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Uranium (U)-Total	0.000023		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908
Vanadium (V)-Total	<0.00050		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Zinc (Zn)-Total	0.0047		0.0030	mg/L	14-FEB-19	14-FEB-19	R4506908
Zirconium (Zr)-Total	<0.00030		0.00030	mg/L	14-FEB-19	14-FEB-19	R4506908
Aggregate Organics							
BOD	2.0		2.0	mg/L	13-FEB-19	18-FEB-19	R4513593
L2232152-3 OL-4 Sampled By: CLIENT on 11-FEB-19 @ 15:25 Matrix: WATER							
Physical Tests							

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2232152-3 OL-4 Sampled By: CLIENT on 11-FEB-19 @ 15:25 Matrix: WATER							
Physical Tests							
Hardness (as CaCO3)	70	нтс	10	mg/L		14-FEB-19	
рН	7.92		0.10	pH units		14-FEB-19	R4508730
Total Suspended Solids	<2.0		2.0	mg/L	14-FEB-19	15-FEB-19	R4509378
Anions and Nutrients			2.0				
Alkalinity, Total (as CaCO3)	69		10	mg/L		14-FEB-19	R4508730
Ammonia, Total (as N)	0.160		0.010	mg/L		14-FEB-19	R4508876
Chloride (CI)	48.9		0.50	mg/L		14-FEB-19	R4509769
Nitrate (as N)	0.206		0.020	mg/L		14-FEB-19	R4509769
Total Kjeldahl Nitrogen	0.82		0.15	mg/L	15-FEB-19	15-FEB-19	R4509888
Phosphorus, Total	0.0182		0.0030	mg/L	15-FEB-19	19-FEB-19	R4512420
Sulfate (SO4)	2.04		0.30	mg/L		14-FEB-19	R4509769
Organic / Inorganic Carbon	2.04		0.00				
Dissolved Carbon Filtration Location	LAB					13-FEB-19	R4505827
Dissolved Organic Carbon	5.56		0.50	mg/L	13-FEB-19	19-FEB-19	R4515112
Bacteriological Tests							
E. Coli	0	PEHT	0	CFU/100mL		14-FEB-19	R4507107
Fecal Coliforms	0	PEHT	0	CFU/100mL		14-FEB-19	R4507113
Total Metals							
Aluminum (Al)-Total	0.0101		0.0050	mg/L	14-FEB-19	14-FEB-19	R4506908
Antimony (Sb)-Total	0.00013		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Arsenic (As)-Total	0.00069		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Barium (Ba)-Total	0.0151		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Boron (B)-Total	<0.010		0.010	mg/L	14-FEB-19	14-FEB-19	R4506908
Cadmium (Cd)-Total	0.0000144		0.0000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Calcium (Ca)-Total	24.1		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908
Chromium (Cr)-Total	<0.00050		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Cobalt (Co)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Copper (Cu)-Total	0.0014		0.0010	mg/L	14-FEB-19	14-FEB-19	R4506908
Iron (Fe)-Total	0.012		0.010	mg/L	14-FEB-19	14-FEB-19	R4506908
Lead (Pb)-Total	0.000090		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Lithium (Li)-Total	<0.0010		0.0010	mg/L	14-FEB-19	14-FEB-19	R4506908
Magnesium (Mg)-Total	2.50		0.0050	mg/L	14-FEB-19	14-FEB-19	R4506908
Manganese (Mn)-Total	0.00342		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Molybdenum (Mo)-Total	0.000098		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Nickel (Ni)-Total	<0.00050		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Phosphorus (P)-Total	<0.050		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Potassium (K)-Total	1.63		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Rubidium (Rb)-Total	0.00121		0.00020	mg/L	14-FEB-19	14-FEB-19	R4506908
Selenium (Se)-Total	0.000064		0.00020	mg/L	14-FEB-19 14-FEB-19	14-FEB-19 14-FEB-19	R4506908
Refer to Referenced Information for Qualifiers (if any)			0.000050	iiig/∟	14-1 LD-13	14-1 20-19	114500900

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2232152-3 OL-4 Sampled By: CLIENT on 11-FEB-19 @ 15:25 Matrix: WATER							
Total Metals							
Silicon (Si)-Total	<0.10		0.10	mg/L	14-FEB-19	14-FEB-19	R4506908
Silver (Ag)-Total	<0.000050		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Sodium (Na)-Total	25.7		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Strontium (Sr)-Total	0.0579		0.0010	mg/L	14-FEB-19	14-FEB-19	R4506908
Sulfur (S)-Total	0.79		0.50	mg/L	14-FEB-19	14-FEB-19	R4506908
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	14-FEB-19	14-FEB-19	R4506908
Thallium (TI)-Total	<0.00010		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908
Thorium (Th)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Tin (Sn)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Titanium (Ti)-Total	0.00036		0.00030	mg/L	14-FEB-19	14-FEB-19	R4506908
Tungsten (W)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Uranium (U)-Total	0.000020		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908
Vanadium (V)-Total	<0.00050		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Zinc (Zn)-Total	0.0035		0.0030	mg/L	14-FEB-19	14-FEB-19	R4506908
Zirconium (Zr)-Total	<0.00030		0.00030	mg/L	14-FEB-19	14-FEB-19	R4506908
Aggregate Organics				Ŭ			
BOD	<2.0		2.0	mg/L	13-FEB-19	18-FEB-19	R4513593
L2232152-4 OL-7 Sampled By: CLIENT on 11-FEB-19 @ 14:40 Matrix: WATER							
Physical Tests							
Hardness (as CaCO3)	65	HTC	10	mg/L		14-FEB-19	
рН	7.61		0.10	pH units		14-FEB-19	R4508730
Total Suspended Solids	4.3		2.0	mg/L	14-FEB-19	15-FEB-19	R4509378
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	64		10	mg/L		14-FEB-19	R4508730
Ammonia, Total (as N)	0.113		0.010	mg/L		14-FEB-19	R4508876
Chloride (Cl)	53.7		0.50	mg/L		14-FEB-19	R4509769
Nitrate (as N)	0.258		0.020	mg/L		14-FEB-19	R4509769
Total Kjeldahl Nitrogen	0.81		0.15	mg/L	15-FEB-19	15-FEB-19	R4509888
Phosphorus, Total	0.0714		0.0030	mg/L	15-FEB-19	19-FEB-19	R4512420
Sulfate (SO4) Organic / Inorganic Carbon	2.23		0.30	mg/L		14-FEB-19	R4509769
Dissolved Carbon Filtration Location	LAB					13-FEB-19	R4505827
Dissolved Organic Carbon	6.36		0.50	mg/L	13-FEB-19	13-FEB-19 19-FEB-19	R4505827
Bacteriological Tests	0.00		0.50			101 - 10-13	
E. Coli	0	PEHT	0	CFU/100mL		14-FEB-19	R4507107
Fecal Coliforms Total Metals	0	PEHT	0	CFU/100mL		14-FEB-19	R4507113
Aluminum (Al)-Total	0.0350		0.0050	mg/L	14-FEB-19	14-FEB-19	R4506908
Antimony (Sb)-Total	0.00011		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
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Beryllum (Be)-Total         -0.00010         mg/L         14-FEB-19         14-FEB-19         R4500           Bismuth (Bi)-Total         -0.000050         0.000050         mg/L         14-FEB-19         R4500           Boron (B)-Total         -0.010         0.011         0.011         mg/L         14-FEB-19         14-FEB-19         R4500           Cadmium (Cd)-Total         0.0000297         0.0000000         mg/L         14-FEB-19         14-FEB-19         R4500           Cadmium (Cd)-Total         -0.000010         0.000010         0.00000         mg/L         14-FEB-19         14-FEB-19         R4500           Chromium (Cr)-Total         -0.000010         0.00010         mg/L         14-FEB-19         14-FEB-19         R4500           Cobatl (Co)-Total         -0.00003         0.00000         mg/L         14-FEB-19         14-FEB-19         R4500           Lead (Pb)-Total         -0.0010         0.0010         mg/L         14-FEB-19         R4500           Magnasium (Mg)-Total         -0.0010         0.0010         mg/L         14-FEB-19         R4500           Magnasium (Mg)-Total         -0.0010         0.0010         mg/L         14-FEB-19         R4500           Magnasium (Mg)-Total         -0.0011 <t< th=""><th>Sample Details/Parameters</th><th>Result</th><th>Qualifier*</th><th>D.L.</th><th>Units</th><th>Extracted</th><th>Analyzed</th><th>Batch</th></t<>	Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
Total Metais         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         -         - <t< td=""><td>Sampled By: CLIENT on 11-FEB-19 @ 14:40</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>	Sampled By: CLIENT on 11-FEB-19 @ 14:40							
Beryllium (Be)-Total         -0.00010         mg/L         14-FEB-19         14-FEB-19         14-FEB-19         14-FEB-19         14-FEB-18         14-FEB-18         14-FEB-18         14-FEB-18         14-FEB-18         14-FEB-18         14-FEB-18         14-FEB-18         14-FEB-18         14-FEB-19         14-FEB-19         14-FEB-18								
Beryllium (Be)-Total         -0.00010         mg/L         14-FEB-19         14-FEB-19         R4500           Bismuth (Bi)-Total         -0.000050         0.000050         mg/L         14-FEB-19         14-FEB-18         14-FEB-18         14-FEB-19         14	Barium (Ba)-Total	0.0149		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Bismuth (B)-Total         <0.000050         mg/L         14-FEB-19         14-FEB-19         R4500           Cardinuin (Ca)-Total         0.0000287         0.0000050         mg/L         14-FEB-19         14-FEB-19         R4500           Cacium (Ca)-Total         22.0         0.0000050         mg/L         14-FEB-19         14-FEB-19         R4500           Cacium (Ca)-Total         22.0         0.0000         mg/L         14-FEB-19         14-FEB-19         R4500           Chromium (Cr)-Total         <0.000010	Beryllium (Be)-Total	<0.00010		0.00010	•	14-FEB-19		R4506908
Cadmium (Cd)-Total         0.0000297         0.0000000         mg/L         14-FEB-19         14-FEB-19         R4500           Calcium (Ca)-Total         22.0         0.0660         mg/L         14-FEB-19         14-FEB-19         R4500           Calcium (Ca)-Total         -0.000010         0.000010         0.000010         mg/L         14-FEB-19         14-FEB-19         R4500           Chromium (Cr)-Total         -0.00010         0.00010         mg/L         14-FEB-19         14-FEB-19         R4500           Copper (Cu)-Total         0.0049         0.0010         mg/L         14-FEB-19         14-FEB-19         R4500           Laad (Pb)-Total         0.0622         0.010         mg/L         14-FEB-19         14-FEB-19         R4500           Mangaese (Mn)-Total         0.0011         0.00050         mg/L         14-FEB-19         14-FEB-19         R4500           Mokybdenum (Mo)-Total         0.0011         0.00050         mg/L         14-FEB-19         14-FEB-19         R4500           Nickel (N)-Total         0.0020         mg/L         14-FEB-19         14-FEB-19         R4500           Mokybdenum (Mo)-Total         0.0020         mg/L         14-FEB-19         14-FEB-19         R4500           Silcen (Si	Bismuth (Bi)-Total	<0.000050		0.000050	•	14-FEB-19	14-FEB-19	R4506908
Cadmium (Cd)-Total         0.0000297         0.0000050         mg/L         14-FEB-19         14-FEB-19         R4500           Calcium (Ca)-Total         22.0         0.050         mg/L         14-FEB-19         14-FEB-19         R4500           Casium (Ca)-Total         -0.000010         0.000010         mg/L         14-FEB-19         14-FEB-19         R4500           Chromium (Cr)-Total         -0.00010         0.00010         mg/L         14-FEB-19         14-FEB-19         R4500           Copper (Cu)-Total         0.0049         0.0010         mg/L         14-FEB-19         14-FEB-19         R4500           Laad (Pb)-Total         0.062         0.010         mg/L         14-FEB-19         14-FEB-19         R4500           Magnesium (Ma)-Total         0.00011         0.00050         mg/L         14-FEB-19         14-FEB-19         R4500           Magnese (Mn)-Total         0.0011         0.00050         mg/L         14-FEB-19         14-FEB-19         R4500           Mokybdenum (Mo)-Total         0.0011         0.00050         mg/L         14-FEB-19         R4500           Mokybdenum (Mb)-Total         0.00173         0.00000         mg/L         14-FEB-19         R4500           Soleinum (Kb)-Total         0	Boron (B)-Total	<0.010		0.010	mg/L	14-FEB-19	14-FEB-19	R4506908
Cesium (Cs)-Total         c0.000010         0.000010         mg/L         14-FEB-19         14-FEB-19         R4500           Chomium (Ch)-Total         <0.00050	Cadmium (Cd)-Total	0.0000297		0.0000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Chromium Cr)-Total         -0.00050         mg/L         14-FEB-19	Calcium (Ca)-Total	22.0		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Cobalt (Co). Total         c0.00010         0.00010         mg/L         14+FEB-19         14+FEB-19         R4500           Copper (Cu)-Total         0.0049         0.0010         mg/L         14+FEB-19         14+FEB-19         R4500           Lead (Pb)-Total         0.00033         0.000050         mg/L         14+FEB-19         14+FEB-19         R4500           Lithium (L)-Total         0.0010         0.010         mg/L         14+FEB-19         14+FEB-19         R4500           Magnessium (Mg)-Total         0.00014         0.00050         mg/L         14+FEB-19         14+FEB-19         R4500           Molybdenum (Mo)-Total         0.00114         0.00050         mg/L         14+FEB-19         R4500           Nickel (Ni)-Total         0.0014         0.00050         mg/L         14+FEB-19         R4500           Phosphorus (P)-Total         0.092         0.050         mg/L         14+FEB-19         R4500           Potassium (K)-Total         0.00173         0.00020         mg/L         14+FEB-19         R4501           Selenium (Se)-Total         0.022         0.10         mg/L         14+FEB-19         R4502           Silicon (Si)-Total         0.0527         0.0010         mg/L         14+FEB-19	Cesium (Cs)-Total	<0.000010		0.000010	•	14-FEB-19	14-FEB-19	R4506908
Copper (Cu)-Total         0.0049         0.0010         mg/L         14-FEB-19         1	Chromium (Cr)-Total	<0.00050		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Iron (Fe)-Total         0.062         0.010         mg/L         14-FEB-19         14-FEB-19         R4500           Lead (Pb)-Total         0.000093         0.000050         mg/L         14-FEB-19	Cobalt (Co)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Iron (Fe)-Total         0.062         0.010         mgL         14-FEB-19         14-FEB-19         R4500           Lead (Pb)-Total         0.000033         0.000050         mgL         14-FEB-19         14-FEB-19         R4500           Magnesium (Mg)-Total         2.40         0.0050         mgL         14-FEB-19         14-FEB-19         R4500           Mangarese (Mn)-Total         0.0101         0.00050         mgL         14-FEB-19         14-FEB-19         R4500           Molybdenum (Mo)-Total         0.0011         0.00050         mgL         14-FEB-19         14-FEB-19         R4500           Nickel (Ni)-Total         0.000141         0.00050         mgL         14-FEB-19         14-FEB-19         R4500           Phosphorus (P)-Total         0.00173         0.00020         mgL         14-FEB-19         14-FEB-19         R4500           Rubidium (Rb)-Total         0.00173         0.00020         mgL         14-FEB-19         14-FEB-19         R4500           Silicon (Si)-Total         0.22         0.10         mgL         14-FEB-19         R4500           Siliver (Ag)-Total         0.0527         0.0010         mgL         14-FEB-19         R4500           Sultur (S)-Total         0.00220	Copper (Cu)-Total				•	14-FEB-19	14-FEB-19	R4506908
Lithium (Li)-Total         c0.0010         mg/L         14-FEB-19         14-FEB-19         R4500           Magnessium (Mg)-Total         0.0101         0.0050         mg/L         14-FEB-19         14-FEB-	Iron (Fe)-Total	0.062		0.010	•	14-FEB-19		R4506908
Lithium (Li)-Total         c0.0010         mg/L         14-FEB-19		0.000093		0.000050	•	14-FEB-19	14-FEB-19	R4506908
Magnesium (Mg)-Total         2.40         0.0050         mg/L         14-FEB-19         14-FEB-19         R4500           Manganese (Mn)-Total         0.0101         0.00050         mg/L         14-FEB-19         14-FEB-19 </td <td>Lithium (Li)-Total</td> <td></td> <td></td> <td></td> <td>•</td> <td>14-FEB-19</td> <td></td> <td>R4506908</td>	Lithium (Li)-Total				•	14-FEB-19		R4506908
Molybdenum (Mo)-Total         0.000141         0.000050         mg/L         14-FEB-19         14-FEB-19         R4500           Nickel (Ni)-Total         <0.00050	Magnesium (Mg)-Total	2.40		0.0050	•	14-FEB-19		R4506908
Nickel (Ni)-Total         c0.00050         0.00050         mg/L         14-FEB-19         14-FEB-19         R4500           Phosphorus (P)-Total         0.092         0.050         mg/L         14-FEB-19         14-FEB-19 <td>Manganese (Mn)-Total</td> <td>0.0101</td> <td></td> <td>0.00050</td> <td>mg/L</td> <td>14-FEB-19</td> <td>14-FEB-19</td> <td>R4506908</td>	Manganese (Mn)-Total	0.0101		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Phosphorus (P)-Total         0.092         0.050         mg/L         14-FEB-19         14-FEB-19         R4500           Potassium (K)-Total         2.27         0.050         mg/L         14-FEB-19         14-FEB-19         R4500           Rubidium (Rb)-Total         0.00173         0.00020         mg/L         14-FEB-19         14-FEB-19         R4500           Selenium (Se)-Total         0.00066         0.000050         mg/L         14-FEB-19         14-FEB-19         R4500           Siliver (Ag)-Total         0.22         0.10         mg/L         14-FEB-19         14-FEB-19         R4500           Solum (Na)-Total         0.027         0.0010         mg/L         14-FEB-19         14-FEB-19         R4500           Sulfur (S)-Total         0.0527         0.0010         mg/L         14-FEB-19         14-FEB-19         R4500           Sulfur (S)-Total         1.11         0.50         mg/L         14-FEB-19         14-FEB-19         R4500           Sulfur (Th)-Total         <0.00020	Molybdenum (Mo)-Total	0.000141		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Potassium (K)-Total         2.27         0.050         mg/L         14-FEB-19         14-FEB-19         R4500           Rubidium (Rb)-Total         0.00173         0.00020         mg/L         14-FEB-19         14-FEB-19         R4500           Selenium (Se)-Total         0.00066         0.000050         mg/L         14-FEB-19         14-FEB-19         R4500           Silicon (Si)-Total         0.22         0.10         mg/L         14-FEB-19         14-FEB-19         R4500           Soliwer (Ag)-Total         0.22         0.10         mg/L         14-FEB-19         14-FEB-19         R4500           Soliwer (Ag)-Total         0.22         0.10         mg/L         14-FEB-19         14-FEB-19         R4500           Soliwer (Ag)-Total         0.0557         0.0010         mg/L         14-FEB-19         14-FEB-19         R4500           Sulfur (S)-Total         1.11         0.50         mg/L         14-FEB-19         14-FEB-19         R4500           Sulfur (S)-Total         0.0020         0.00020         mg/L         14-FEB-19         14-FEB-19         R4500           Sulfur (Te)-Total         0.00020         0.000010         mg/L         14-FEB-19         14-FEB-19         R4500           Thorium (Th)-To	Nickel (Ni)-Total	<0.00050		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Rubidium (Rb)-Total         0.00173         0.00020         mg/L         14-FEB-19         14-FEB-19         R4500           Selenium (Se)-Total         0.000066         0.000050         mg/L         14-FEB-19         14-FEB-19         R4500           Silicon (Si)-Total         0.22         0.10         mg/L         14-FEB-19         14-FEB-19         R4500           Silver (Ag)-Total         0.22         0.10         mg/L         14-FEB-19         14-FEB-19         R4500           Sodium (Na)-Total         0.22         0.10         mg/L         14-FEB-19         14-FEB-19         R4500           Sodium (Na)-Total         0.0527         0.0010         mg/L         14-FEB-19         14-FEB-19         R4500           Sulfur (S)-Total         1.11         0.50         mg/L         14-FEB-19         14-FEB-19         R4500           Sulfur (S)-Total         1.11         0.50         mg/L         14-FEB-19         14-FEB-19         R4500           Sulfur (S)-Total         0.00020         0.00020         mg/L         14-FEB-19         R4500           Thorium (Th)-Total         0.00010         0.00010         mg/L         14-FEB-19         R4500           Tin (Sn)-Total         <0.00010	Phosphorus (P)-Total	0.092		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Selenium (Se)-Total         0.000066         0.000050         mg/L         14-FEB-19         14-FEB-19         R4506           Silicon (Si)-Total         0.22         0.10         mg/L         14-FEB-19         14-FEB-19         R4506           Silver (Ag)-Total         -0.000050         0.000050         mg/L         14-FEB-19         14-FEB-19         R4506           Sodium (Na)-Total         30.7         0.050         mg/L         14-FEB-19         14-FEB-19         R4506           Strontium (Sr)-Total         0.0527         0.0010         mg/L         14-FEB-19         14-FEB-19         R4506           Sulfur (S)-Total         1.11         0.50         mg/L         14-FEB-19         14-FEB-19         R4506           Sulfur (S)-Total         1.11         0.50         mg/L         14-FEB-19         14-FEB-19         R4506           Tellurium (Te)-Total         <0.00020	Potassium (K)-Total	2.27		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Silicon (Si)-Total         0.22         0.10         mg/L         14-FEB-19         14-FEB-19         R4500           Silver (Ag)-Total         <0.000050	Rubidium (Rb)-Total	0.00173		0.00020	mg/L	14-FEB-19	14-FEB-19	R4506908
Silver (Ag)-Total       <0.000050	Selenium (Se)-Total	0.000066		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Sodium (Na)-Total         30.7         0.050         mg/L         14-FEB-19         14-FEB-19         R4506           Strontium (Sr)-Total         0.0527         0.0010         mg/L         14-FEB-19         14-FEB-19         R4506           Sulfur (S)-Total         1.11         0.50         mg/L         14-FEB-19         14-FEB-19         R4506           Tellurium (Te)-Total         <0.00020	Silicon (Si)-Total	0.22		0.10	mg/L	14-FEB-19	14-FEB-19	R4506908
Strontium (Sr)-Total       0.0527       0.0010       mg/L       14-FEB-19       14-FEB-19       R4506         Sulfur (S)-Total       1.11       0.50       mg/L       14-FEB-19       14-FEB-19       R4506         Tellurium (Te)-Total       <0.00020	Silver (Ag)-Total	<0.000050		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Sulfur (S)-Total       1.11       0.50       mg/L       14-FEB-19       14-FEB-19       R4506         Tellurium (Te)-Total       <0.00020	Sodium (Na)-Total	30.7		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Tellurium (Te)-Total       <0.00020	Strontium (Sr)-Total	0.0527		0.0010	mg/L	14-FEB-19	14-FEB-19	R4506908
Thallium (TI)-Total       <0.000010	Sulfur (S)-Total	1.11		0.50	mg/L	14-FEB-19	14-FEB-19	R4506908
Thorium (Th)-Total       <0.00010	Tellurium (Te)-Total	<0.00020		0.00020	mg/L	14-FEB-19	14-FEB-19	R4506908
Tin (Sn)-Total       <0.00010	Thallium (TI)-Total	<0.000010		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908
Tin (Sn)-Total       <0.00010	Thorium (Th)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Titanium (Ti)-Total       0.00128       0.00030       mg/L       14-FEB-19       14-FEB-19       R4504         Tungsten (W)-Total       <0.00010	Tin (Sn)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Uranium (U)-Total       0.000027       0.000010       mg/L       14-FEB-19       14-FEB-19       R4504         Vanadium (V)-Total       <0.00050	Titanium (Ti)-Total	0.00128		0.00030	mg/L	14-FEB-19	14-FEB-19	R4506908
Uranium (U)-Total       0.000027       0.000010       mg/L       14-FEB-19       14-FEB-19       R4504         Vanadium (V)-Total       <0.00050	Tungsten (W)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Zinc (Zn)-Total       0.0039       0.0030       mg/L       14-FEB-19       14-FEB-19       R4506         Zirconium (Zr)-Total       <0.00030	Uranium (U)-Total	0.000027		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908
Zirconium (Zr)-Total	Vanadium (V)-Total	<0.00050		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Aggregate Organics         2.9         2.0         mg/L         14-FEB-19         19-FEB-19         R4513           L2232152-5         OL-9         Sampled By:         CLIENT on 11-FEB-19 @ 14:16         Image: Client of the second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second se	Zinc (Zn)-Total	0.0039		0.0030	mg/L	14-FEB-19	14-FEB-19	R4506908
BOD         2.9         2.0         mg/L         14-FEB-19         19-FEB-19         R4513           L2232152-5         OL-9         OL-9         Image: CLIENT on 11-FEB-19 @ 14:16         Im	Zirconium (Zr)-Total	<0.00030		0.00030	mg/L	14-FEB-19	14-FEB-19	R4506908
L2232152-5 OL-9 Sampled By: CLIENT on 11-FEB-19 @ 14:16	Aggregate Organics							
Sampled By: CLIENT on 11-FEB-19 @ 14:16	BOD	2.9		2.0	mg/L	14-FEB-19	19-FEB-19	R4513627
	Sampled By: CLIENT on 11-FEB-19 @ 14:16							
Physical Tests	Physical Tests							

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2232152-5 OL-9 Sampled By: CLIENT on 11-FEB-19 @ 14:16							
Matrix: WATER							
Physical Tests			10				
Hardness (as CaCO3)	80	HTC	10	mg/L		14-FEB-19	
pH	7.59		0.10	pH units		14-FEB-19	R4508730
Total Suspended Solids Anions and Nutrients	3.1		2.0	mg/L	14-FEB-19	15-FEB-19	R4509378
Alkalinity, Total (as CaCO3)	80		10	ma/l		14-FEB-19	R4508730
Ammonia, Total (as N)	0.210		0.010	mg/L		14-FEB-19 14-FEB-19	R4508730
Chloride (Cl)	51.5		0.010	mg/L		14-FEB-19	
Nitrate (as N)				mg/L		-	R4509769
	0.299		0.020	mg/L	15-FEB-19	14-FEB-19 15-FEB-19	R4509769 R4509888
Total Kjeldahl Nitrogen	1.02		0.15	mg/L			
Phosphorus, Total	0.151		0.0030	mg/L	15-FEB-19	19-FEB-19	R4512420
Sulfate (SO4) Organic / Inorganic Carbon	2.52		0.30	mg/L		14-FEB-19	R4509769
Dissolved Carbon Filtration Location	LAB					13-FEB-19	R4505827
Dissolved Organic Carbon	8.23		0.50	ma/l	13-FEB-19	19-FEB-19	R4505827
Bacteriological Tests	0.23		0.50	mg/L	13-FED-19	19-FED-19	R4313112
E. Coli	14	PEHT	0	CFU/100mL		14-FEB-19	R4507107
Fecal Coliforms	21	PEHT	0	CFU/100mL		14-FEB-19	R4507113
Total Metals	21		Ū	or of roomE		1112010	114007110
Aluminum (Al)-Total	0.0658		0.0050	mg/L	14-FEB-19	14-FEB-19	R4506908
Antimony (Sb)-Total	0.00016		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Arsenic (As)-Total	0.00059		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Barium (Ba)-Total	0.0187		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Boron (B)-Total	0.010		0.010	mg/L	14-FEB-19	14-FEB-19	R4506908
Cadmium (Cd)-Total	0.0000519		0.0000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Calcium (Ca)-Total	27.1		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908
Chromium (Cr)-Total	<0.00050		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Cobalt (Co)-Total	0.00011		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Copper (Cu)-Total	0.0024		0.0010	mg/L	14-FEB-19	14-FEB-19	R4506908
Iron (Fe)-Total	0.091		0.010	mg/L	14-FEB-19	14-FEB-19	R4506908
Lead (Pb)-Total	0.000162		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Lithium (Li)-Total	<0.0010		0.000000	mg/L	14-FEB-19	14-FEB-19	R4506908
Magnesium (Mg)-Total	2.92		0.0050	•	14-FEB-19	14-FEB-19	R4506908
Magnese (Mn)-Total				mg/L	14-FEB-19 14-FEB-19	14-FEB-19 14-FEB-19	
Manganese (Min)-Total Molybdenum (Mo)-Total	0.0390 0.000217		0.00050	mg/L mg/L	14-FEB-19 14-FEB-19	14-FEB-19 14-FEB-19	R4506908
			0.000050	•			R4506908
Nickel (Ni)-Total	< 0.00050		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Phosphorus (P)-Total	0.201		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Potassium (K)-Total	4.38		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Rubidium (Rb)-Total	0.00210		0.00020	mg/L	14-FEB-19	14-FEB-19	R4506908
Selenium (Se)-Total	0.000094		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2232152-5 OL-9							
Sampled By: CLIENT on 11-FEB-19 @ 14:16 Matrix: WATER							
Total Metals							
Silicon (Si)-Total	0.43		0.10	mg/L	14-FEB-19	14-FEB-19	R4506908
Silver (Ag)-Total	<0.000050		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Sodium (Na)-Total	29.8		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Strontium (Sr)-Total	0.0638		0.0010	mg/L	14-FEB-19	14-FEB-19	R4506908
Sulfur (S)-Total	0.96		0.50	mg/L	14-FEB-19	14-FEB-19	R4506908
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	14-FEB-19	14-FEB-19	R4506908
Thallium (TI)-Total	<0.000010		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908
Thorium (Th)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Tin (Sn)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Titanium (Ti)-Total	0.00281		0.00030	mg/L	14-FEB-19	14-FEB-19	R4506908
Tungsten (W)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Uranium (U)-Total	0.000050		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908
Vanadium (V)-Total	<0.00050		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Zinc (Zn)-Total	0.0103		0.0030	mg/L	14-FEB-19	14-FEB-19	R4506908
Zirconium (Zr)-Total	<0.00030		0.00030	mg/L	14-FEB-19	14-FEB-19	R4506908
Aggregate Organics							
BOD	2.7		2.0	mg/L	14-FEB-19	19-FEB-19	R4513627
L2232152-12 OL-1-BOTTOM Sampled By: CLIENT on 11-FEB-19 Matrix: WATER							
Physical Tests							
Total Suspended Solids	<2.0		2.0	mg/L	15-FEB-19	16-FEB-19	R4511468
Anions and Nutrients							
Phosphorus, Total	0.0193		0.0030	mg/L	15-FEB-19	19-FEB-19	R4512420
Total Metals							
Iron (Fe)-Total	0.059		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
L2232152-13 TRIB 4 Sampled By: CLIENT on 11-FEB-19 @ 13:00 Matrix: WATER							
Physical Tests							
Hardness (as CaCO3)	97	HTC	10	mg/L		14-FEB-19	
pH	7.03		0.10	pH units		14-FEB-19	R4508730
Total Suspended Solids Anions and Nutrients	10.5		2.0	mg/L	14-FEB-19	15-FEB-19	R4509378
Alkalinity, Total (as CaCO3)	108		10	mg/L		14-FEB-19	R4508730
Ammonia, Total (as N)	0.94	DLHC	0.10	mg/L		14-FEB-19	R4508876
Chloride (Cl)	6.69		0.50	mg/L		14-FEB-19	R4509769
Nitrate (as N)	0.843		0.020	mg/L		14-FEB-19	R4509769
Total Kjeldahl Nitrogen	2.37		0.15	mg/L	15-FEB-19	15-FEB-19	R4509888
Phosphorus, Total	0.572		0.0030	mg/L	15-FEB-19	19-FEB-19	R4512420
Sulfate (SO4)	3.65		0.30	mg/L		14-FEB-19	R4509769
Organic / Inorganic Carbon							
Dissolved Carbon Filtration Location	LAB					13-FEB-19	R4505827

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
.2232152-13 TRIB 4 Sampled By: CLIENT on 11-FEB-19 @ 13:00 Matrix: WATER							
Organic / Inorganic Carbon							
Dissolved Organic Carbon	22.9		0.50	mg/L	13-FEB-19	19-FEB-19	R451511
Bacteriological Tests							
E. Coli	4	PEHT	0	CFU/100mL		14-FEB-19	R450710
Fecal Coliforms	5	PEHT	0	CFU/100mL		14-FEB-19	R45071
Total Metals							
Aluminum (AI)-Total	0.169		0.0050	mg/L	14-FEB-19	14-FEB-19	R450690
Antimony (Sb)-Total	0.00013		0.00010	mg/L	14-FEB-19	14-FEB-19	R450690
Arsenic (As)-Total	0.00053		0.00010	mg/L	14-FEB-19	14-FEB-19	R450690
Barium (Ba)-Total	0.0251		0.00010	mg/L	14-FEB-19	14-FEB-19	R450690
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R450690
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	14-FEB-19	14-FEB-19	R45069
Boron (B)-Total	0.011		0.010	mg/L	14-FEB-19	14-FEB-19	R45069
Cadmium (Cd)-Total	0.0000294		0.0000050	mg/L	14-FEB-19	14-FEB-19	R45069
Calcium (Ca)-Total	32.5		0.050	mg/L	14-FEB-19	14-FEB-19	R45069
Cesium (Cs)-Total	0.000011		0.000010	mg/L	14-FEB-19	14-FEB-19	R45069
Chromium (Cr)-Total	0.00055		0.00050	mg/L	14-FEB-19	14-FEB-19	R45069
Cobalt (Co)-Total	0.00047		0.00010	mg/L	14-FEB-19	14-FEB-19	R45069
Copper (Cu)-Total	0.0052		0.0010	mg/L	14-FEB-19	14-FEB-19	R45069
Iron (Fe)-Total	0.206		0.010	mg/L	14-FEB-19	14-FEB-19	R45069
Lead (Pb)-Total	0.000167		0.000050	mg/L	14-FEB-19	14-FEB-19	R45069
Lithium (Li)-Total	<0.0010		0.0010	mg/L	14-FEB-19	14-FEB-19	R45069
Magnesium (Mg)-Total	3.72		0.0050	mg/L	14-FEB-19	14-FEB-19	R45069
Manganese (Mn)-Total	0.156		0.00050	mg/L	14-FEB-19	14-FEB-19	R45069
Molybdenum (Mo)-Total	0.000509		0.000050	mg/L	14-FEB-19	14-FEB-19	R45069
Nickel (Ni)-Total	<0.00050		0.00050	mg/L	14-FEB-19	14-FEB-19	R45069
Phosphorus (P)-Total	0.635		0.050	mg/L	14-FEB-19	14-FEB-19	R45069
Potassium (K)-Total	11.3		0.050	mg/L	14-FEB-19	14-FEB-19	
Rubidium (Rb)-Total	0.00236		0.00020	mg/L	14-FEB-19	14-FEB-19	R45069
Selenium (Se)-Total	0.000198		0.000050	mg/L	14-FEB-19	14-FEB-19	R45069
Silicon (Si)-Total	2.00		0.10	mg/L	14-FEB-19	14-FEB-19	R45069
Silver (Ag)-Total	<0.000050		0.000050	mg/L	14-FEB-19	14-FEB-19	R45069
Sodium (Na)-Total	3.18		0.050	mg/L	14-FEB-19	14-FEB-19	R45069
Strontium (Sr)-Total	0.0599		0.0010	mg/L	14-FEB-19	14-FEB-19	R45069
Sulfur (S)-Total	1.32		0.50	mg/L	14-FEB-19	14-FEB-19	
Tellurium (Te)-Total				•			R45069
	<0.00020		0.00020	mg/L	14-FEB-19	14-FEB-19	R45069
Thallium (TI)-Total	<0.000010		0.000010	mg/L	14-FEB-19	14-FEB-19	R45069
Thorium (Th)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R45069
Tin (Sn)-Total	< 0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R45069
Titanium (Ti)-Total	0.00680		0.00030	mg/L	14-FEB-19	14-FEB-19	R45069
Tungsten (W)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R45069
Uranium (U)-Total	0.000289		0.000010	mg/L	14-FEB-19	14-FEB-19	R45069

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2232152-13 TRIB 4							
Sampled By: CLIENT on 11-FEB-19 @ 13:00 Matrix: WATER							
Total Metals							
Vanadium (V)-Total	0.00116		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Zinc (Zn)-Total	0.0081		0.0030	mg/L	14-FEB-19	14-FEB-19	R4506908
Zirconium (Zr)-Total	<0.00030		0.00030	mg/L	14-FEB-19	14-FEB-19	R4506908
Aggregate Organics							
BOD	12.6		2.0	mg/L	14-FEB-19	19-FEB-19	R4513627
L2232152-14 TRIB 5 Sampled By: CLIENT on 11-FEB-19 @ 13:11 Matrix: WATER							
Physical Tests							
Hardness (as CaCO3)	96	нтс	10	mg/L		14-FEB-19	
рН	7.15		0.10	pH units		14-FEB-19	R4508730
Total Suspended Solids	5.5		2.0	mg/L	14-FEB-19	15-FEB-19	R4509378
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	109		10	mg/L		14-FEB-19	R4508730
Ammonia, Total (as N)	0.81	DLHC	0.10	mg/L		14-FEB-19	R4508876
Chloride (Cl)	6.75		0.50	mg/L		14-FEB-19	R4509769
Nitrate (as N)	0.718		0.020	mg/L		14-FEB-19	R4509769
Total Kjeldahl Nitrogen	2.25		0.15	mg/L	15-FEB-19	15-FEB-19	R4509888
Phosphorus, Total	0.512		0.0030	mg/L	15-FEB-19	19-FEB-19	R4512420
Sulfate (SO4)	3.39		0.30	mg/L		14-FEB-19	R4509769
Organic / Inorganic Carbon							
Dissolved Carbon Filtration Location	LAB					13-FEB-19	R4505827
Dissolved Organic Carbon	22.1		0.50	mg/L	13-FEB-19	19-FEB-19	R4515112
Bacteriological Tests							
E. Coli	1	PEHT	0	CFU/100mL		14-FEB-19	R4507107
Fecal Coliforms	2	PEHT	0	CFU/100mL		14-FEB-19	R4507113
Total Metals							
Aluminum (Al)-Total	0.128		0.0050	mg/L	14-FEB-19	14-FEB-19	
Antimony (Sb)-Total	0.00013		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Arsenic (As)-Total	0.00062		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Barium (Ba)-Total	0.0218		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Boron (B)-Total	0.011		0.010	mg/L	14-FEB-19	14-FEB-19	R4506908
Cadmium (Cd)-Total	0.0000238		0.0000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Calcium (Ca)-Total	32.6		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908
Chromium (Cr)-Total	0.00160		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Cobalt (Co)-Total	0.00046		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Copper (Cu)-Total	0.0052		0.0010	mg/L	14-FEB-19	14-FEB-19	R4506908
Iron (Fe)-Total	0.180		0.010	mg/L	14-FEB-19	14-FEB-19	R4506908
Lead (Pb)-Total	0.000137		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908

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# ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2232152-14 TRIB 5 Sampled By: CLIENT on 11-FEB-19 @ 13:11 Matrix: WATER							
Total Metals							
Lithium (Li)-Total	<0.0010		0.0010	mg/L	14-FEB-19	14-FEB-19	R4506908
Magnesium (Mg)-Total	3.61		0.0050	mg/L	14-FEB-19	14-FEB-19	R4506908
Manganese (Mn)-Total	0.239		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Molybdenum (Mo)-Total	0.000561		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Nickel (Ni)-Total	0.00056		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Phosphorus (P)-Total	0.587		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Potassium (K)-Total	11.5		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Rubidium (Rb)-Total	0.00255		0.00020	mg/L	14-FEB-19	14-FEB-19	R4506908
Selenium (Se)-Total	0.000215		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Silicon (Si)-Total	1.85		0.10	mg/L	14-FEB-19	14-FEB-19	R4506908
Silver (Ag)-Total	<0.000050		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Sodium (Na)-Total	3.45		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Strontium (Sr)-Total	0.0589		0.0010	mg/L	14-FEB-19	14-FEB-19	R4506908
Sulfur (S)-Total	1.25		0.50	mg/L	14-FEB-19	14-FEB-19	R4506908
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	14-FEB-19	14-FEB-19	R4506908
Thallium (TI)-Total	<0.000010		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908
Thorium (Th)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Tin (Sn)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Titanium (Ti)-Total	0.00484		0.00030	mg/L	14-FEB-19	14-FEB-19	R4506908
Tungsten (W)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Uranium (U)-Total	0.000245		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908
Vanadium (V)-Total	0.00125		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Zinc (Zn)-Total	0.0137		0.0030	mg/L	14-FEB-19	14-FEB-19	R4506908
Zirconium (Zr)-Total	<0.00030		0.00030	mg/L	14-FEB-19	14-FEB-19	R4506908
Aggregate Organics							
BOD	11.1		2.0	mg/L	14-FEB-19	19-FEB-19	R4513627

# **Reference Information**

## **QC Samples with Qualifiers & Comments:**

QC Type Descri	iption	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate		Fecal Coliforms	DUP-H	L2232152-1, -13, -14, -2, -3, -4, -5
Sample Param	eter Qualifier ke	y listed:		
Qualifier	Description	-		
DLHC	Detection Limit R	aised: Dilution required due to high	concentration of test ana	ilyte(s).
DLUI		aised: Unknown Interference genera		
DUP-H	Duplicate results	outside ALS DQO, due to sample h	eterogeneity.	
нтс	Hardness was ca	culated from Total Ca and/or Mg co	incentrations and may be	e biased high (dissolved Ca/Mg results unavailable).
PEHT	Parameter Excee	ded Recommended Holding Time P	rior to Analysis	
est Method R	eferences:			
ALS Test Code	Matrix	Test Description	Method Refere	ence**
ALK-WT This analysis is colourimetric m	01	Alkalinity, Total (as CaCO3) procedures adapted from EPA Meth	EPA 310.2 od 310.2 "Alkalinity". Tot	al Alkalinity is determined using the methyl orange
BOD-WT	Water	BOD	APHA 5210 B	
oxygen deman dissolved oxyg	d (BOD) are detern en meter. Dissolve	nined by diluting and incubating a sa	ample for a specified time / filtering the sample thro	al Oxygen Demand (BOD)". All forms of biochemical e period, and measuring the oxygen depletion using a bugh a glass fibre filter prior to dilution. Carbonaceous abation.
CL-IC-N-WT Inorganic anior	Water ns are analyzed by	Chloride by IC Ion Chromatography with conductivi	EPA 300.1 (mo ty and/or UV detection.	od)
Analysis condu Protection Act		with the Protocol for Analytical Met	hods Used in the Asses	sment of Properties under Part XV.1 of the Environment
	the organic carbon			is packed with an oxidative catalyst. The water is ted in a carrier gas and is measured by a non-dispersive
EC-MF-WT A 100 mL volu	Water me of sample is filte	E. coli ered through a membrane, the mem	SM 9222D brane is placed on mFC	-BCIG agar and incubated at 44.5 –0 .2 °C for 24 – 2 h.
Method ID: WT		<b>v</b>	·	
FC-MF-WT A 100mL volun WT-TM-1200	Water ne of sample is filte	Fecal Coliforms red through a membrane, the mem	SM 9222D prane is placed on mFC	agar and incubated at 24–2h@44.5–0.2°C. Method ID:
	known as Total Ha	Hardness ardness) is calculated from the sum n concentrations are preferentially u		ium concentrations, expressed in CaCO3 equivalents. Iculation.
MET-T-CCMS-V Water samples		Total Metals in Water by CRC nitric <b>ଣୟମMୁସ</b> rochloric acids, and an		20A (mod)
Method Limitat	ion (re: Sulfur): Sul	fide and volatile sulfur species may	not be recovered by this	method.
Analysis condu Protection Act		with the Protocol for Analytical Met	hods Used in the Asses	sment of Properties under Part XV.1 of the Environment
NH3-F-WT	Water	Ammonia in Water by Fluores	cence EPA 350.1	
				m J. Environ. Monit., 2005, 7, 37 - 42, The Royal Societ e levels of ammonium in seawater", Roslyn J. Waston e
NH3-F-WT	Water	Ammonia in Water by Fluores	cence J. ENVIRON.	MONIT., 2005, 7, 37-42, RSC
				m J. Environ. Monit., 2005, 7, 37 - 42, The Royal Societ e levels of ammonium in seawater", Roslyn J. Waston e
NO3-IC-WT Inorganic anior	Water ns are analyzed by	Nitrate in Water by IC Ion Chromatography with conductivi	EPA 300.1 (mo ty and/or UV detection.	od)
P-T-COL-WT	Water	Total P in Water by Colour	APHA 4500-P	PHOSPHORUS

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is deteremined colourimetrically after persulphate digestion of the sample.

# **Reference Information**

PH-WT Water samples are ar	Water nalyzed directly	pH v by a calibrated pH meter.	APHA 4500 H-Electrode								
		ith the Protocol for Analytical Methone for samples under this regulation	ods Used in the Assessment of Properties under Part XV.1 of the Environmental n is 28 days								
SO4-IC-N-WT	Water	Sulfate in Water by IC	EPA 300.1 (mod)								
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.											
SOLIDS-TSS-WT Water Suspended solids APHA 2540 D-Gravimetric A well-mixed sample is filtered through a weighed standard glass fibre filter and the residue retained is dried in an oven at 104–1°C for a minimum of four hours or until a constant weight is achieved.											
2	0.	Total Kjeldahl Nitrogen ocedures adapted from APHA Metho a analysis using an automated color	od 4500-Norg "Nitrogen (Organic)". Total Kjeldahl Nitrogen is determined by								
** ALS test methods may	/ incorporate m	nodifications from specified reference	ce methods to improve performance.								
The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:											
Laboratory Definition	Code Lab	oratory Location									

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Chain of Custody Numbers:	

#### chain of custouy runns

LON-180129

### **GLOSSARY OF REPORT TERMS**

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid weight of sample

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory. UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION. Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



		Workorder:	L2232152	2 R	Report Date: 20	D-FEB-19		Page 1 of 12
	HUTCHINSON ENVIRON 501 Krug St. Suite 202 Kitchener ON N2B 1L3	MENTAL SCIENC	ES LTD					
Contact:	Brent Parsons							
Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALK-WT	Water							
Batch R	4508730							
WG2988667-16		WG2988667-1	-					
Alkalinity, Tota <b>WG2988667-1</b> 4		95	95		mg/L	0.2	20	14-FEB-19
Alkalinity, Tota			108.3		%		85-115	14-FEB-19
WG2988667-13 Alkalinity, Tota			<10		mg/L		10	14-FEB-19
BOD-WT	Water							
Batch R	4513593							
WG2988229-2	DUP	L2231330-3						
BOD		<2.0	<2.0	RPD-NA	mg/L	N/A	20	18-FEB-19
WG2988229-3 BOD	LCS		99.0		%		85-115	18-FEB-19
WG2988229-1 BOD	МВ		<2.0		mg/L		2	18-FEB-19
	1510005		12.0		<u>9</u> / <b>-</b>		-	
Batch R WG2989072-2	4513627 DUP	L2232371-1						
BOD	DOP	<2.0	<2.0	RPD-NA	mg/L	N/A	20	19-FEB-19
WG2989072-3	LCS				-			
BOD			96.0		%		85-115	19-FEB-19
WG2989072-1	MB							
BOD			<2.0		mg/L		2	19-FEB-19
CL-IC-N-WT	Water							
Batch R	4509769							
WG2988849-14	DUP	WG2988849-1						
Chloride (Cl)		6.76	6.69		mg/L	1.0	20	14-FEB-19
WG2988849-4 Chloride (Cl)	DUP	WG2988849-3 20.0	20.0		mg/L	0.1	20	14-FEB-19
WG2988849-12		20.0	20.0			0.1	20	
Chloride (Cl)			102.3		%		90-110	14-FEB-19
WG2988849-2	LCS							
Chloride (Cl)			102.3		%		90-110	14-FEB-19
WG2988849-1 Chloride (Cl)	MB		<0.50		mg/L		0.5	14-FEB-19
WG2988849-11 Chloride (Cl)	MB		<0.50		mg/L		0.5	14-FEB-19
WG2988849-15 Chloride (Cl)	5 MS	WG2988849-1	<b>3</b> 104.5		%		75-125	14-FEB-19
WG2988849-5	MS	WG2988849-3						



Quality Control Report									
			Workorder:	L2232152	Re	port Date: 20-F	EB-19		Page 2 of 12
Client:	501 Krug	SON ENVIRONM St. Suite 202 ON N2B 1L3	MENTAL SCIENC	ES LTD					
Contact:	Brent Pars	sons							
Test		Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CL-IC-N-WT		Water							
Batch F	R4509769								
WG2988849-5	MS		WG2988849-3						
Chloride (CI)				105.9		%		75-125	14-FEB-19
DOC-WT		Water							
Batch F	R4515112								
WG2988513-3	DUP		L2232152-1						
Dissolved Org	anic Carbo	on	5.88	6.03		mg/L	2.6	25	19-FEB-19
WG2988513-2						24			
Dissolved Org		on		96.2		%		70-130	19-FEB-19
WG2988513-1 Dissolved Org		n		<0.50		mg/L		0.5	19-FEB-19
WG2988513-4			L2232152-1	<0.50		ing/E		0.0	19-FED-19
Dissolved Org	-	on	L2232152-1	100.2		%		70-130	19-FEB-19
EC-MF-WT		Water							
-	R4507107	Valer							
WG2988279-3			L2232152-3						
E. Coli			0	<10	RPD-NA	CFU/100mL	N/A	65	14-FEB-19
WG2988279-1	МВ								
E. Coli				0		CFU/100mL		1	14-FEB-19
FC-MF-WT		Water							
Batch F	R4507113								
WG2988283-3	-		L2232152-5	40					
Fecal Coliforn			21	<10	DUP-H	CFU/100mL	N/A	65	14-FEB-19
WG2988283-1 Fecal Coliforn				0		CFU/100mL		1	14-FEB-19
		Water		0					
MET-T-CCMS-W	r 4506908	water							
Batch F WG2988595-4			WG2988595-3						
Aluminum (Al			<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	14-FEB-19
Antimony (Sb)	)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	14-FEB-19
Arsenic (As)-7	Fotal		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	14-FEB-19
Barium (Ba)-T	otal		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	14-FEB-19
Beryllium (Be)	-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	14-FEB-19
Bismuth (Bi)-1	Fotal		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	14-FEB-19
Boron (B)-Tot	al		<0.010	<0.010	RPD-NA	mg/L	N/A	20	14-FEB-19
Cadmium (Cd	l)-Total		<0.0000050	<0.0000050		mg/L	N/A	20	14-FEB-19
1									



Report Date: 20-FEB-19

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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD 501 Krug St. Suite 202

Workorder: L2232152

Kitchener ON N2B 1L3

Brent Parsons

Contact:

		Defens	<b>D</b> !!	Out all (	11-24		1.1	A
Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT	Water							
Batch R4506908								
WG2988595-4 DUP Calcium (Ca)-Total		WG2988595-3 <0.050	<0.050	RPD-NA	mg/L	N/A	20	14-FEB-19
Chromium (Cr)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20 20	
Cesium (Cs)-Total		<0.000000	<0.000000		mg/L	N/A	20 20	14-FEB-19
Cobalt (Co)-Total		<0.00010	<0.00010		mg/L			14-FEB-19
Copper (Cu)-Total		<0.0010	<0.0010	RPD-NA RPD-NA	mg/L	N/A N/A	20 20	14-FEB-19
Iron (Fe)-Total		<0.010	<0.010	RPD-NA	mg/L	N/A	20 20	14-FEB-19
Lead (Pb)-Total		<0.000050	<0.000050		mg/L	N/A	20 20	14-FEB-19
Lithium (Li)-Total		<0.0010	<0.000030	RPD-NA	mg/L	N/A	20 20	14-FEB-19
Magnesium (Mg)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20 20	14-FEB-19 14-FEB-19
Magnesiam (Mg) Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	
Molybdenum (Mo)-Tota	I	0.000072	0.000068	KFD-NA	mg/L	5.3	20 20	14-FEB-19 14-FEB-19
Nickel (Ni)-Total	I.	<0.00050	< 0.00050	RPD-NA	mg/L	5.5 N/A	20	14-FEB-19
Phosphorus (P)-Total		<0.050	<0.050	RPD-NA	mg/L	N/A	20	14-FEB-19
Potassium (K)-Total		<0.050	<0.050	RPD-NA	mg/L	N/A	20	14-FEB-19
Rubidium (Rb)-Total		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	14-FEB-19
Selenium (Se)-Total		<0.00020	<0.00020		mg/L	N/A	20	14-FEB-19
Silicon (Si)-Total		<0.10	<0.10	RPD-NA	mg/L	N/A	20	14-FEB-19
Silver (Ag)-Total		<0.000050	<0.000050		mg/L	N/A	20	14-FEB-19
Sodium (Na)-Total		<0.050	<0.050	RPD-NA	mg/L	N/A	20	14-FEB-19
Strontium (Sr)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	14-FEB-19
Sulfur (S)-Total		<0.50	<0.50	RPD-NA	mg/L	N/A	25	14-FEB-19
Thallium (TI)-Total		<0.000010	<0.000010		mg/L	N/A	20	14-FEB-19
Tellurium (Te)-Total		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	14-FEB-19
Thorium (Th)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	25	14-FEB-19
Tin (Sn)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	14-FEB-19
Titanium (Ti)-Total		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	14-FEB-19
Tungsten (W)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	14-FEB-19
Uranium (U)-Total		<0.000010	<0.000010		mg/L	N/A	20	14-FEB-19
Vanadium (V)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	14-FEB-19
Zinc (Zn)-Total		<0.0030	<0.0030	RPD-NA	mg/L	N/A	20	14-FEB-19
Zirconium (Zr)-Total		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	14-FEB-19
WG2988595-2 LCS Aluminum (Al)-Total			97.8		%		80-120	14-FEB-19



Report Date: 20-FEB-19

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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD 501 Krug St. Suite 202

Workorder: L2232152

Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT	Water							
Batch R45069	08							
WG2988595-2 LCS	6		00.0		0/			
Antimony (Sb)-Total			99.3		%		80-120	14-FEB-19
Arsenic (As)-Total			95.1		%		80-120	14-FEB-19
Barium (Ba)-Total			95.4		%		80-120	14-FEB-19
Beryllium (Be)-Total			95.5		%		80-120	14-FEB-19
Bismuth (Bi)-Total			102.6		%		80-120	14-FEB-19
Boron (B)-Total			95.1		%		80-120	14-FEB-19
Cadmium (Cd)-Total			93.9		%		80-120	14-FEB-19
Calcium (Ca)-Total			97.3		%		80-120	14-FEB-19
Chromium (Cr)-Total			96.5		%		80-120	14-FEB-19
Cesium (Cs)-Total			98.1		%		80-120	14-FEB-19
Cobalt (Co)-Total			94.0		%		80-120	14-FEB-19
Copper (Cu)-Total			94.4		%		80-120	14-FEB-19
Iron (Fe)-Total			95.1		%		80-120	14-FEB-19
Lead (Pb)-Total			103.8		%		80-120	14-FEB-19
Lithium (Li)-Total			99.5		%		80-120	14-FEB-19
Magnesium (Mg)-Tot	al		94.4		%		80-120	14-FEB-19
Manganese (Mn)-Tot	al		94.4		%		80-120	14-FEB-19
Molybdenum (Mo)-To	otal		98.2		%		80-120	14-FEB-19
Nickel (Ni)-Total			94.0		%		80-120	14-FEB-19
Phosphorus (P)-Tota	I		99.0		%		70-130	14-FEB-19
Potassium (K)-Total			95.0		%		80-120	14-FEB-19
Rubidium (Rb)-Total			97.2		%		80-120	14-FEB-19
Selenium (Se)-Total			96.8		%		80-120	14-FEB-19
Silicon (Si)-Total			100.0		%		60-140	14-FEB-19
Silver (Ag)-Total			97.5		%		80-120	14-FEB-19
Sodium (Na)-Total			95.6		%		80-120	14-FEB-19
Strontium (Sr)-Total			100.6		%		80-120	14-FEB-19
Sulfur (S)-Total			83.4		%		80-120	14-FEB-19
Thallium (TI)-Total			103.3		%		80-120	14-FEB-19
Tellurium (Te)-Total			96.5		%		80-120	14-FEB-19
Thorium (Th)-Total			101.1		%		70-130	14-FEB-19
Tin (Sn)-Total			95.4		%		80-120	14-FEB-19
Titanium (Ti)-Total			91.8		%		80-120	14-FEB-19
1								



Report Date: 20-FEB-19

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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD 501 Krug St. Suite 202

Workorder: L2232152

Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT	Water							
Batch R450690	8							
WG2988595-2 LCS			104.8		%		00.400	
Tungsten (W)-Total			104.8		%		80-120	14-FEB-19
Uranium (U)-Total							80-120	14-FEB-19
Vanadium (V)-Total			98.0		%		80-120	14-FEB-19
Zinc (Zn)-Total			94.0		%		80-120	14-FEB-19
Zirconium (Zr)-Total			94.0		%		80-120	14-FEB-19
WG2988595-1 MB Aluminum (Al)-Total			<0.0050		mg/L		0.005	14-FEB-19
Antimony (Sb)-Total			<0.00010	)	mg/L		0.0001	14-FEB-19
Arsenic (As)-Total			<0.00010		mg/L		0.0001	14-FEB-19
Barium (Ba)-Total			<0.00010		mg/L		0.0001	14-FEB-19
Beryllium (Be)-Total			<0.00010		mg/L		0.0001	14-FEB-19
Bismuth (Bi)-Total			< 0.00005		mg/L		0.00005	14-FEB-19
Boron (B)-Total			<0.010		mg/L		0.01	14-FEB-19
Cadmium (Cd)-Total			<0.00000	)5C	mg/L		0.000005	14-FEB-19
Calcium (Ca)-Total			<0.050		mg/L		0.05	14-FEB-19
Chromium (Cr)-Total			<0.00050	)	mg/L		0.0005	14-FEB-19
Cesium (Cs)-Total			<0.00001	0	mg/L		0.00001	14-FEB-19
Cobalt (Co)-Total			<0.00010	)	mg/L		0.0001	14-FEB-19
Copper (Cu)-Total			<0.0010		mg/L		0.001	14-FEB-19
Iron (Fe)-Total			<0.010		mg/L		0.01	14-FEB-19
Lead (Pb)-Total			<0.00005	50	mg/L		0.00005	14-FEB-19
Lithium (Li)-Total			<0.0010		mg/L		0.001	14-FEB-19
Magnesium (Mg)-Tota	al		<0.0050		mg/L		0.005	14-FEB-19
Manganese (Mn)-Tota	al		<0.00050	)	mg/L		0.0005	14-FEB-19
Molybdenum (Mo)-Tot	tal		<0.00005	50	mg/L		0.00005	14-FEB-19
Nickel (Ni)-Total			<0.00050	)	mg/L		0.0005	14-FEB-19
Phosphorus (P)-Total			<0.050		mg/L		0.05	14-FEB-19
Potassium (K)-Total			<0.050		mg/L		0.05	14-FEB-19
Rubidium (Rb)-Total			<0.00020	)	mg/L		0.0002	14-FEB-19
Selenium (Se)-Total			<0.00005	50	mg/L		0.00005	14-FEB-19
Silicon (Si)-Total			<0.10		mg/L		0.1	14-FEB-19
Silver (Ag)-Total			<0.00005	50	mg/L		0.00005	14-FEB-19
Sodium (Na)-Total			<0.050		mg/L		0.05	14-FEB-19
Strontium (Sr)-Total			<0.0010		mg/L		0.001	14-FEB-19



Workorder: L2232152 Report Date: 20-FEB-19 Page 6 of 12 HUTCHINSON ENVIRONMENTAL SCIENCES LTD Client: 501 Krug St. Suite 202 Kitchener ON N2B 1L3 Contact: **Brent Parsons** Test Matrix Reference Result Qualifier Units RPD Limit Analyzed MET-T-CCMS-WT Water R4506908 Batch WG2988595-1 MB Sulfur (S)-Total <0.50 0.5 mg/L 14-FEB-19 Thallium (TI)-Total < 0.000010 mg/L 0.00001 14-FEB-19 Tellurium (Te)-Total < 0.00020 mg/L 0.0002 14-FEB-19 Thorium (Th)-Total < 0.00010 mg/L 0.0001 14-FEB-19 Tin (Sn)-Total 0.0001 mg/L < 0.00010 14-FEB-19 Titanium (Ti)-Total < 0.00030 mg/L 0.0003 14-FEB-19 Tungsten (W)-Total 0.0001 < 0.00010 mg/L 14-FEB-19 Uranium (U)-Total < 0.000010 mg/L 0.00001 14-FEB-19 Vanadium (V)-Total 0 00050 ma/l 0 0005 14 EED 10

Vanadium (V)-Total		<0.00050	mg/L	0.0005	14-FEB-19
Zinc (Zn)-Total		<0.0030	mg/L	0.003	14-FEB-19
Zirconium (Zr)-Total		<0.00030	mg/L	0.0003	14-FEB-19
WG2988595-5 MS	WG2988595-3				
Aluminum (Al)-Total		96.0	%	70-130	14-FEB-19
Antimony (Sb)-Total		96.5	%	70-130	14-FEB-19
Arsenic (As)-Total		93.3	%	70-130	14-FEB-19
Barium (Ba)-Total		93.3	%	70-130	14-FEB-19
Beryllium (Be)-Total		91.8	%	70-130	14-FEB-19
Bismuth (Bi)-Total		100.3	%	70-130	14-FEB-19
Boron (B)-Total		93.8	%	70-130	14-FEB-19
Cadmium (Cd)-Total		93.9	%	70-130	14-FEB-19
Calcium (Ca)-Total		94.2	%	70-130	14-FEB-19
Chromium (Cr)-Total		95.5	%	70-130	14-FEB-19
Cesium (Cs)-Total		95.9	%	70-130	14-FEB-19
Cobalt (Co)-Total		94.5	%	70-130	14-FEB-19
Copper (Cu)-Total		96.3	%	70-130	14-FEB-19
Iron (Fe)-Total		93.6	%	70-130	14-FEB-19
Lead (Pb)-Total		100.2	%	70-130	14-FEB-19
Lithium (Li)-Total		96.0	%	70-130	14-FEB-19
Magnesium (Mg)-Total		91.4	%	70-130	14-FEB-19
Manganese (Mn)-Total		93.8	%	70-130	14-FEB-19
Molybdenum (Mo)-Total		95.4	%	70-130	14-FEB-19
Nickel (Ni)-Total		94.5	%	70-130	14-FEB-19
Phosphorus (P)-Total		102.3	%	70-130	14-FEB-19
Potassium (K)-Total		92.1	%	70-130	14-FEB-19



Workorder: L2232152

Report Date: 20-FEB-19

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HUTCHINSON ENVIRONMENTAL SCIENCES LTD Client: 501 Krug St. Suite 202 Kitchener ON N2B 1L3 Brent Parsons

Contact:

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT	Water							
Batch R4506908								
WG2988595-5 MS		WG2988595-3	02.0		0/		70.400	
Rubidium (Rb)-Total			93.8		%		70-130	14-FEB-19
Selenium (Se)-Total			95.3				70-130	14-FEB-19
Silicon (Si)-Total			95.3		%		70-130	14-FEB-19
Silver (Ag)-Total			95.2		%		70-130	14-FEB-19
Sodium (Na)-Total			95.1		%		70-130	14-FEB-19
Strontium (Sr)-Total			97.9		%		70-130	14-FEB-19
Sulfur (S)-Total			82.9		%		70-130	14-FEB-19
Thallium (TI)-Total			98.1		%		70-130	14-FEB-19
Tellurium (Te)-Total			90.2		%		70-130	14-FEB-19
Thorium (Th)-Total			97.7		%		70-130	14-FEB-19
Tin (Sn)-Total			94.4		%		70-130	14-FEB-19
Titanium (Ti)-Total			90.6		%		70-130	14-FEB-19
Tungsten (W)-Total			102.4		%		70-130	14-FEB-19
Uranium (U)-Total			98.3		%		70-130	14-FEB-19
Vanadium (V)-Total			96.8		%		70-130	14-FEB-19
Zirconium (Zr)-Total			93.8		%		70-130	14-FEB-19
NH3-F-WT	Water							
Batch R4508876								
WG2988797-3 DUP Ammonia, Total (as N)		<b>L2231483-1</b> 0.024	0.041	J	mg/L	0.017	0.02	14-FEB-19
WG2988797-2 LCS								
Ammonia, Total (as N)			90.7		%		85-115	14-FEB-19
WG2988797-1 MB								
Ammonia, Total (as N)			<0.010		mg/L		0.01	14-FEB-19
WG2988797-4 MS		L2231483-1	110.0		0/		/	
Ammonia, Total (as N)	<b>14</b>		112.8		%		75-125	14-FEB-19
NO3-IC-WT	Water							
Batch R4509769 WG2988849-14 DUP		WG2988849-1:	<b>,</b>					
Nitrate (as N)		0.719	<b>o</b> .718		mg/L	0.0	20	14-FEB-19
WG2988849-4 DUP Nitrate (as N)		<b>WG2988849-3</b> <0.020	<0.020	RPD-NA	mg/L	N/A	20	14-FEB-19
WG2988849-12 LCS Nitrate (as N)			102.0		%		90-110	14-FEB-19
WG2988849-2 LCS								



WG2988849-1 MB

				-	-			
		Workorder:	L223215	2 F	Report Date: 20	-FEB-19		Page 8 of 12
501 K	HINSON ENVIRONI rug St. Suite 202 ner ON N2B 1L3	MENTAL SCIENC	ES LTD					
Contact: Brent	Parsons							
Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO3-IC-WT	Water							
Batch R45097 WG2988849-2 LC								
Nitrate (as N)			101.6		%		90-110	14-FEB-19
WG2988849-1 ME Nitrate (as N)	i -		<0.020		mg/L		0.02	14-FEB-19
WG2988849-11 ME Nitrate (as N)	5		<0.020		mg/L		0.02	14-FEB-19
WG2988849-15 MS Nitrate (as N)	i	WG2988849-1	<b>3</b> 103.8		%		75-125	14-FEB-19
WG2988849-5 MS Nitrate (as N)	i	WG2988849-3	104.5		%		75-125	14-FEB-19
P-T-COL-WT	Water							
Batch R45124	20							
WG2990010-3 DU Phosphorus, Total	Р	<b>L2232152-2</b> 0.0372	0.0359		mg/L	3.6	20	19-FEB-19
WG2990010-2 LC Phosphorus, Total	S		97.3		%		80-120	19-FEB-19
WG2990010-1 ME Phosphorus, Total	1		<0.0030		mg/L		0.003	19-FEB-19
WG2990010-4 MS Phosphorus, Total	i	L2232152-2	83.4		%		70-130	19-FEB-19
PH-WT	Water							
Batch R45087	30							
<b>WG2988667-16 DU</b> рН	Р	<b>WG2988667-1</b> 7.66	<b>5</b> 7.64	J	pH units	0.02	0.2	14-FEB-19
<b>WG2988667-14 LC</b> рН	S		6.99		pH units		6.9-7.1	14-FEB-19
SO4-IC-N-WT	Water							
Batch R45097	69							
WG2988849-14 DU Sulfate (SO4)	Ρ	<b>WG2988849-1</b> 3 3.39	<b>3</b> 3.40		mg/L	0.4	20	14-FEB-19
WG2988849-4 DU Sulfate (SO4)	P	<b>WG2988849-3</b> 1.96	1.93		mg/L	1.5	20	14-FEB-19
WG2988849-12 LC Sulfate (SO4)	S		103.1		%		90-110	14-FEB-19
WG2988849-2 LC	S							
Sulfate (SO4)			103.2		%		90-110	14-FEB-19



			Workorder:	L2232152	: 1	Report Date: 20-F	EB-19		Page 9 of 12
5	501 Krug S	SON ENVIRON St. Suite 202 ON N2B 1L3	MENTAL SCIENC	ES LTD					
Contact: E	Brent Pars	sons							
Test		Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SO4-IC-N-WT		Water							
Batch R4 WG2988849-1 Sulfate (SO4)	1509769 MB			<0.30		mg/L		0.3	14-FEB-19
WG2988849-11 Sulfate (SO4)	MB			<0.30		mg/L		0.3	14-FEB-19
WG2988849-15 Sulfate (SO4)	MS		WG2988849-13	<b>3</b> 104.3		%		75-125	14-FEB-19
WG2988849-5 Sulfate (SO4)	MS		WG2988849-3	105.4		%		75-125	14-FEB-19
SOLIDS-TSS-WT		Water							
Batch R4	1509378								
WG2989110-3 Total Suspende	DUP ed Solids		<b>L2232240-1</b> 81	71		mg/L	13	20	15-FEB-19
WG2989110-2 Total Suspende				100.9		%		85-115	15-FEB-19
WG2989110-1 Total Suspende	MB ed Solids			<2.0		mg/L		2	15-FEB-19
Batch R4	4511468								
WG2989483-2 Total Suspende	LCS ed Solids			101.2		%		85-115	16-FEB-19
WG2989483-1 Total Suspende	MB ed Solids			<2.0		mg/L		2	16-FEB-19
TKN-WT		Water							
Batch R4 WG2989114-3	1509192		1 2222452 4						
Total Kjeldahl N	Nitrogen		<b>L2232152-1</b> 0.37	0.45		mg/L	19	20	15-FEB-19
WG2989114-2 Total Kjeldahl N	litrogen			110.9		%		75-125	15-FEB-19
WG2989114-1 Total Kjeldahl N	MB Nitrogen			<0.15		mg/L		0.15	15-FEB-19
WG2989114-4 Total Kjeldahl N			L2232152-1	112.3		%		70-130	15-FEB-19
	1509888								
WG2989423-3 Total Kjeldahl N	<b>DUP</b> Nitrogen		<b>L2232152-3</b> 0.82	0.63	J	mg/L	0.19	0.3	15-FEB-19
WG2989423-2 Total Kjeldahl N				84.4		%		75-125	15-FEB-19
WG2989423-1	МВ							0.15	



			Workorder:	L223215	2	Report Date:	20-FEB-19		Page 10 of 12
Client:	501 Krug	NSON ENVIRON St. Suite 202 ON N2B 1L3	IMENTAL SCIEN	CES LTD					
Contact:	Brent Par	sons							
Test		Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TKN-WT		Water							
Batch	R4509888								
WG2989423 Total Kjelda	<b>B-1 MB</b> ahl Nitrogen			<0.15		mg/L		0.15	15-FEB-19
WG2989423 Total Kjelda	<b>3-4 MS</b> ahl Nitrogen		L2232152-3	110.0		%		70-130	15-FEB-19

Workorder: L2232152

Report Date: 20-FEB-19

Client:	HUTCHINSON ENVIRONMENTAL SCIENCES LTD
	501 Krug St. Suite 202
	Kitchener ON N2B 1L3
Contact:	Brent Parsons

## Contact:

## Legend:

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## Sample Parameter Qualifier Definitions:

Qualifier	Description
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Workorder: L2232152

Report Date: 20-FEB-19

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD 501 Krug St. Suite 202 Kitchener ON N2B 1L3 Contact: Brent Parsons

Page 12 of 12

## Hold Time Exceedances:

	Sample						
ALS Product Description	ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Bacteriological Tests							
E. coli							
	2	11-FEB-19 13:35	13-FEB-19 15:45	48	50	hours	EHTL
	4	11-FEB-19 14:40	13-FEB-19 15:45	48	49	hours	EHTL
	5	11-FEB-19 14:16	13-FEB-19 15:45	48	49	hours	EHTL
	13	11-FEB-19 13:00	13-FEB-19 15:45	48	51	hours	EHTL
	14	11-FEB-19 13:11	13-FEB-19 15:45	48	51	hours	EHTL
Fecal Coliforms							
	2	11-FEB-19 13:35	13-FEB-19 15:45	48	50	hours	EHTL
	4	11-FEB-19 14:40	13-FEB-19 15:45	48	49	hours	EHTL
	5	11-FEB-19 14:16	13-FEB-19 15:45	48	49	hours	EHTL
	13	11-FEB-19 13:00	13-FEB-19 15:45	48	51	hours	EHTL
	14	11-FEB-19 13:11	13-FEB-19 15:45	48	51	hours	EHTL

## Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.

EHTR: Exceeded ALS recommended hold time prior to sample receipt.

EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry. EHT: Exceeded ALS recommended hold time prior to analysis.

Rec. HT: ALS recommended hold time (see units).

Rec. HT. ALS recommended hold time (see t

Notes\*:

Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes. Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2232152 were received on 13-FEB-19 10:30.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



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# Chain of Custody (COC) / Analytical

**Request Form** 



# COC Number: LON-180129 Page of

SIF

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Canada Toll Free: 1 800 668 9878

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Phone:	519-576-1711		Compare Result	s to Criteria on Report -	provide details below	w if box checked		3 da	y (P3	-25%]			EKG	Same	a Day,	Weet	kend (	or Sta	tutory	holida	(E2 -2009	* _
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Failure to complete all portions of this form may delay analysis. Ptease fill in this form LEGIBLY, By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy. 1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

ALS Environmental	Chain of Custody (COC) Request Forn	ז		L2232152-	COF	C					coc	Numb	_			L53	0
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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



HUTCHINSON ENVIRONMENTAL SCIENCES LTD ATTN: Brent Parsons 501 Krug St. Suite 202 Kitchener ON N2B 1L3 Date Received:14-FEB-19Report Date:18-MAR-19 12:54 (MT)Version:DRAFT

Client Phone: 519-576-1711

# Certificate of Analysis

Lab Work Order #: L2232735 Project P.O. #: NOT SUBMITTED Job Reference: 180050 C of C Numbers: Legal Site Desc:

Gayle Braun Senior Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 1329 Niakwa Road East, Unit 12, Winnipeg, MB R2J 3T4 Canada | Phone: +1 204 255 9720 | Fax: +1 204 255 9721 ALS CANADA LTD Part of the ALS Group An ALS Limited Company

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Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2232735-1 OL-1 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER							
Bacteriological Tests							
Fecal Streptococcus	1	PEHR	1	CFU/100mL		14-FEB-19	R4511527
Pseudomonas aeruginosa	<1		1	CFU/100mL		14-FEB-19	R4511940
Plant Pigments							
Chlorophyll a	1.63		0.10	ug/L	14-FEB-19	14-FEB-19	R4530568
L2232735-2 OL-2 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER							
Bacteriological Tests							
Fecal Streptococcus	3	PEHR	1	CFU/100mL		14-FEB-19	R4511527
Pseudomonas aeruginosa	<1		1	CFU/100mL		14-FEB-19	R4511940
Plant Pigments							
Chlorophyll a	13.5		0.10	ug/L	14-FEB-19	14-FEB-19	R4530568
L2232735-3 OL-4 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER			K				
Bacteriological Tests							
Fecal Streptococcus	4	PEHR	1	CFU/100mL		14-FEB-19	R4511527
Pseudomonas aeruginosa Plant Pigments	<1		1	CFU/100mL		14-FEB-19	R4511940
Chlorophyll a	4.65	Ĩ.	0.10	ug/L	14-FEB-19	14-FEB-19	R4530568
L2232735-4 OL-7 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER							
Bacteriological Tests							
Fecal Streptococcus	4	PEHR	1	CFU/100mL		14-FEB-19	R4511527
Pseudomonas aeruginosa Plant Pigments	<1		1	CFU/100mL		14-FEB-19	R4511940
Chlorophyll a	10.2		0.10	ug/L	14-FEB-19	14-FEB-19	R4530568
L2232735-5 OL-9 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER							
Bacteriological Tests							
Fecal Streptococcus	59	PEHR	1	CFU/100mL		14-FEB-19	R4511527
Pseudomonas aeruginosa	<1		1	CFU/100mL		14-FEB-19	R4511940
Plant Pigments							
Chlorophyll a	9.23		0.10	ug/L	14-FEB-19	14-FEB-19	R4530568
L2232735-6 OL-3 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER							
Bacteriological Tests							
Escherichia Coli	1		1	CFU/100mL		14-FEB-19	R4510407
Fecal Coliforms	<1	PEHR	1	CFU/100mL			
		PEHR	1	CFU/100mL			
Fecal Streptococcus	37	FERR	1	GFU/ IUUIIIL		14-FEB-19	R4511527
L2232735-7 OL-5							

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2232735-7 OL-5 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER							
Bacteriological Tests							
Escherichia Coli	2		1	CFU/100mL		14-FEB-19	R4510407
Fecal Coliforms	<1	PEHR	1	CFU/100mL		14-FEB-19	R4510391
Fecal Streptococcus	4	PEHR	1	CFU/100mL		14-FEB-19	R4511527
L2232735-8 OL-6 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER							
Bacteriological Tests							
Escherichia Coli	4		1	CFU/100mL		14-FEB-19	R4510407
Fecal Coliforms	2	PEHR	1	CFU/100mL		14-FEB-19	R4510391
Fecal Streptococcus	26	PEHR	1	CFU/100mL		14-FEB-19	R4511527
L2232735-9 OL-8 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER							
Bacteriological Tests							
Escherichia Coli	6		1	CFU/100mL		14-FEB-19	
Fecal Coliforms	<1	PEHR	1	CFU/100mL		14-FEB-19	R4510391
Fecal Streptococcus Report Remarks : Approximate result: suspected inte Report Remarks : Approximate result, interference su		PEHR	1	CFU/100mL		14-FEB-19	R4511527
L2232735-10 OL-10 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER		~					
Bacteriological Tests							
Escherichia Coli	18		1	CFU/100mL		14-FEB-19	R4510407
Fecal Coliforms	7	PEHR	1	CFU/100mL		14-FEB-19	R4510391
Fecal Streptococcus Report Remarks : Approximate result: suspected inte Report Remarks : Approximate result, interference su		PEHR	1	CFU/100mL		14-FEB-19	R4511527
L2232735-11 OL-11 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER							
Bacteriological Tests							
Escherichia Coli	1		1	CFU/100mL		14-FEB-19	R4510407
Fecal Coliforms	<1	PEHR	1	CFU/100mL		14-FEB-19	R4510391
Fecal Streptococcus	<1	PEHR	1	CFU/100mL		14-FEB-19	R4511527
Fecal Streptococcus	<1	PEHK	1	CFU/100mL		14-FEB-19	R45115
* Refer to Referenced Information for Qualifiers (if any) and							

## **Reference Information**

## **Qualifiers for Individual Samples Listed:**

Sample Numbe	Client ID	Qualifier	Description	
L2232735-1	OL-1	UIC	Unreliable: Improper Container	
L2232735-2	OL-2	UIC	Unreliable: Improper Container	
L2232735-3	OL-4	UIC	Unreliable: Improper Container	
L2232735-4	OL-7	UIC	Unreliable: Improper Container	
L2232735-5	OL-9	UIC	Unreliable: Improper Container	

#### Qualifier Description

PFHR Parameter Exceeded Recommended Holding Time On Receipt: Proceed With Analysis As Requested.

Test Method References:				
ALS Test Code	Matrix	Test Description	Method Reference**	
CHL/A-ACET-FLUORO- WP	Water	Chlorophyll a by fluorometry	EPA 445.0 ACET	

This analysis is done using procedures modified from EPA method 445.0. Chlorophyll a is determined by a 90 % acetone extraction followed with analysis by fluorometry using the non-acidification procedure. This method is not subject to interferences from chlorophyll b.

EC-DCMF-WP Water

APHA 9222 J (modified) E. coli by DC agar An aliquot of sample water (usually 100 mL) is passed through a sterile .45 micron membrane filter. The filter is placed on media which contains lactose and a nonselective dye, plus a chromogenic agent (BCIG) to differentiate E. coli spp. from other coliforms. Samples are incubated at 35 C for 23 +/- 1 hours. Colonies exhibiting the expected metabolic reactions for the target groups on the filter after incubation are counted and results are reported as Colony Forming Units (CFU) per 100 mL. For this test, E. coli will appear blue to purple and other coliforms will appear reddish-pink. The detection limit for this test is 1 when 100 mL of sample is processed, and is adjusted accordingly, with report notes as required, when less than 100 mL is processed.

APHA 9222D

APHA 9230C (modified)

FC-MF-WP Water Fecal Coliform

An aliquot of sample water (usually 100 mL) is passed through a sterile .45 micron membrane filter. The filter is placed on selective media and incubated at 44.5°C for 24 – 2 hours. Colonies exhibiting characteristic morphology for the target group on the filter after incubation are counted and results are reported as Colony Forming Units (CFU) per 100 mL. The detection limit for this test is 1 when 100 mL of sample is processed, and is adjusted accordingly, with report notes as required, when less than 100 mL is processed.

FECALSTREP-MF-WP Water Fecal streptococcus

An aliquot of sample water (usually 100 mL) is passed through a sterile .45 micron membrane filter. The filter is placed on selective media and incubated at 35°C for 47 +/- 1 hour. Colonies exhibiting characteristic morphology for the target group on the filter after incubation are counted and results are reported as Colony Forming Units (CFU) per 100 mL. The detection limit for this test is 1 when 100 mL of sample is processed, and is adjusted accordingly, with report notes as required, when less than 100 mL is processed. Due to taxonomic fluidity, the term "Fecal Streptococcus" is applied here to include all members of genus names Streptococcus and Enterococcus as described in the reference method.

PSA-MF-WP Water Pseudomonas aeruginosa APHA 9213E

A known volume of sample (typically 100 mL) is filtered through a 0.45 micron membrane filter. The filter is placed on the surface of a selective agar plate and incubated for 72 hours at 41.5 +/- 0.5 C. Plates are examined under low magnification and colonies exhibiting typical morphology are counted. Results are reported as the number of presumptive P. aeruginosa CFU/100 mL. Additional confirmation tests can be performed upon request.

\*\* ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WP	ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA

**Chain of Custody Numbers:** 

# **Reference Information**

## **GLOSSARY OF REPORT TERMS**

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid weight of sample

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory. UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION. Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



				Quant	y conti	ornepon			
			Workorder:	L223273	5	Report Date: 18-M	IAR-19		Page 1 of 4
Client: Contact:	501 Krug S	St. Suite 202 ON N2B 1L3	MENTAL SCIENC	ES LTD					
Test		Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CHL/A-ACET-FL	UORO-WP	Water							
Batch I WG2996476-3 Chlorophyll a	R4530568 B DUP		<b>L2232473-1</b> 20.8	20.9		ug/L	0.5	35	14-FEB-19
WG2996476-2 Chlorophyll a	LCS			101.1		%		80-120	27-FEB-19
WG2996476-1 Chlorophyll a	MB			<0.10		ug/L		0.1	14-FEB-19
EC-DCMF-WP Batch I WG2989200-1	R4510407 MB	Water				$\langle \cdot \rangle$			
Escherichia C	Coli			<1	ſ	CFU/100mL		1	14-FEB-19
FC-MF-WP		Water							
Batch I WG2989036-2 Fecal Coliforr	-		<b>L2232735-6</b> <1	<1	RPD-NA	CFU/100mL	N/A	65	14-FEB-19
WG2989036-1 Fecal Coliforr				<1		CFU/100mL		1	14-FEB-19
FECALSTREP-M Batch I WG2989022-1	R4511527	Water							
Fecal Strepto				<1		CFU/100mL		1	14-FEB-19
PSA-MF-WP		Water							
Batch I WG2989035-1 Pseudomona		а		<1		CFU/100mL		1	14-FEB-19

Workorder: L2232735

Report Date: 18-MAR-19

Page 2 of 4

Client:	HUTCHINSON ENVIRONMENTAL SCIENCES LTD
	501 Krug St. Suite 202
	Kitchener ON N2B 1L3
Contact:	Brent Parsons

Contact:

### Legend:

Limit	ALS Control Limit (Data Quality Objectives)	
DUP	Duplicate	
RPD	Relative Percent Difference	
N/A	Not Available	
LCS	Laboratory Control Sample	
SRM	I Standard Reference Material	
MS	Matrix Spike	
MSD	Matrix Spike Duplicate	
ADE	Average Desorption Efficiency	
MB	Method Blank	
IRM	Internal Reference Material	
CRM	1 Certified Reference Material	
CCV	Continuing Calibration Verification	
CVS	Calibration Verification Standard	
LCSD	D Laboratory Control Sample Duplicate	
Sample	e Parameter Qualifier Definitions:	

### Sample Parameter Qualifier Definitions:

Qualifier	Description
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Workorder: L2232735

Report Date: 18-MAR-19

HUTCHINSON ENVIRONMENTAL SCIENCES LTD Client: 501 Krug St. Suite 202 Kitchener ON N2B 1L3 **Brent Parsons** 

Contact:

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Bacteriological Tests							
E. coli by DC agar							
, ,	6	11-FEB-19	14-FEB-19 16:55	30	77	hours	EHTR
	7	11-FEB-19	14-FEB-19 16:55	30	77	hours	EHTR
	8	11-FEB-19	14-FEB-19 16:55	30	77	hours	EHTR
	9	11-FEB-19	14-FEB-19 16:55	30	77	hours	EHTR
	10	11-FEB-19	14-FEB-19 16:55	30	77	hours	EHTR
	11	11-FEB-19	14-FEB-19 16:55	30	77	hours	EHTR
Fecal Coliform							
	6	11-FEB-19	14-FEB-19 16:10	30	76	hours	EHTR
	7	11-FEB-19	14-FEB-19 16:10	30	76	hours	EHTR
	8	11-FEB-19	14-FEB-19 16:10	30	76	hours	EHTR
	9	11-FEB-19	14-FEB-19 16:10	30	76	hours	EHTR
	10	11-FEB-19	14-FEB-19 16:10	30	76	hours	EHTR
	10	11-FEB-19	14-FEB-19 16:10	30	76	hours	EHTR
Fecal streptococcus				00	10	nouro	2
r etal streptotottus	1	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	2	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	2	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	4	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	5	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	6	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	7	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	8	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	9	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	10	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	11	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
Pseudomonas aeruginosa				00	10	nouro	LIIII
i seudomonas aeruginosa	1	11-FEB-19	14-FEB-19 14:50	30	75	hours	EHTR
	1 2	11-FEB-19 11-FEB-19	14-FEB-19 14:50	30 30	75 75	hours	EHTR
	2	11-FEB-19	14-FEB-19 14:50	30	75 75	hours	EHTR
	4	11-FEB-19	14-FEB-19 14:50	30	75 75	hours	EHTR
	4 5	11-FEB-19	14-FEB-19 14:50	30	75 75	hours	EHTR
Plant Pigments	5	TI-FED-19	14-FED-19 14.50	30	75	nouis	LIIIK
•							
Chlorophyll a by fluorometry							
	1	11-FEB-19	14-FEB-19 13:05	48	73	hours	EHTR
	2	11-FEB-19	14-FEB-19 13:05	48	73	hours	EHTR
	3	11-FEB-19	14-FEB-19 13:05	48	73	hours	EHTR
	4	11-FEB-19	14-FEB-19 13:05	48	73	hours	EHTR
	5	11-FEB-19	14-FEB-19 13:05	48	73	hours	EHTR

### Legend & Qualifier Definitions:

Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended. EHTR-FM:

Exceeded ALS recommended hold time prior to sample receipt. EHTR:

EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry. EHT: Exceeded ALS recommended hold time prior to analysis.

Rec. HT: ALS recommended hold time (see units).

Notes\*:

Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.

Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2232735 were received on 14-FEB-19 09:00.

Workorder: L2232735

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD 501 Krug St. Suite 202 Kitchener ON N2B 1L3 Contact: Brent Parsons Report Date: 18-MAR-19

Page 4 of 4

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



### Chain of Custody (COC) / Analy Request Form

Canada Toll Free: 1 800 668 9878



### COC Number: LON-190128/

Page

Report To Contact and company name below will appear on the final report Report Format / Distribution Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply) Company HUTCHINSON ENV Select Report Format: PpF From From COGTAL Regular IR1 V Standard TAT if received by 3 pm - business days - no surcharges apoly Contact: BRENT PARSONS Quality Control (QC) Report with Report 17 yes 1 NO 4 day [P4-20%] Π Business day (E - 100%) Ē Compare Results to Criteria on Report - provide details below if box checked Phone: 519-576-1711 3 day [P3-25%] Same Day, Weekend or Statutory holiday IE2 -200% FIEMAIL THAIL FIFAX Company address below will appear on the final report Select Distribution: 2 day [P2-50%] (Laboratory opening fees may apply) 1 501 KRUG ST ST 202 Date and Time Required for all E&P TATS Email 1 or Eax deborah sinclain@environmentalsciences.ca dd-mmm-vy hh:mm Street: KTICHENER ON City/Province Email 2 brent parsons@environmentalsciences.ca For tests that can not be nettormed according to the service level selected, you will be contacted. Postal Code: N2B 1L3 Email 3 Analysis Request HOLD Same as Report To I/I YES INO Invoice Distribution Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below Invoice To S ECTED HAZARD (see Special Instructions) Myes INO Copy of Invoice with Report Select Invoice Distribution: 7 BMAIL MAIL G FAX ñ ш Email 1 or Fax accounting@environmentalsciences.ca Company: AIN Contact: Email 2 Project Information Z O Oil and Gas Required Fields (client use) È ALS Account # / Quote # Q69690 PO# AFF/Cost Center ខ្ល 180050 iob # Routing Code: Major/Minor Code: S Ш PO/AFE: LL\_ Requisitioner: ō AMPLI SD: Location: HYTOPLANKTON n c SEUDOMONAS CHLOROPHYLL ш STREP ALS Lab Work Order # (lab use only): ALS Contact: Gayle Sampler: Ξ NUM ECAL Sample Identification and/or Coordinates Date Time ALS Sample # Sample Type ഹ (lab use only) (This description will appear on the report) (dd-mmm-yy) (hh:mm) OL-1 11-02-19 WATER 3 R R R R ..... 01.2 WATER 2 R R R OL-4 R WATER 2 R R 01-7 2 R WATER R R OL-9 WATER 2 R R R OL-3 R WATER 1 OL-5 WATER R 1 OL-6 R WATER 1 OL-8 R WATER OL-10 WATER R 1 OI -11 R WATER SAMPLE CONDITION AS RECEIVED (lab use only) Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below Drinking Water (DW) Samples<sup>1</sup> (client use) (electronic COC only) SIF Observations Yes Frozen No . Are samples taken from a Regulated DW System? Ice Packs Ice Cubes **I** Custody seal intact Π Yeş No TYES THO Cooling Initiated Are samples for human consumption/ use? INIITIAL COOLER TEMPERATURES \*C FINAL COOLER TEMPERATURES \*C Пиез Пию 1.7 **INITIAL SHIPMENT RECEPTION (lab use only)** SHIPMENT RELEASE (client use) FINAL SHIPMENT RECEPTION (lab use only) Time: Released by: Date: Received by: Time: Received by: Date: Date: Time: M 900

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

D SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

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ALS Lab Wor	rk Order # (lab use only)		ALS Contact:		Sampler:		-	3	Chlorophy						2 5. <b>Q</b>					~
ALS Sample #	Sample Identificati	on and/or Coordinates		Date	Time	Sample Type	teres 1	2	12					:			i			J
(lab use only)	(This description wi	ill appear on the report)		(dd-mmm-yy)	(hh:mm)	Sample Type	142	14	U I											
	Trib 4			11-02-19		water	×	$\checkmark$	~											
	Trib 5			11-02-19		Water	1		1	1										
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	g Water (DW) Samples' (client use) n from a Regulated DW System? es Г No	Special	Instructions / Spe	cify Criteria to add on	report (client Use)	)	Froze Ice pa Cooli		Yes		No		SIF O	bservat dy seal	ions	Yes Yes		No No		]
Are samples for hi	uman drinking water use?							-		TEMPER		6 °C -	10 N - 10	F	INAL CO	OLER T	EMPERATI	URES °C		
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Failure to complete all portions of this form may defay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the while - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



# Sample Receipt Confirmation

Donort D:	atribution.				Invoice	Distribution:	
	stribution: Company Name:	HUTCHINSON E	NVIRONMENTAL			<ul> <li>HUTCHINSON ENVIRONMEN SCIENCES LTD</li> </ul>	ITAL
	Contact:	Brent Parsons			Contact	ACCOUNTS PAYABLE	
	Address:	501 Krug St., Sui	ite 202			1-5 Chancery Lane,	
		Kitchener, ON, N	12B 1L3		Address	Bracebridge, ON, P1L 2E3	
	Phone:	519-576-1711			Dhama	=	
	Fax:	866-205-7766			Phone:	100 010 0021	
	Email:		@environmentalscience		Fax:	705-457-5811	
		brent.parsons@e	environmentalsciences.	ica li	nvoice Email:		talsciences.
	EDD Email:					Ca	
	Distribution:	Hard Copy: N	Email: Y Fax:	N EDD: N	Desired #	accounting@environmentalsci	ences.ca
					Project #:		
					Account #:	20126	
<b>Client Inf</b>	ormation:						
	Job Reference #:	180050			Date Sampled	I: 11-FEB-19	
	Project PO #:			I	Date Received	l: 13-FEB-19	
Legal	Site Description:	N/A			Sampled By	CLIENT	
	Quote #:	Q69690		Cha	in Of Custody	r: LON-180129	
Workord	er Summary	/ <u>.</u>			Client Job #	<b>⊭</b> 180050	
L	ab Work Order #:			Acc			
	ab Work Order #: completion date:	L2232152			ount Manage	: Gayle Braun	tion section
Estimated	ab Work Order #: completion date: eceived at ALS in	L2232152			ount Manage		tion section
Estimated	completion date:	L2232152 21-FEB-19	Date		ount Manage disposal date	<ul> <li>Gayle Braun</li> <li>See Sample Disposal Informa below.</li> </ul>	tion section
Estimated 14 Samples re	completion date: eceived at ALS in	L2232152 21-FEB-19	Date Sampled	Estimated sample	ount Manage disposal date	<ul><li>Gayle Braun</li><li>See Sample Disposal Informa</li></ul>	tion section
Estimated 14 Samples re Lab	completion date: eceived at ALS in Client	L2232152 21-FEB-19	Sampled	Estimated sample Date	ount Manager disposal date Sample	Gayle Braun     See Sample Disposal Informa     below.  Priority Sample	tion section
Estimated 14 Samples re Lab Sample ID	completion date: eceived at ALS in Client Sample ID	L2232152 21-FEB-19	Sampled 11-FEB-19 16:04	Estimated sample Date Received 13-FEB-19 10:30	ount Manager disposal date Sample Due Date	<ul> <li>Gayle Braun</li> <li>See Sample Disposal Informa below.</li> <li>Priority Sample Flag Type</li> </ul>	tion section
Estimated 14 Samples re Lab Sample ID L2232152-1	completion date: eccived at ALS in Client Sample ID OL-1	L2232152 21-FEB-19	Sampled 11-FEB-19 16:04	Estimated sample Date Received 13-FEB-19 10:30	ount Managel disposal date Sample Due Date 21-FEB-19	<ul> <li>Gayle Braun</li> <li>See Sample Disposal Informa below.</li> <li>Priority Sample Flag Type</li> <li>WATER</li> </ul>	tion section
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ADDRESS 309 Exeter Road, Unit #29, London, ON, Canada N6L 1C1 PHONE +1 519 652 6044 FAX +1 519 652 0671 ALS CANADA LTD. Part of the ALS Group A Campbell Brothers Limited Company

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Analysis Requested :				6												SI	
	Alkalinity, Total [as CaCO3]	BOD	Chloride by IC	Dissolved Organic Carbon	E. coli	Fecal Coliforms	Hardness	One Metal in Water by ICPMS [Total]	Total Metals in Water by CRC ICPMS	Ammonia in Water by Fluorescence	Nitrate in Water by IC	Total P in Water by Colour	Hd	Sulfate in Water by IC	Suspended solids	TKN and Total Phosphorus	Sample Handling and Disposal Fee
OL-1	$\checkmark$	$\checkmark$	$\checkmark$	√	$\checkmark$	$\checkmark$	$\checkmark$	•	$\checkmark$	$\checkmark$	$\checkmark$	-	√	√	$\checkmark$	$\checkmark$	$\checkmark$
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OL-4	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
OL-7	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
OL-9	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
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OL-5					$\checkmark$	$\checkmark$											$\checkmark$
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TRIB 5	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$

**Login Comments:** Your samples were at 1.4 °C when unpacked at the laboratory.

Sample Integrity Observations: No observations were identified for this work order submission.



### Notice of Sub-contract Laboratory Service

#### Please be advised that the following tests will be subcontracted to the corresponding laboratory:

Ammonia in Water by Fluorescence subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Suspended solids subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA E. coli subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Alkalinity, Total (as CaCO3) subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Total P in Water by Colour subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA pH subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Nitrate in Water by IC subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Hardness subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Total Kjeldahl Nitrogen subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Fecal Coliforms subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Chloride by IC subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Sulfate in Water by IC subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Sulfate in Water by IC subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Soll subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Sulfate in Water by IC subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA BOD subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Dissolved Organic Carbon subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Please contact your Account Manager immediately should you have questions or concerns regarding this arrangement. Approval of this arrangement shall be implied unless otherwise notified by you.

### Sample Disposal Information:

Where possible, ALS will store samples for the following durations, measured from date of sample submission: 45 days for Soil and Water samples; 6 months for Tissue/Biota samples; 14 days for air samples collected on re-usable media; and 3 days for water samples submitted for microbiological testing. Longer storage times are available upon request.

For information about ALS accreditations and certifications please contact your Account Manager or visit our webpage at www.alsglobal.com (see Canada downloads).

ALS Group strives to deliver on-time results to our clients at all times. However, there are times when due to capacity issues or other unforeseen circumstances we are unable to meet our expected turnaround times. The information above is related to a recent workorder you have submitted to our laboratory. In the event that you have an inquiry, please refer to the Lab Work Order # when calling your Account Manager.

ALS Group appreciates your business. Thank you for the opportunity to work with you.



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# Chain of Custody (COC) / Analytical

**Request Form** 



# COC Number: LON-180129 Page of

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Canada Toll Free: 1 800 668 9878

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Failure to complete all portions of this form may delay analysis. Ptease fill in this form LEGIBLY, By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy. 1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

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Drinking Water (DW) Samples <sup>1</sup> (client use)	Special instructions / Sp	pecify Criteria to add on	report (client Use	a) .	<u> </u>			SAM	PLE C					ab use i			
Are samples taken from a Regulated DW System?					Frozer			뀚				bservai		Yes	닖	No	Ц
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Are samples for human drinking water use?					INI		JULER	TEMPER	onuke:	<u></u>			INAL CO	OLER TEN	T	WES C	<u> </u>
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Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the while - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



# Sample Receipt Confirmation

Report Di	stribution:				Invoice I	Distribution:
	Company Name:	HUTCHINSON E SCIENCES LTD	NVIRONMENTAL		Acct Name:	HUTCHINSON ENVIRONMENTAL SCIENCES LTD
	Contact:	Brent Parsons			Contact:	ACCOUNTS PAYABLE
	Address:	501 Krug St., Suit	e 202		Address:	1-5 Chancery Lane,
		Kitchener, ON, N	2B 1L3			Bracebridge, ON, P1L 2E3
	Phone: Fax:	519-576-1711			Phone:	705-645-0021
	Email:	866-205-7766		202 02	Fax:	
	Eman.		nvironmentalscience		nvoice Email:	deborah.sinclair@environmentalsciences.
	EDD Email:	•		I	invoice Email.	ca
						accounting@environmentalsciences.ca
	Distribution:	Hard Copy: N	Email: Y Fax:	N EDD: N	Project #:	N/A
					Account #:	20126
<b>Client Inf</b>	ormation:					
	Job Reference #:	180050			Date Sampled	: 11-FEB-19
	Project PO #:				Date Received	
Legal	Site Description:	N/A		0	Sampled By	
	Quote #:	Q69690		Cna	in Of Custody	
	er Summary				Client Job #	
	ab Work Order #:	L2232735				: Connor Cattani
	completion date:	25-JUN-19		Estimated sample	disposal date	: See Sample Disposal Information section
11 Samples re	eceived at ALS in	WINNIPEG				below.
Lab	Client		Date	Date	Sample	Priority Sample
Sample ID	Sample ID		Sampled	Received	Due Date	Flag Type
L2232735-1	OL-1		11-FEB-19 00:0	0 14-FEB-19 09:00	25-JUN-19	WATER
L2232735-2	OL-2		11-FEB-19 00:00	0 14-FEB-19 09:00	25-JUN-19	WATER
L2232735-3	OL-4		11-FEB-19 00:00		25-JUN-19	WATER
L2232735-4	OL-7		11-FEB-19 00:00	0 14-FEB-19 09:00	25-JUN-19	WATER
L2232735-5	OL-9			0 14-FEB-19 09:00	25-JUN-19	WATER
L2232735-6	OL-3			0 14-FEB-19 09:00	25-JUN-19	WATER
L2232735-7	OL-5			0 14-FEB-19 09:00	25-JUN-19	WATER
L2232735-8	OL-6			0 14-FEB-19 09:00	25-JUN-19	WATER
L2232735-9	OL-8			0 14-FEB-19 09:00	25-JUN-19	WATER
L2232735-10	OL-10			0 14-FEB-19 09:00	25-JUN-19	WATER
L2232735-11	OL-11		11-FEB-19 00:00	0 14-FEB-19 09:00	25-JUN-19	WATER

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Analysis Requested :	Chlorophyll a by fluorometry	E. coli by DC agar	Fecal Coliform	Fecal streptococcus	Phytoplankton	Pseudomonas aeruginosa	Sample Handling and Disposal Fee
OL-1	$\checkmark$			$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
OL-2	$\checkmark$			$\checkmark$		$\checkmark$	$\checkmark$
OL-4	$\checkmark$			$\checkmark$		$\checkmark$	$\checkmark$
OL-7	$\checkmark$			$\checkmark$		$\checkmark$	$\checkmark$
OL-9	$\checkmark$			$\checkmark$		$\checkmark$	$\checkmark$
OL-3		$\checkmark$	$\checkmark$	$\checkmark$			$\checkmark$
OL-5		$\checkmark$	$\checkmark$	$\checkmark$			$\checkmark$
OL-6		$\checkmark$	$\checkmark$	$\checkmark$			$\checkmark$
OL-8		$\checkmark$	$\checkmark$	$\checkmark$			$\checkmark$
OL-10		$\checkmark$	$\checkmark$	$\checkmark$			$\checkmark$
OL-11		$\checkmark$	$\checkmark$	$\checkmark$			$\checkmark$

### Hold Time Exceedences: The following samples have exceeded recommended holding times prior to sample receipt.

Analysis Requested	Lab Sample ID	Recommended Hold Time	Date Sampled	Date Received
Chlorophyll a by fluorometry	L2232735-1, 2, 3, 4, 5	48 hours	11-FEB-19	14-FEB-19
E. coli by DC agar	L2232735-6, 7, 8, 9, 10, 11	30 hours	11-FEB-19	14-FEB-19
Fecal Coliform	L2232735-6, 7, 8, 9, 10, 11	30 hours	11-FEB-19	14-FEB-19
Fecal streptococcus	L2232735-1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11	30 hours	11-FEB-19	14-FEB-19
Pseudomonas aeruginosa	L2232735-1, 2, 3, 4, 5	30 hours	11-FEB-19	14-FEB-19

Sample Integrity Observations: No observations were identified for this work order submission.



### Sample Disposal Information:

Where possible, ALS will store samples for the following durations, measured from date of sample submission: 45 days for Soil and Water samples; 6 months for Tissue/Biota samples; 14 days for air samples collected on re-usable media; and 3 days for water samples submitted for microbiological testing. Longer storage times are available upon request.

For information about ALS accreditations and certifications please contact your Account Manager or visit our webpage at www.alsglobal.com (see Canada downloads).

ALS Group strives to deliver on-time results to our clients at all times. However, there are times when due to capacity issues or other unforeseen circumstances we are unable to meet our expected turnaround times. The information above is related to a recent workorder you have submitted to our laboratory. In the event that you have an inquiry, please refer to the Lab Work Order # when calling your Account Manager.

ALS Group appreciates your business. Thank you for the opportunity to work with you.



### Chain of Custody (COC) / Analy Request Form

Canada Toll Free: 1 800 668 9878



### COC Number: LON-190128/

Page

Report To Contact and company name below will appear on the final report Report Format / Distribution Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply) Company HUTCHINSON ENV Select Report Format: PpF From From COGTAL Regular IR1 V Standard TAT if received by 3 pm - business days - no surcharges apoly Contact: BRENT PARSONS Quality Control (QC) Report with Report 17 yes 1 NO 4 day [P4-20%] Π Business day (E - 100%) Ē Compare Results to Criteria on Report - provide details below if box checked Phone: 519-576-1711 3 day [P3-25%] Same Day, Weekend or Statutory holiday IE2 -200% FIEMAIL THAIL FIFAX Company address below will appear on the final report Select Distribution: 2 day [P2-50%] (Laboratory opening fees may apply) 1 501 KRUG ST ST 202 Date and Time Required for all E&P TATS Email 1 or Eax deborah sinclain@environmentalsciences.ca dd-mmm-vy hh:mm Street: KTICHENER ON City/Province Email 2 brent parsons@environmentalsciences.ca For tests that can not be nettormed according to the service level selected, you will be contacted. Postal Code: N2B 1L3 Email 3 Analysis Request HOLD Same as Report To I/I YES INO Invoice Distribution Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below Invoice To S ECTED HAZARD (see Special Instructions) Myes INO Copy of Invoice with Report Select Invoice Distribution: 7 BMAIL MAIL G FAX ñ ш Email 1 or Fax accounting@environmentalsciences.ca Company: AIN Contact: Email 2 Project Information Z O Oil and Gas Required Fields (client use) È ALS Account # / Quote # Q69690 PO# AFF/Cost Center ខ្ល 180050 iob # Routing Code: Major/Minor Code: S Ш PO/AFE: LL\_ Requisitioner: ō AMPLI SD: Location: HYTOPLANKTON n c SEUDOMONAS CHLOROPHYLL ш STREP ALS Lab Work Order # (lab use only): ALS Contact: Gayle Sampler: Ξ NUM ECAL Sample Identification and/or Coordinates Date Time ALS Sample # Sample Type ഹ (lab use only) (This description will appear on the report) (dd-mmm-yy) (hh:mm) OL-1 11-02-19 WATER 3 R R R R ..... 01.2 WATER 2 R R R OL-4 R WATER 2 R R 01-7 2 R WATER R R OL-9 WATER 2 R R R OL-3 R WATER 1 OL-5 WATER R 1 OL-6 R WATER 1 OL-8 R WATER OL-10 WATER R 1 OI -11 R WATER SAMPLE CONDITION AS RECEIVED (lab use only) Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below Drinking Water (DW) Samples<sup>1</sup> (client use) (electronic COC only) SIF Observations Yes Frozen No . Are samples taken from a Regulated DW System? Ice Packs Ice Cubes **I** Custody seal intact Π Yeş No TYES THO Cooling Initiated Are samples for human consumption/ use? INIITIAL COOLER TEMPERATURES \*C FINAL COOLER TEMPERATURES \*C Пиез Пию 1.7 **INITIAL SHIPMENT RECEPTION (lab use only)** SHIPMENT RELEASE (client use) FINAL SHIPMENT RECEPTION (lab use only) Time: Released by: Date: Received by: Time: Received by: Date: Date: Time: M 900

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

D SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

DCT 2018 FROM



# Sample Receipt Confirmation

Report Distributi Company					VIRONMEN	ITAL		Acct Name		NSON ENVIRO	NMENTAL
C	ontact		nt Pars					Contact	: ACCOUI	NTS PAYABLE	
Ad	dress:	501	Krug S	St., Suite	202		Address:       1-5 Chancery Lane, Bracebridge, ON, P1L 2E3         Phone:       705-645-0021         iences.ca       Fax:       705-457-5811         ices.ca       Invoice Email:       deborah.sinclair@environmental ca         ax:       N       EDD:       N         Project #:       N/A         Account #:       20126         Date Sampled:       11-FEB-19         Date Received:       14-FEB-19         Sampled By:				
				ON, N2E	3 1L3				Bracebri	dge, ON, P1L 2	E3
F	Phone: Fax:		-576-1					Phone:			
					nvironmen	talscience	6.0.2	Fax:			
	Linan				vironmental			Invoice Email	deborah	sinclair@enviro	nmentalsciences
EDD	Email							involoc Email.			
Distril	bution	: Har	rd Cop	V: N	Email: Y	Fax: I			accounti	ng@environmer	ntalsciences.ca
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								Account #:	20126		
Client Informatic Job Refere Project Legal Site Descr Qu	ence #: t PO #:	N/A	9690				Cł	Date Received Sampled By	l: 14-FEB /:		
Workorder Sum Lab Work O		: L2					Ac	count Manage	Connor	Cattani	
Lab Work O Estimated completio 2 Samples received at Lab Client	Order # on date ALS in	<b>L2</b> :	23274 FEB-19 NNIPE	9	_	ate	Estimated samp	le disposal date	e: See San below. Priority	nple Disposal In Sample	Client
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Lab Work O Estimated completion 2 Samples received at Lab Client Sample ID Sample	Order # on date ALS in	<b>L2</b> :	FEB-1	9	Sar 11-FEB-	npled	Estimated samp Date Received 14-FEB-19 09:00	Sample Due Date 22-FEB-19	e: See San below. Priority	nple Disposal In Sample Type WATER	Client
Lab Work O Estimated completio 2 Samples received at Lab Client Sample ID Sample	Order # on date ALS in	<b>L2</b> :	FEB-1	9	Sar 11-FEB-	npled	Estimated samp Date Received	Sample Due Date 22-FEB-19	e: See San below. Priority	nple Disposal In Sample Type	Client
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Lab Work O Estimated completio 2 Samples received at Sample ID L2232740-1 TRIB 4 L2232740-2 TRIB 5 Analysis Requested:	Drder # n date ALS in ID	<b>L2</b> :	FEB-1	9	Sar 11-FEB-	npled	Estimated samp Date Received 14-FEB-19 09:00	Sample Due Date 22-FEB-19	e: See San below. Priority	nple Disposal In Sample Type WATER	Client
Lab Work O Estimated completio 2 Samples received at Sample ID L2232740-1 TRIB 4 L2232740-2 TRIB 5 Analysis Requested:	Order # n date ALS in ID	: L2: : 22- . WI	FEB-1	9 <b>G</b>	Sar 11-FEB-	npled	Estimated samp Date Received 14-FEB-19 09:00	Sample Due Date 22-FEB-19	e: See San below. Priority	nple Disposal In Sample Type WATER	Client

### Analysis Completion Date (if different than sample due date):

Analysis Requested	Matrix	Due Date	Lab Sample ID
Chlorophyll a by fluorometry	Water	01-MAR-19	L2232740-1, 2
Fecal streptococcus	Water	21-FEB-19	L2232740-1, 2

# Hold Time Exceedences: The following samples have exceeded recommended holding times prior to sample receipt. Analysis Requested Lab Sample ID Recommended Hold Time Date Sampled Date Received

ADDRESS 1329 Niakwa Road East, Unit 12, Winnipeg, MB, Canada R2J 3T4 PHONE +1 204 255 9720 FAX +1 204 255 9721 MANITOBA TECHNOLOGY CENTRE LTD. Part of the ALS Group A Campbell Brothers Limited Company



### Hold Time Exceedences:

Analysis Requested	Lab Sample ID	Recommended Hold Time	Date Sampled	Date Received
Chlorophyll a by fluorometry	L2232740-1, 2	48 hours	11-FEB-19	14-FEB-19
Fecal streptococcus	L2232740-1, 2	30 hours	11-FEB-19	14-FEB-19
Pseudomonas aeruginosa	L2232740-1, 2	30 hours	11-FEB-19	14-FEB-19

Sample Integrity Observations: No observations were identified for this work order submission.

### **Sample Disposal Information:**

Where possible, ALS will store samples for the following durations, measured from date of sample submission: 45 days for Soil and Water samples; 6 months for Tissue/Biota samples; 14 days for air samples collected on re-usable media; and 3 days for water samples submitted for microbiological testing. Longer storage times are available upon request.

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ALS Group strives to deliver on-time results to our clients at all times. However, there are times when due to capacity issues or other unforeseen circumstances we are unable to meet our expected turnaround times. The information above is related to a recent workorder you have submitted to our laboratory. In the event that you have an inquiry, please refer to the Lab Work Order # when calling your Account Manager.

ALS Group appreciates your business. Thank you for the opportunity to work with you.

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	g Water (DW) Samples' (client use) n from a Regulated DW System? es Г No	Special	Instructions / Spe	cify Criteria to add on	report (client Use)	)	Froze Ice pa Cooli		Yes		No		SIF O	bservat dy seal	ions	Yes Yes		No No		]
Are samples for hi	uman drinking water use?							-		TEMPER		6 °C -	10 N - 10	F	INAL CO	OLER T	EMPERATI	URES °C		
F Ye	es TNo	·						1			•						T	<u> </u>		<u> </u>
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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



HUTCHINSON ENVIRONMENTAL SCIENCES LTD ATTN: Brent Parsons 501 Krug St. Suite 202 Kitchener ON N2B 1L3 Date Received:29-MAR-19Report Date:01-APR-19 15:05 (MT)Version:DRAFT

Client Phone: 519-576-1711

# Certificate of Analysis

Lab Work Order #: L2250922 Project P.O. #: 180050 Job Reference: 180050 C of C Numbers: Legal Site Desc:

Gayle Braun Senior Account Manager

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Environmental 🕽

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**RIGHT SOLUTIONS** RIGHT PARTNER

Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
>200		1	CFU/100mL		29-MAR-19	R4587850
16		1	CFU/100mL		29-MAR-19	R458837
>200		1	CFU/100mL		29-MAR-19	R458785
20		1	CFU/100mL		29-MAR-19	R458837
	>200 16 >200	>200 16 >200	>200 1 16 1 >200 1	>200 1 CFU/100mL 16 1 CFU/100mL >200 1 CFU/100mL	>200 1 CFU/100mL 16 1 CFU/100mL >200 1 CFU/100mL	>200         1         CFU/100mL         29-MAR-19           16         1         CFU/100mL         29-MAR-19           >200         1         CFU/100mL         29-MAR-19

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

# **Reference Information**

L2250922 CONTD....

PAGE 3 of 3 Version: DRAFT

### Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
incubated at 35°C for 47 results are reported as Co adjusted accordingly, with	+/- 1 hour. blony Formin report not the term "F	Colonies exhibiting characteristic ing Units (CFU) per 100 mL. The es as required, when less than 100	APHA 9230C (modified) e .45 micron membrane filter. The filter is placed on selective media and morphology for the target group on the filter after incubation are counted and detection limit for this test is 1 when 100 mL of sample is processed, and is 0 mL is processed. re to include all members of genus names Streptococcus and Enterococcus a
plate and incubated for 72 counted. Results are rep	2 hours at 4 orted as the	I1.5 +/- 0.5 C. Plates are examine e number of presumptive P. aerug	APHA 9213E micron membrane filter. The filter is placed on the surface of a selective again d under low magnification and colonies exhibiting typical morphology are inosa CFU/100 mL. Additional confirmation tests can be performed upon requ
ALS test methods may inc	corporate m	nodifications from specified referer	nce methods to improve performance.
The last two letters of the a	above test o	code(s) indicate the laboratory that	t performed analytical analysis for that test. Refer to the list below:
Laboratory Definition Co	de Lab	oratory Location	
WP	ALS	ENVIRONMENTAL - WINNIPEG	, MANITOBA, CANADA
Chain of Custody Number	s:		

applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory

objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid weight of sample

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory. UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION. Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



# **Quality Control Report**

			Workorder:	L2250922	2	Report Date: 01-	APR-19		Page 1 of 2
Client:	501 Krug	ISON ENVIRON St. Suite 202 ON N2B 1L3	MENTAL SCIEN	CES LTD					
Contact:	Brent Pars	sons							
Test		Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
FECALSTREP-N	IF-WP	Water							
Batch WG3017215- Fecal Strepto				<1		CFU/100mL		1	29-MAR-19
PSA-MF-WP		Water							
Batch WG3017218-	R4588376 1 MB								
Pseudomona		sa		<1		CFU/100mL		1	29-MAR-19
					<b>)</b>				

Workorder: L2250922

Report Date: 01-APR-19

Client:	HUTCHINSON ENVIRONMENTAL SCIENCES LTD
	501 Krug St. Suite 202
	Kitchener ON N2B 1L3
Contact:	Brent Parsons

### Juniaci.

Legend:	
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Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

### Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



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### Chain of Custody (COC) / Analytical **Request Form**

Canada Toll Free: 1 800 668 9878



COC Number: LON-190128/

Page of

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treet:	501 KRUG ST ST 202				Email 1 or Fax deborah.sindair@environmentalsciences.ca						Date and Time Required for all ESP TATs: dd-mmm-yy hh:mm														
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HUTCHINSON ENVIRONMENTAL SCIENCES LTD ATTN: Brent Parsons 501 Krug St. Suite 202 Kitchener ON N2B 1L3 Date Received: 29-MAR-19 Report Date: 08-APR-1913:41 (MT) Version: FINAL

Client Phone: 519-576-1711

# Certificate of Analysis

Gayle Braun Senior Account Manager

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Environmental 🕽

www.alsglobal.com

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Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
287	нтс	0.50	ma/L		01-APR-19	
7.56					29-MAR-19	R4587561
10.3		2.0	mg/L	03-APR-19	04-APR-19	R4590119
		-				
280		10	mg/L		29-MAR-19	R4587561
2.21	DLHC	0.10	mg/L		02-APR-19	R4589327
12.2		0.50	mg/L		01-APR-19	R458900 <sup>2</sup>
0.786		0.020	mg/L		01-APR-19	R458900 <sup>2</sup>
3.45		0.15	mg/L	03-APR-19	03-APR-19	R4589872
0.329		0.0030	mg/L	02-APR-19	03-APR-19	R4589414
6.59		0.30	mg/L		01-APR-19	R458900 <sup>2</sup>
LAB					01-APR-19	R458814
11.3		0.50	mg/L	01-APR-19	02-APR-19	R458937
3		0	CFU/100mL		30-MAR-19	R458762
7		0	CFU/100mL		30-MAR-19	R458763
0.278		0.0050	mg/L	29-MAR-19	29-MAR-19	R458792
0.00014		0.00010	mg/L	29-MAR-19	29-MAR-19	R458792
0.00139		0.00010	mg/L	29-MAR-19	29-MAR-19	R458792
0.0534		0.00010	mg/L	29-MAR-19	29-MAR-19	R458792
<0.00010		0.00010	mg/L	29-MAR-19	29-MAR-19	R458792
<0.000050		0.000050	mg/L	29-MAR-19	29-MAR-19	R458792
0.031		0.010	mg/L	29-MAR-19	29-MAR-19	R458792
0.0000313		0.0000050	mg/L	29-MAR-19	29-MAR-19	R458792
100		0.050	mg/L	29-MAR-19	29-MAR-19	R458792
0.000013		0.000010	mg/L	29-MAR-19	29-MAR-19	R458792
0.00082		0.00050	mg/L	29-MAR-19	29-MAR-19	R458792
0.00126		0.00010	mg/L	29-MAR-19	29-MAR-19	R458792
0.0017		0.0010	mg/L	29-MAR-19	29-MAR-19	R458792
0.967		0.010	mg/L	29-MAR-19	29-MAR-19	R458792
0.000172		0.000050	mg/L	29-MAR-19	29-MAR-19	R458792
<0.0010		0.0010	mg/L	29-MAR-19	29-MAR-19	R458792
8.93		0.0050	mg/L	29-MAR-19	29-MAR-19	R458792
0.860		0.00050		29-MAR-19	29-MAR-19	R458792
0.000690		0.000050	mg/L	29-MAR-19	29-MAR-19	R458792
0.00110		0.00050	-	29-MAR-19	29-MAR-19	
0.314		0.050	mg/L	29-MAR-19		R458792
7.28		0.050	mg/L	29-MAR-19	29-MAR-19	
			- <sup>37</sup>			1
0.00197		0.00020	mg/L	29-MAR-19	29-MAR-19	R458792
	287 7.56 10.3 280 2.21 12.2 0.786 3.45 0.329 6.59 LAB 11.3 3 7 0.278 0.0014 0.00139 0.0534 <0.00014 0.00139 0.0534 <0.00010 <0.000050 0.031 0.000050 0.031 0.000013 0.000013 0.000013 0.000126 0.0017 0.967 0.000172 <0.0010 8.93 0.860 0.00110 0.314	287       HTC         7.56       10.3         280       2.21         0.786       3.45         0.329       6.59         6.59       11.3         3       7         0.278       0.00014         0.00139       0.0534         <0.00010	287         HTC         0.50           7.56         0.10           10.3         2.0           280         10           2.21         DLHC           0.786         0.020           3.45         0.15           0.329         0.0030           6.59         0.30           LAB         0.50           11.3         0.50           0.0010         0.00010           0.0014         0.00010           0.00139         0.00010           0.0010         0.00010           0.00010         0.00010           0.00010         0.00010           0.00010         0.00010           0.00010         0.00010           0.00010         0.00010           0.00010         0.00010           0.00010         0.00010           0.00013         0.000050           0.00013         0.000050           0.000126         0.00010           0.00017         0.00050           0.00017         0.00050           0.00017         0.00050           0.00017         0.00050           0.00017         0.00050 <td< td=""><td>287         HTC         0.50         mg/L           7.56         0.10         pH units           10.3         2.0         mg/L           280         10         mg/L           2.21         DLHC         0.10         mg/L           12.2         0.10         mg/L         0.50         mg/L           0.786         0.020         mg/L         0.50         mg/L           0.329         0.0030         mg/L         0.50         mg/L           6.59         0.30         mg/L         0.50         mg/L           11.3         0.50         mg/L         0.0010         mg/L           0.0014         0.0050         mg/L         0.0010         mg/L           0.00534         0.00010         mg/L         0.00010         mg/L           0.00050         0.0010         mg/L         0.00010         mg/L           0.00014         0.00010         mg/L         0.00010         mg/L           0.00050         mg/L         0.00010         mg/L         0.00010           0.00051         0.00010         mg/L         0.00010         mg/L           0.00051         0.00010         mg/L         0.00050&lt;</td><td>287         HTC         0.50         mg/L pH units         ang/L         03-APR-19           280         10         mg/L         03-APR-19           280         10         mg/L         03-APR-19           280         0.10         mg/L         03-APR-19           280         0.10         mg/L         03-APR-19           12.2         0LHC         0.10         mg/L         03-APR-19           0.786         0.020         mg/L         03-APR-19           0.329         0.030         mg/L         02-APR-19           6.59         0.30         mg/L         02-APR-19           11.3         0.50         mg/L         01-APR-19           3         0         CFU/100mL         CFU/100mL           0.0014         0.00010         mg/L         29-MAR-19           0.00139         0.00010         mg/L         29-MAR-19           0.0014         0.00010         mg/L         29-MAR-19           0.00050         mg/L         29-MAR-19         20-000050           0.00013         0.000050         mg/L         29-MAR-19           0.00013         0.000050         mg/L         29-MAR-19           0.00013</td><td>287         HTC         0.50         mg/L         01-APR-19           7.56         0.10         pH units         29-MAR-19           10.3         2.0         mg/L         03-APR-19         04-APR-19           280         10         mg/L         03-APR-19         04-APR-19           2.21         DLHC         0.10         mg/L         02-APR-19           0.786         0.020         mg/L         03-APR-19         03-APR-19           0.329         0.0030         mg/L         03-APR-19         03-APR-19           0.329         0.0030         mg/L         01-APR-19         03-APR-19           1.3         0.50         mg/L         01-APR-19         02-APR-19           3.45         0.15         mg/L         01-APR-19         02-APR-19           1.3         0.50         mg/L         01-APR-19         02-APR-19           3         0         CFU/100mL         30-MAR-19         29-MAR-19           0.00014         0.00010         mg/L         29-MAR-19         29-MAR-19           0.0033         0.00010         mg/L         29-MAR-19         29-MAR-19           0.00050         0.000050         mg/L         29-MAR-19</td></td<>	287         HTC         0.50         mg/L           7.56         0.10         pH units           10.3         2.0         mg/L           280         10         mg/L           2.21         DLHC         0.10         mg/L           12.2         0.10         mg/L         0.50         mg/L           0.786         0.020         mg/L         0.50         mg/L           0.329         0.0030         mg/L         0.50         mg/L           6.59         0.30         mg/L         0.50         mg/L           11.3         0.50         mg/L         0.0010         mg/L           0.0014         0.0050         mg/L         0.0010         mg/L           0.00534         0.00010         mg/L         0.00010         mg/L           0.00050         0.0010         mg/L         0.00010         mg/L           0.00014         0.00010         mg/L         0.00010         mg/L           0.00050         mg/L         0.00010         mg/L         0.00010           0.00051         0.00010         mg/L         0.00010         mg/L           0.00051         0.00010         mg/L         0.00050<	287         HTC         0.50         mg/L pH units         ang/L         03-APR-19           280         10         mg/L         03-APR-19           280         10         mg/L         03-APR-19           280         0.10         mg/L         03-APR-19           280         0.10         mg/L         03-APR-19           12.2         0LHC         0.10         mg/L         03-APR-19           0.786         0.020         mg/L         03-APR-19           0.329         0.030         mg/L         02-APR-19           6.59         0.30         mg/L         02-APR-19           11.3         0.50         mg/L         01-APR-19           3         0         CFU/100mL         CFU/100mL           0.0014         0.00010         mg/L         29-MAR-19           0.00139         0.00010         mg/L         29-MAR-19           0.0014         0.00010         mg/L         29-MAR-19           0.00050         mg/L         29-MAR-19         20-000050           0.00013         0.000050         mg/L         29-MAR-19           0.00013         0.000050         mg/L         29-MAR-19           0.00013	287         HTC         0.50         mg/L         01-APR-19           7.56         0.10         pH units         29-MAR-19           10.3         2.0         mg/L         03-APR-19         04-APR-19           280         10         mg/L         03-APR-19         04-APR-19           2.21         DLHC         0.10         mg/L         02-APR-19           0.786         0.020         mg/L         03-APR-19         03-APR-19           0.329         0.0030         mg/L         03-APR-19         03-APR-19           0.329         0.0030         mg/L         01-APR-19         03-APR-19           1.3         0.50         mg/L         01-APR-19         02-APR-19           3.45         0.15         mg/L         01-APR-19         02-APR-19           1.3         0.50         mg/L         01-APR-19         02-APR-19           3         0         CFU/100mL         30-MAR-19         29-MAR-19           0.00014         0.00010         mg/L         29-MAR-19         29-MAR-19           0.0033         0.00010         mg/L         29-MAR-19         29-MAR-19           0.00050         0.000050         mg/L         29-MAR-19

 $^{\ast}$  Refer to Referenced Information for Qualifiers (if any) and Methodology.

Sample Details/P	arameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
Sampled By: C	RIB 4 :LIENT on 28-MAR-19 @ 16:00 /ATER							
Total Metals								
Silicon (Si)-To	tal	4.51		0.10	mg/L	29-MAR-19	29-MAR-19	R4587923
Silver (Ag)-Tot		<0.000050		0.000050	mg/L	29-MAR-19	29-MAR-19	R4587923
Sodium (Na)-1		6.79		0.050	mg/L	29-MAR-19	29-MAR-19	
( )	Strontium (Sr)-Total			0.0010	mg/L	29-MAR-19	29-MAR-19	
Sulfur (S)-Total		0.170 2.48		0.50	mg/L	29-MAR-19		R458792
Tellurium (Te)		<0.00020		0.00020	mg/L	29-MAR-19	29-MAR-19	
Thallium (TI)-T		<0.000010		0.000010	mg/L	29-MAR-19	29-MAR-19	R458792
Thorium (Th)-		<0.00010		0.00010	mg/L	29-MAR-19	29-MAR-19	R458792
Tin (Sn)-Total		<0.00010		0.00010	mg/L	29-MAR-19		
Titanium (Ti)-1	Fotal	0.0123		0.00030	mg/L	29-MAR-19	29-MAR-19	
Tungsten (W)-		<0.00123		0.00010	mg/L	29-MAR-19	29-MAR-19	R458792
Uranium (U)-T		0.00282		0.000010	mg/L	29-MAR-19	29-MAR-19	R458792
Vanadium (V)		0.00222		0.00050	mg/L	29-MAR-19	29-MAR-19	R458792
Zinc (Zn)-Tota		0.0116		0.0030	mg/L	29-MAR-19	29-MAR-19	R458792
Zirconium (Zr)		<0.00030		0.00030	mg/L	29-MAR-19		R458792
Aggregate Or		<0.00000		0.00000		20 10 10	20 10 10	11400702
BOD	-	4.9		2.0	mg/L	03-APR-19	08-APR-19	R459235
Sampled By: C Matrix: W	RIB 5 :LIENT on 28-MAR-19 @ 16:00 /ATER							
Physical Tests								
Hardness (as	CaCO3)	256	HTC	0.50	mg/L		01-APR-19	
рН		7.67		0.10	pH units		29-MAR-19	R458756
Total Suspend		4.6		2.0	mg/L	03-APR-19	04-APR-19	R459011
Anions and N								
Alkalinity, Tota	( )	270		10	mg/L		29-MAR-19	R458756
Ammonia, Tot	al (as N)	1.58	DLHC	0.10	mg/L		02-APR-19	R458932
Chloride (Cl)		14.4		0.50	mg/L		01-APR-19	R458900
Nitrate (as N)		0.491		0.020	mg/L		01-APR-19	R458900
Total Kjeldahl	-	2.71		0.15	mg/L	03-APR-19	03-APR-19	R458987
Phosphorus, T	Fotal	0.398		0.0030	mg/L	03-APR-19	04-APR-19	R459025
Sulfate (SO4)		7.21		0.30	mg/L		01-APR-19	R458900
Organic / Inor	-							<b>D</b> ( <b>D</b> )
	bon Filtration Location	LAB					01-APR-19	R458814
Dissolved Org		9.01		0.50	mg/L	01-APR-19	02-APR-19	R458937
E. Coli		2		0			20 MAD 10	D 450700
		3		0	CFU/100mL			
Fecal Coliform Total Metals	15	8		0	CFU/100mL		30-MAR-19	R458763
Aluminum (Al)	-Total	0.0605		0.0050	mg/L	29-MAR-19	29-MAR-19	R458702
Antimony (Sb)		0.00012		0.0050	mg/L	29-MAR-19 29-MAR-19		
,					-			
Arsenic (As)-T	υιαι	0.00121		0.00010	mg/L	29-MAR-19	29-MAR-19	R458792

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2250927-2 TRIB 5 Sampled By: CLIENT on 28-MAR-19 @ 16:00 Matrix: WATER							
Total Metals							
Barium (Ba)-Total	0.0415		0.00010	mg/L	29-MAR-19	29-MAR-19	R4587923
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	29-MAR-19	29-MAR-19	R4587923
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	29-MAR-19		R4587923
Boron (B)-Total	0.023		0.010	mg/L	29-MAR-19	29-MAR-19	R4587923
Cadmium (Cd)-Total	0.0000150		0.0000050	mg/L	29-MAR-19	29-MAR-19	R4587923
Calcium (Ca)-Total	88.9		0.050	mg/L	29-MAR-19	29-MAR-19	R4587923
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	29-MAR-19	29-MAR-19	R4587923
Chromium (Cr)-Total	<0.00050		0.00050	mg/L	29-MAR-19	29-MAR-19	R4587923
Cobalt (Co)-Total	0.00115		0.00010	mg/L	29-MAR-19	29-MAR-19	R4587923
Copper (Cu)-Total	0.0013		0.0010	mg/L	29-MAR-19	29-MAR-19	R4587923
Iron (Fe)-Total	0.826		0.010	mg/L	29-MAR-19	29-MAR-19	R4587923
Lead (Pb)-Total	0.000106		0.000050	mg/L	29-MAR-19	29-MAR-19	R4587923
Lithium (Li)-Total	<0.0010		0.0010	mg/L	29-MAR-19	29-MAR-19	R4587923
Magnesium (Mg)-Total	8.28		0.0050	mg/L	29-MAR-19	29-MAR-19	R4587923
Manganese (Mn)-Total	1.31		0.00050	mg/L	29-MAR-19	29-MAR-19	R4587923
Molybdenum (Mo)-Total	0.000589		0.000050	mg/L	29-MAR-19	29-MAR-19	R4587923
Nickel (Ni)-Total	0.00079		0.00050	mg/L	29-MAR-19	29-MAR-19	R4587923
Phosphorus (P)-Total	0.413		0.050	mg/L	29-MAR-19	29-MAR-19	R4587923
Potassium (K)-Total	7.54		0.050	mg/L	29-MAR-19	29-MAR-19	R4587923
Rubidium (Rb)-Total	0.00217		0.00020	mg/L	29-MAR-19	29-MAR-19	R4587923
Selenium (Se)-Total	0.000168		0.000050	mg/L	29-MAR-19	29-MAR-19	R4587923
Silicon (Si)-Total	3.72		0.10	mg/L	29-MAR-19	29-MAR-19	R4587923
Silver (Ag)-Total	<0.000050		0.000050	mg/L	29-MAR-19	29-MAR-19	R4587923
Sodium (Na)-Total	8.50		0.050	mg/L	29-MAR-19	29-MAR-19	R4587923
Strontium (Sr)-Total	0.158		0.0010	mg/L	29-MAR-19	29-MAR-19	R4587923
Sulfur (S)-Total	2.54		0.50	mg/L	29-MAR-19	29-MAR-19	R4587923
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	29-MAR-19	29-MAR-19	R4587923
Thallium (TI)-Total	<0.000010		0.000010	mg/L	29-MAR-19	29-MAR-19	
Thorium (Th)-Total	<0.00010		0.00010	mg/L	29-MAR-19		R4587923
Tin (Sn)-Total	<0.00010		0.00010	mg/L	29-MAR-19	29-MAR-19	
Titanium (Ti)-Total	<0.0030	DLUI	0.0030	mg/L	29-MAR-19	29-MAR-19	R4587923
Tungsten (W)-Total	<0.00010		0.00010	mg/L	29-MAR-19	29-MAR-19	
Uranium (U)-Total	0.00169		0.000010	mg/L	29-MAR-19	29-MAR-19	
Vanadium (V)-Total	0.00109		0.00050	mg/L	29-MAR-19		R4587923
Zinc (Zn)-Total	0.0189		0.0030	mg/L	29-MAR-19		R4587923
Zirconium (Zr)-Total Aggregate Organics	<0.00030		0.00030	mg/L	29-MAR-19	29-MAR-19	R4587923
BOD	2.9		2.0	mg/L	03-APR-19	08-APR-19	R4592350
	2.5		2.0				1,1-002000

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

# **Reference Information**

### **QC Samples with Qualifiers & Comments:**

-				
QC Type Descri	ption	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike		Barium (Ba)-Total	MS-B	L2250927-1, -2
Matrix Spike		Calcium (Ca)-Total	MS-B	L2250927-1, -2
Matrix Spike		Iron (Fe)-Total	MS-B	L2250927-1, -2
Matrix Spike		Magnesium (Mg)-Total	MS-B	L2250927-1, -2
Matrix Spike		Manganese (Mn)-Total	MS-B	L2250927-1, -2
Matrix Spike		Potassium (K)-Total	MS-B	L2250927-1, -2
Matrix Spike		Silicon (Si)-Total	MS-B	L2250927-1, -2
Matrix Spike		Sodium (Na)-Total	MS-B	L2250927-1, -2
Matrix Spike		Strontium (Sr)-Total	MS-B	L2250927-1, -2
Matrix Spike		Sulfur (S)-Total	MS-B	L2250927-1, -2
Matrix Spike		Uranium (U)-Total	MS-B	L2250927-1, -2
Matrix Spike		Ammonia, Total (as N)	MS-B	L2250927-1, -2
ample Param	eter Qualifier key l	isted:		
Qualifier	Description			
DLHC	Detection Limit Raise	ed: Dilution required due to high con	centration of test and	alyte(s).
DLUI	Detection Limit Raise	ed: Unknown Interference generated	l an apparent false p	ositive test result.
нтс	Hardness was calcul	ated from Total Ca and/or Mg conce	entrations and may b	e biased high (dissolved Ca/Mg results unavailable).
MS-B		y could not be accurately calculated		а (
est Method R	oforoncos:	· · ·		
ALS Test Code	Matrix	Test Description	Method Refere	ence**
		· · · · · · · · · · · · · · · · · · ·		
ALK-WT This analysis is colourimetric m		Alkalinity, Total (as CaCO3) cedures adapted from EPA Method 3	EPA 310.2 310.2 "Alkalinity". To	tal Alkalinity is determined using the methyl orange
oxygen deman dissolved oxyg	d (BOD) are determine en meter. Dissolved B	ed by diluting and incubating a samp	le for a specified tim ering the sample three	cal Oxygen Demand (BOD)". All forms of biochemical e period, and measuring the oxygen depletion using a ough a glass fibre filter prior to dilution. Carbonaceous ubation.
CL-IC-N-WT	Water	Chloride by IC	EPA 300.1 (m	od)
Inorganic anior	ns are analyzed by Ion	Chromatography with conductivity a	nd/or UV detection.	
Analysis condu Protection Act		th the Protocol for Analytical Method	ls Used in the Asses	sment of Properties under Part XV.1 of the Environmer
DOC-WT Sample is filter vaporized and infrared detecto	the organic carbon is o	Dissolved Organic Carbon ilter, then injected into a heated read oxidized to carbon dioxide. The carbo	APHA 5310B ction chamber which on dioxide is transpo	is packed with an oxidative catalyst. The water is rted in a carrier gas and is measured by a non-dispersiv
EC-MF-WT	Water	E. coli	SM 9222D	
A 100 mL volur Method ID: WT		d through a membrane, the membra	ne is placed on mFC	-BCIG agar and incubated at 44.5 –0 .2 °C for 24 – 2 h
FC-MF-WT	Water	Fecal Coliforms	SM 9222D	
	ne of sample is filtered			agar and incubated at 24–2h@44.5–0.2°C. Method ID:
	known as Total Hardı	Hardness ness) is calculated from the sum of C oncentrations are preferentially used		ium concentrations, expressed in CaCO3 equivalents. Iculation.
MET-T-CCMS-W Water samples		Total Metals in Water by CRC c acids, and analyz	EPA 200.2/602 zed by CRC ICPMS.	20A (mod)
Method Limitat	ion (re: Sulfur): Sulfide	and volatile sulfur species may not	be recovered by this	method.
Analysis condu	icted in accordance wi	th the Protocol for Analytical Method	ls Used in the Asses	sment of Properties under Part XV.1 of the Environmen
Protection Act				

NH3-F-WT Water Ammonia in Water by Fluorescence J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

# **Reference Information**

NO3-IC-WT Inorganic anions are ana	Water lyzed by Ion C	Nitrate in Water by IC Chromatography with conductivity and/or	EPA 300.1 (mod) r UV detection.
P-T-COL-WT	Water	Total P in Water by Colour	APHA 4500-P PHOSPHORUS
This analysis is carried o after persulphate digestic			0-P "Phosphorus". Total Phosphorus is deteremined colourimetrically
PH-WT Water samples are analy	Water zed directly b	pH y a calibrated pH meter.	APHA 4500 H-Electrode
		the Protocol for Analytical Methods Us for samples under this regulation is 28	ed in the Assessment of Properties under Part XV.1 of the Environmental days
SO4-IC-N-WT	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are ana	lyzed by Ion C	Chromatography with conductivity and/o	r UV detection.
SOLIDS-TSS-WT A well-mixed sample is fi four hours or until a cons			APHA 2540 D-Gravimetric d the residue retained is dried in an oven at 104–1°C for a minimum of
		Total Kjeldahl Nitrogen edures adapted from APHA Method 450 nalysis using an automated colorimetric	APHA 4500-Norg D 0-Norg "Nitrogen (Organic)". Total Kjeldahl Nitrogen is determined by e method.
** ALS test methods may in	corporate mo	difications from specified reference met	hods to improve performance.
The last two letters of the a	above test co	de(s) indicate the laboratory that perforr	ned analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

### **Chain of Custody Numbers:**

LON-180129

### **GLOSSARY OF REPORT TERMS**

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid weight of sample

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory. UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION. Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



			Qualit	y Contr	ol Report			
		Workorder:	L2250927	7	Report Date: 08-	APR-19		Page 1 of 11
Olient.	HUTCHINSON ENVIRON 501 Krug St. Suite 202 Kitchener ON N2B 1L3	MENTAL SCIENC	ES LTD					
Contact:	Brent Parsons							
Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALK-WT	Water							
Batch R	4587561							
WG3016874-20 Alkalinity, Tota		<b>WG3016874-1</b> 9 280	<b>9</b> 281		mg/L	0.3	20	29-MAR-19
WG3016874-1 Alkalinity, Tota			109.6		%		85-115	29-MAR-19
WG3016874-1 Alkalinity, Tota			<10		mg/L		10	29-MAR-19
BOD-WT	Water							
Batch R	4592350							
WG3020472-2 BOD	DUP	<b>L2252347-2</b> 92.1	91.5		mg/L	0.7	20	08-APR-19
WG3020472-3	LCS				J.			
BOD			94.9		%		85-115	08-APR-19
WG3020472-1 BOD	МВ		<2.0		mg/L		2	08-APR-19
CL-IC-N-WT	Water							
	4589001							
WG3018591-19 Chloride (Cl)	9 DUP	<b>WG3018591-18</b> 61.3	<b>3</b> 61.3		mg/L	0.1	20	01-APR-19
WG3018591-1 Chloride (Cl)	7 LCS		101.7		%		90-110	01-APR-19
WG3018591-10 Chloride (Cl)	6 MB		<0.50		mg/L		0.5	01-APR-19
WG3018591-20 Chloride (Cl)	0 MS	WG3018591-18	<b>3</b> 101.5		%		75-125	01-APR-19
DOC-WT	Water							
Batch R	4589378							
WG3018432-3 Dissolved Org		<b>L2251250-1</b> 1.14	1.16		mg/L	1.1	25	02-APR-19
WG3018432-2 Dissolved Org			101.6		%		70-130	02-APR-19
WG3018432-1 Dissolved Org	МВ		<0.50		mg/L		0.5	02-APR-19
WG3018432-4 Dissolved Org	MS	L2251250-1	99.5		%			
EC-MF-WT	Water		33.0		70		70-130	02-APR-19
	Hater							



Nickel (Ni)-Total

Phosphorus (P)-Total

Potassium (K)-Total

0.00110

0.314

7.28

0.00112

0.279

7.47

mg/L

mg/L

mg/L

1.5

12

20

20

29-MAR-19

29-MAR-19

# **Quality Control Report**

	Quality Control Report								
			Workorder:	L2250927	I	Report Date: 08-A	PR-19		Page 2 of 11
5 5 8	501 Krug S	SON ENVIRONM St. Suite 202 ON N2B 1L3 sons	IENTAL SCIENC	ES LTD					
Test		Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
EC-MF-WT Batch R4	4587629	Water							
WG3017270-3	+387 029 DUP		L2250901-3						
E. Coli	201		0	0		CFU/100mL	0.0	65	30-MAR-19
WG3017270-1	МВ								
E. Coli				0		CFU/100mL		1	30-MAR-19
FC-MF-WT		Water							
	4587630								
WG3017278-3 Fecal Coliforms	DUP		<b>L2250927-2</b> 8	<10		CFU/100mL	N1/A	05	
			0	<10	RPD-NA	CF0/100IIIL	N/A	65	30-MAR-19
WG3017278-1 Fecal Coliforms	MB S			0		CFU/100mL		1	30-MAR-19
MET-T-CCMS-WT		Water							
Batch R4	4587923								
WG3017454-4	DUP		WG3017454-3						
Aluminum (Al)-			0.278	0.273		mg/L	1.7	20	29-MAR-19
Antimony (Sb)-			0.00014	0.00014		mg/L	0.4	20	29-MAR-19
Arsenic (As)-To			0.00139	0.00132		mg/L	5.7	20	29-MAR-19
Barium (Ba)-To			0.0534	0.0512		mg/L	4.2	20	29-MAR-19
Beryllium (Be)-			<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	29-MAR-19
Bismuth (Bi)-To			<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	29-MAR-19
Boron (B)-Total			0.031	0.028		mg/L	8.8	20	29-MAR-19
Cadmium (Cd)-			0.0000313	0.0000271		mg/L	14	20	29-MAR-19
Calcium (Ca)-T			100	92.4		mg/L	7.9	20	29-MAR-19
Chromium (Cr)			0.00082	0.00082		mg/L	0.5	20	29-MAR-19
Cesium (Cs)-To			0.000013	0.000012		mg/L	3.2	20	29-MAR-19
Cobalt (Co)-Tot	tal		0.00126	0.00126		mg/L	0.0	20	29-MAR-19
Copper (Cu)-To			0.0017	0.0017		mg/L	2.5	20	29-MAR-19
Iron (Fe)-Total			0.967	0.966		mg/L	0.0	20	29-MAR-19
Lead (Pb)-Tota	1		0.000172	0.000170		mg/L	0.9	20	29-MAR-19
Lithium (Li)-Tot			<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	29-MAR-19
Magnesium (Mg			8.93	8.90		mg/L	0.2	20	29-MAR-19
Manganese (M			0.860	0.845		mg/L	1.7	20	29-MAR-19
Molybdenum (N	/lo)-Total		0.000690	0.000622		mg/L	10	20	29-MAR-19



Workorder: L2250927

Report Date: 08-APR-19

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HUTCHINSON ENVIRONMENTAL SCIENCES LTD Client: 501 Krug St. Suite 202 Kitchener ON N2B 1L3

Brent Parsons

Contact:

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT	Water							
Batch R4587923								
WG3017454-4 DUP Potassium (K)-Total		WG3017454-3	7 47		ma/l	0.5	00	
Rubidium (Rb)-Total		7.28 0.00197	7.47 0.00197		mg/L mg/L	2.5	20	29-MAR-19
Selenium (Se)-Total		0.000218	0.000244		mg/L	0.1	20	29-MAR-19
Silicon (Si)-Total		4.51	4.45		•	11	20	29-MAR-19
Silver (Ag)-Total		<0.000050	<0.000050		mg/L	1.2	20	29-MAR-19
Sodium (Na)-Total		<0.000050 6.79	<0.000030	RPD-NA	mg/L	N/A	20	29-MAR-19
Strontium (Sr)-Total		0.170	0.158		mg/L mg/L	3.2	20	29-MAR-19
Sulfur (S)-Total		2.48	2.50		•	7.2	20	29-MAR-19
					mg/L	1.0	25	29-MAR-19
Thallium (TI)-Total		<0.000010	<0.000010	=	mg/L	N/A	20	29-MAR-19
Tellurium (Te)-Total		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	29-MAR-19
Thorium (Th)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	25	29-MAR-19
Tin (Sn)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	29-MAR-19
Titanium (Ti)-Total		0.0123	0.0121		mg/L	1.3	20	29-MAR-19
Tungsten (W)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	29-MAR-19
Uranium (U)-Total		0.00282	0.00283		mg/L	0.3	20	29-MAR-19
Vanadium (V)-Total		0.00222	0.00221		mg/L	0.5	20	29-MAR-19
Zinc (Zn)-Total		0.0116	0.0112		mg/L	3.4	20	29-MAR-19
Zirconium (Zr)-Total		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	29-MAR-19
WG3017454-2 LCS Aluminum (Al)-Total			99.4		%		80-120	29-MAR-19
Antimony (Sb)-Total			103.8		%		80-120	29-MAR-19
Arsenic (As)-Total			97.2		%		80-120	29-MAR-19
Barium (Ba)-Total			98.9		%		80-120	29-MAR-19
Beryllium (Be)-Total			95.0		%		80-120	29-MAR-19
Bismuth (Bi)-Total			103.3		%		80-120	29-MAR-19
Boron (B)-Total			94.3		%		80-120	29-MAR-19
Cadmium (Cd)-Total			95.3		%		80-120	29-MAR-19
Calcium (Ca)-Total			97.2		%		80-120	29-MAR-19
Chromium (Cr)-Total			97.6		%		80-120	29-MAR-19
Cesium (Cs)-Total			94.4		%		80-120	29-MAR-19
Cobalt (Co)-Total			96.7		%		80-120	29-MAR-19
Copper (Cu)-Total			98.0		%		80-120	29-MAR-19
Iron (Fe)-Total			93.1		%		80-120	29-MAR-19



Report Date: 08-APR-19

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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD 501 Krug St. Suite 202

Workorder: L2250927

Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT	Water							
Batch R4587923								
WG3017454-2 LCS					0/			
Lead (Pb)-Total			99.6		%		80-120	29-MAR-19
Lithium (Li)-Total			88.9		%		80-120	29-MAR-19
Magnesium (Mg)-Total			97.6		%		80-120	29-MAR-19
Manganese (Mn)-Total			97.5		%		80-120	29-MAR-19
Molybdenum (Mo)-Total			101.3		%		80-120	29-MAR-19
Nickel (Ni)-Total			96.9		%		80-120	29-MAR-19
Phosphorus (P)-Total			104.5		%		70-130	29-MAR-19
Potassium (K)-Total			91.9		%		80-120	29-MAR-19
Rubidium (Rb)-Total			95.8		%		80-120	29-MAR-19
Selenium (Se)-Total			96.8		%		80-120	29-MAR-19
Silicon (Si)-Total			98.2		%		60-140	29-MAR-19
Silver (Ag)-Total			95.9		%		80-120	29-MAR-19
Sodium (Na)-Total			101.0		%		80-120	29-MAR-19
Strontium (Sr)-Total			101.3		%		80-120	29-MAR-19
Sulfur (S)-Total			97.3		%		80-120	29-MAR-19
Thallium (TI)-Total			103.1		%		80-120	29-MAR-19
Tellurium (Te)-Total			95.8		%		80-120	29-MAR-19
Thorium (Th)-Total			93.8		%		70-130	29-MAR-19
Tin (Sn)-Total			96.5		%		80-120	29-MAR-19
Titanium (Ti)-Total			94.3		%		80-120	29-MAR-19
Tungsten (W)-Total			96.6		%		80-120	29-MAR-19
Uranium (U)-Total			95.4		%		80-120	29-MAR-19
Vanadium (V)-Total			99.1		%		80-120	29-MAR-19
Zinc (Zn)-Total			95.0		%		80-120	29-MAR-19
Zirconium (Zr)-Total			93.9		%		80-120	29-MAR-19
WG3017454-1 MB								
Aluminum (Al)-Total			<0.0050		mg/L		0.005	29-MAR-19
Antimony (Sb)-Total			<0.00010	)	mg/L		0.0001	29-MAR-19
Arsenic (As)-Total			<0.00010	)	mg/L		0.0001	29-MAR-19
Barium (Ba)-Total			<0.00010	)	mg/L		0.0001	29-MAR-19
Beryllium (Be)-Total			<0.00010	)	mg/L		0.0001	29-MAR-19
Bismuth (Bi)-Total			<0.00005	i0	mg/L		0.00005	29-MAR-19
Boron (B)-Total			<0.010		mg/L		0.01	29-MAR-19
Cadmium (Cd)-Total			<0.00000	50	mg/L		0.000005	29-MAR-19



Workorder: L2250927

Report Date: 08-APR-19

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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD 501 Krug St. Suite 202

Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT	Water							
Batch R4587923								
WG3017454-1 MB Calcium (Ca)-Total			<0.050		ma/l		0.05	
Chromium (Cr)-Total			<0.00050		mg/L mg/L		0.0005	29-MAR-19
Cesium (Cs)-Total			<0.000010	h	mg/L		0.00001	29-MAR-19
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	29-MAR-19 29-MAR-19
Copper (Cu)-Total			<0.0010		mg/L		0.0001	
Iron (Fe)-Total			<0.010		mg/L		0.01	29-MAR-19
Lead (Pb)-Total			< 0.000050	,	mg/L		0.00005	29-MAR-19
Lithium (Li)-Total			<0.000000	1	mg/L		0.0000	29-MAR-19
Magnesium (Mg)-Total			<0.0010		mg/L		0.001	29-MAR-19
Magnesium (Mg)-Total			<0.0050		mg/L		0.0005	29-MAR-19
Molybdenum (Mo)-Total			< 0.000050	1	mg/L		0.00005	29-MAR-19 29-MAR-19
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	29-MAR-19 29-MAR-19
Phosphorus (P)-Total			<0.050		mg/L		0.05	29-MAR-19 29-MAR-19
Potassium (K)-Total			<0.050		mg/L		0.05	29-MAR-19 29-MAR-19
Rubidium (Rb)-Total			<0.00020		mg/L		0.0002	29-MAR-19 29-MAR-19
Selenium (Se)-Total			<0.000050	)	mg/L		0.00005	29-MAR-19
Silicon (Si)-Total			<0.10	,	mg/L		0.1	29-MAR-19
Silver (Ag)-Total			<0.000050	)	mg/L		0.00005	29-MAR-19
Sodium (Na)-Total			<0.050		mg/L		0.05	29-MAR-19
Strontium (Sr)-Total			<0.0010		mg/L		0.001	29-MAR-19
Sulfur (S)-Total			<0.50		mg/L		0.5	29-MAR-19
Thallium (TI)-Total			<0.000010	)	mg/L		0.00001	29-MAR-19
Tellurium (Te)-Total			<0.00020		mg/L		0.0002	29-MAR-19
Thorium (Th)-Total			<0.00010		mg/L		0.0001	29-MAR-19
Tin (Sn)-Total			<0.00010		mg/L		0.0001	29-MAR-19
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	29-MAR-19
Tungsten (W)-Total			<0.00010		mg/L		0.0001	29-MAR-19
Uranium (U)-Total			<0.000010	)	mg/L		0.00001	29-MAR-19
Vanadium (V)-Total			<0.00050		mg/L		0.0005	29-MAR-19
Zinc (Zn)-Total			<0.0030		mg/L		0.003	29-MAR-19
Zirconium (Zr)-Total			<0.00030		mg/L		0.0003	29-MAR-19
WG3017454-5 MS		WG3017454-6			-			-
Aluminum (Al)-Total			103.2		%		70-130	29-MAR-19
Antimony (Sb)-Total			99.9		%		70-130	29-MAR-19



Workorder: L2250927

Report Date: 08-APR-19

Page 6 of 11

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD 501 Krug St. Suite 202 Kitchener ON N2B 1L3

Contact: Brent Parsons

Teet	Motrie	Deference	Decult	Qualifier	l Init-	000	l inclé	Analyza
Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT	Water							
Batch R4587923								
WG3017454-5 MS Arsenic (As)-Total		WG3017454-	<b>6</b> 97.9		%		70-130	20 MAR 10
Barium (Ba)-Total			97.9 N/A	MS-B	%		70-130	29-MAR-19 29-MAR-19
Beryllium (Be)-Total			96.2	INIO-D	%		- 70-130	
Bismuth (Bi)-Total			96.6		%		70-130	29-MAR-19 29-MAR-19
Boron (B)-Total			90.8		%		70-130	29-MAR-19 29-MAR-19
Cadmium (Cd)-Total			96.8		%		70-130	29-MAR-19 29-MAR-19
Calcium (Ca)-Total			N/A	MS-B	%		-	29-MAR-19 29-MAR-19
Chromium (Cr)-Total			99.4	NIO-D	%		- 70-130	29-MAR-19 29-MAR-19
Cesium (Cs)-Total			93.9		%		70-130	29-MAR-19 29-MAR-19
Cobalt (Co)-Total			95.8		%		70-130	29-MAR-19
Copper (Cu)-Total			94.5		%		70-130	29-MAR-19
Iron (Fe)-Total			N/A	MS-B	%		-	29-MAR-19
Lead (Pb)-Total			94.3		%		70-130	29-MAR-19
Lithium (Li)-Total			90.5		%		70-130	29-MAR-19
Magnesium (Mg)-Total			N/A	MS-B	%		-	29-MAR-19
Manganese (Mn)-Total			N/A	MS-B	%		-	29-MAR-19
Molybdenum (Mo)-Total			106.4		%		70-130	29-MAR-19
Nickel (Ni)-Total			95.2		%		70-130	29-MAR-19
Phosphorus (P)-Total			95.8		%		70-130	29-MAR-19
Potassium (K)-Total			N/A	MS-B	%		-	29-MAR-19
Rubidium (Rb)-Total			100.2		%		70-130	29-MAR-19
Selenium (Se)-Total			99.4		%		70-130	29-MAR-19
Silicon (Si)-Total			N/A	MS-B	%		-	29-MAR-19
Silver (Ag)-Total			91.4		%		70-130	29-MAR-19
Sodium (Na)-Total			N/A	MS-B	%		-	29-MAR-19
Strontium (Sr)-Total			N/A	MS-B	%		-	29-MAR-19
Sulfur (S)-Total			N/A	MS-B	%		-	29-MAR-19
Thallium (TI)-Total			97.7		%		70-130	29-MAR-19
Tellurium (Te)-Total			92.6		%		70-130	29-MAR-19
Thorium (Th)-Total			88.4		%		70-130	29-MAR-19
Tin (Sn)-Total			94.3		%		70-130	29-MAR-19
Titanium (Ti)-Total			100.4		%		70-130	29-MAR-19
Tungsten (W)-Total			95.8		%		70-130	29-MAR-19



				Qualit	y Conti	rol Report			
			Workorder:	L225092	7	Report Date:	08-APR-19		Page 7 of 11
Client: Contact:	501 Krug	St. Suite 202 ON N2B 1L3	MENTAL SCIENC	ES LTD					
Test		Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-	wт	Water							
Batch	R4587923								
<b>WG301745</b> Uranium (L			WG3017454-6	N/A	MS-B	%		-	29-MAR-19
Vanadium	(V)-Total			102.0		%		70-130	29-MAR-19
Zinc (Zn)-T				87.4		%		70-130	29-MAR-19
Zirconium				84.9		%		70-130	29-MAR-19
NH3-F-WT		Water							
Batch	R4589327								
WG301910 Ammonia,	6-3 DUP Total (as N)		<b>L2251616-1</b> 0.304	0.292		mg/L	3.9	20	02-APR-19
WG301910 Ammonia,	6-2 LCS Total (as N)			108.8		%		85-115	02-APR-19
WG301910 Ammonia,	6-1 MB Total (as N)			<0.010		mg/L		0.01	02-APR-19
WG301910 Ammonia,	6 <b>-4 MS</b> Total (as N)		L2251616-1	N/A	MS-B	%		-	02-APR-19
NO3-IC-WT		Water							
Batch WG301859 <sup>,</sup> Nitrate (as			<b>WG3018591-1</b> 8 0.054	<b>8</b> 0.056		mg/L	2.4	20	01-APR-19
WG301859 Nitrate (as				101.3		%		90-110	01-APR-19
WG301859 Nitrate (as				<0.020		mg/L		0.02	01-APR-19
WG301859 Nitrate (as			WG3018591-18	<b>8</b> 100.9		%		75-125	01-APR-19
P-T-COL-WT		Water							
Batch WG301958 Phosphoru			<b>L2251223-1</b> 0.0114	0.0121		mg/L	6.7	20	03-APR-19
WG301958 Phosphoru				103.0		%		80-120	03-APR-19
WG301958 Phosphoru				<0.0030		mg/L		0.003	03-APR-19
WG301958 Phosphoru			L2251223-1	93.7		%		70-130	03-APR-19



			guanty		Report			
		Workorder:	L2250927	R	eport Date: 08-AF	PR-19		Page 8 of 11
501 Krug	NSON ENVIRONM St. Suite 202 ON N2B 1L3	IENTAL SCIENC	ES LTD					
Contact: Brent Par	sons							
Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
P-T-COL-WT	Water							
Batch R4590253								
WG3020446-3 DUP Phosphorus, Total		<b>L2251227-1</b> 0.0065	0.0087	J	mg/L	0.0022	0.006	04-APR-19
WG3020446-2 LCS Phosphorus, Total			99.3		%		80-120	04-APR-19
WG3020446-1 MB Phosphorus, Total			<0.0030		mg/L		0.003	04-APR-19
WG3020446-4 MS		L2251227-1	<0.0030		iiig/L		0.003	04-APR-19
Phosphorus, Total		L2231227-1	93.0		%		70-130	04-APR-19
PH-WT	Water							
Batch R4587561								
WG3016874-20 DUP		WG3016874-19			al lucaita			
рН		7.56	7.56	J	pH units	0.00	0.2	29-MAR-19
<b>WG3016874-18 LCS</b> рН			6.99		pH units		6.9-7.1	29-MAR-19
SO4-IC-N-WT	Water							
Batch R4589001								
WG3018591-19 DUP		WG3018591-18						
Sulfate (SO4)		14.3	14.3		mg/L	0.3	20	01-APR-19
WG3018591-17 LCS Sulfate (SO4)			102.4		%		90-110	01-APR-19
WG3018591-16 MB Sulfate (SO4)			<0.30		mg/L		0.3	01-APR-19
<b>WG3018591-20 MS</b> Sulfate (SO4)		WG3018591-18	<b>3</b> 102.2		%		75-125	
SOLIDS-TSS-WT	Water		102.2		70		75-125	01-APR-19
Batch R4590119								
WG3019915-3 DUP		L2251141-10						
Total Suspended Solids		297	338		mg/L	13	20	04-APR-19
WG3019915-2 LCS Total Suspended Solids			100.9		%		85-115	04-APR-19
WG3019915-1 MB Total Suspended Solids			<2.0		mg/L		2	04-APR-19
TKN-WT	Water							
Batch R4589872								
WG3019767-3 DUP Total Kjeldahl Nitrogen		<b>L2250927-1</b> 3.45	3.43		mg/L	0.7	20	03-APR-19
WG3019767-2 LCS								



				-		-			
			Workorder:	L2250927	,	Report Date:	08-APR-19		Page 9 of 11
Client:	501 Krug	ISON ENVIRON St. Suite 202 ON N2B 1L3	MENTAL SCIEN	CES LTD					
Contact:	Brent Par								
Test		Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TKN-WT		Water							
Batch	R4589872								
WG3019767- Total Kjeldal				99.6		%		75-125	03-APR-19
WG3019767- Total Kjeldal				<0.15		mg/L		0.15	03-APR-19
<b>WG3019767-</b> Total Kjeldal	-		L2250927-1	100.5		%		70-130	03-APR-19

Workorder: L2250927

Report Date: 08-APR-19

Client:	HUTCHINSON ENVIRONMENTAL SCIENCES LTD
	501 Krug St. Suite 202
	Kitchener ON N2B 1L3
Contact:	Brent Parsons

### Contact:

#### Legend:

Limit DUP	ALS Control Limit (Data Quality Objectives) Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

#### Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Workorder: L2250927

Report Date: 08-APR-19

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD 501 Krug St. Suite 202 Kitchener ON N2B 1L3 Contact: Brent Parsons

Page 11 of 11

#### Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Aggregate Organics							
BOD							
	1	28-MAR-19 16:00	08-APR-19 12:00	4	11	days	EHT
	2	28-MAR-19 16:00	08-APR-19 12:00	4	11	days	EHT

#### Legend & Qualifier Definitions:

EHTR-FM:	Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR:	Exceeded ALS recommended hold time prior to sample receipt.
EHTL:	Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT:	Exceeded ALS recommended hold time prior to analysis.
Rec. HT:	ALS recommended hold time (see units).

Notes\*:

Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes. Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2250927 were received on 29-MAR-19 10:00.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



### Chain of Custody (COC) / Analytical

Request Form



COC Number: LON-180129

Page of

www.alsglobal.com

#### Canada Toll Free: 1 800 668 9878

Report To	Contact and company name below will appear on the fit	nal report	Report Format	/ Distribution		1	Sēleci	Servi	ce Le	/ei 19ek	- w	Contac	t you	r AM te	n confi	inn all	E&P T	ATs (	surcha	irges	may apply	0
Company:	HUTCHINSON ENV	Select Report	Format: 🔽 PDF [		O (DIGITAL)		Re	jular	[R]	🖸 Star	dard	TAT if n	eceivec	l by 3 p	m - bus	iness d	ays - no	surcha	nges ap	.apty		
Contact:	BRENT PARSONS	Quality Control	(QC) Report with R	epont 🖸 YES		٢	4 day					ENCY	1 Bu	sine	a day	[E - 1	100%]					
Phone:	519-576-1711	Compare Resu	its to Criteria on Report -			PRIORITY untress Da	3 day	(P3-)	25%]			EKG.	Same	e Day,	Weel	kend (	or Sta	tutory	y holid	day (f	2 -200%	
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Street:	501 KRUG ST ST 202	Email 1 or Fax	deborah.sinclair@	environmentalso	ciences.ca	ě20	Date an	d Time	Requi	red for	il E&	P, TAT:					dd-m	mm-yy	y hh:	mm		
City/Province:	KTICHENER, ON	Email 2	brent.parsons@er	ivironmentalscie	nces.ca	For tes	its tivat c	an not t	be perio	rmed ac	cordin	g to the	service	ievel s	elected,	you will	l be cont	acted.				
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ALS Lab Wor	tk Order # (lab use only): LDDGOC	12 - ALS Contact:	Gayle	Sampler:		<b>ABE</b>	E.COLIFECAL	ALKALINITY			, S04	METAL	NH3/TKN/TP			ŝ					AMP	SUSPECTED HAZARD (see Special Instructions)
ALS Sample #	Sample Identification and/or C	Coordinates	Date	Time	Sample Type	MUN	0F	F	_	0	CI, NO3,	TOTAL	Ě	рНЛSS		THING					<u>ج</u>	Шdg -
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Drinking	Water (DW) Samples <sup>1</sup> (client use) Special t	nstructions / Specify Criteria to	add on report by clin ectronic COC only)	cking on the drop	-down list below	-					PLE		_	VN AS	-	EIVED Yes	(lab i	ise or	nly)			γ.
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REFER TO BACI	K PAGE FOR ALS LOCATIONS AND SAMPLING INFORM	ATION	1NH	ITE - LABORATO	PV COPV VEL		- CLIFT	IT CO	₽V												0011	2018 FRONT

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



### Sample Receipt Confirmation

Report Distribution: Company Name:	HUTCHINSON EN SCIENCES LTD	IVIRONMENTAL		Invoice E Acct Name:		SON ENVIRON	IMENTAL
Contact:	Brent Parsons			Contact:	ACCOUN	TS PAYABLE	
Address:	501 Krug St., Suite	202		Address:	1-5 Chanc	ery Lane,	
	Kitchener, ON, N2I	B 1L3			Bracebrid	ge, ON, P1L 2E	3
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Distribution.	пата Сору. М	Email: T Fax. p	N EDD: N	Project #:	N/A		
				Account #:	20126		
Client Information: Job Reference #: Project PO #:	N1/A			Date Sampled: Date Received: Sampled By:	29-MAR-		
Legal Site Description: Quote #:			Cha	ain Of Custody:			
Workorder Summary Lab Work Order #:			Acc	ount Manager:	Gayle Bra	un	
Lab Work Order #: Estimated completion date: 2 Samples received at ALS in			Estimated sample	disposal date:	See Samp below.	ole Disposal Inf	
Lab Work Order #: Estimated completion date:	<b>L2250922</b> 12-APR-19	Date Sampled		disposal date: Sample F	See Samp		ormation section Client Job#
Lab Work Order #: Estimated completion date: 2 Samples received at ALS in Lab Client Sample ID Sample ID	<b>L2250922</b> 12-APR-19	Date Sampled 28-MAR-19 16:00	Estimated sample Date Received 29-MAR-19 09:00	Sample F Due Date 12-APR-19	See Samp below.	Sample Type WATER	Client
Lab Work Order #: Estimated completion date: 2 Samples received at ALS in Lab Client Sample ID Sample ID	<b>L2250922</b> 12-APR-19	Date Sampled 28-MAR-19 16:00	Estimated sample Date Received	Sample F Due Date 12-APR-19	See Samp below.	ble Disposal Inf Sample Type	Client
Lab Work Order #: Estimated completion date: 2 Samples received at ALS in Lab Client Sample ID Sample ID L2250922-1 TRIB 4 L2250922-2 TRIB 5 Analysis Requested:	Lecal streptococcus Beendomonas aeruginosa Sample Handling and Disposal Fee	Date Sampled 28-MAR-19 16:00	Estimated sample Date Received 29-MAR-19 09:00	Sample F Due Date 12-APR-19	See Samp below.	Sample Type WATER	Client
Lab Work Order #: Estimated completion date: 2 Samples received at ALS in Lab Client Sample ID Sample ID L2250922-1 TRIB 4 L2250922-2 TRIB 5 Analysis Requested:	L2250922 12-APR-19 WINNIPEG	Date Sampled 28-MAR-19 16:00	Estimated sample Date Received 29-MAR-19 09:00	Sample F Due Date 12-APR-19	See Samp below.	Sample Type WATER	Client

Sample Integrity Observations: No observations were identified for this work order submission.

ADDRESS 1329 Niakwa Road East, Unit 12, Winnipeg, MB, Canada R2J 3T4 PHONE +1 204 255 9720 FAX +1 204 255 9721 MANITOBA TECHNOLOGY CENTRE LTD. Part of the ALS Group A Campbell Brothers Limited Company



### **Sample Disposal Information:**

Where possible, ALS will store samples for the following durations, measured from date of sample submission: 45 days for Soil and Water samples; 6 months for Tissue/Biota samples; 14 days for air samples collected on re-usable media; and 3 days for water samples submitted for microbiological testing. Longer storage times are available upon request.

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ALS Group strives to deliver on-time results to our clients at all times. However, there are times when due to capacity issues or other unforeseen circumstances we are unable to meet our expected turnaround times. The information above is related to a recent workorder you have submitted to our laboratory. In the event that you have an inquiry, please refer to the Lab Work Order # when calling your Account Manager.

ALS Group appreciates your business. Thank you for the opportunity to work with you.



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### Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878



COC Number: LON-190128/

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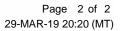
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**Login Comments:** Your samples were at 0.4 °C when unpacked at the laboratory.

Sample Integrity Observations: No observations were identified for this work order submission.

ADDRESS 309 Exeter Road, Unit #29, London, ON, Canada N6L 1C1 PHONE +1 519 652 6044 FAX +1 519 652 0671 ALS CANADA LTD. Part of the ALS Group A Campbell Brothers Limited Company





#### Notice of Sub-contract Laboratory Service

#### Please be advised that the following tests will be subcontracted to the corresponding laboratory:

E. coli subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Alkalinity, Total (as CaCO3) subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Ammonia in Water by Fluorescence subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Suspended solids subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Total P in Water by Colour subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA pH subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Nitrate in Water by IC subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Hardness subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Total Kjeldahl Nitrogen subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Fecal Coliforms subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Chloride by IC subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Sulfate in Water by IC subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Chloride by IC subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Sulfate in Water by IC subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Sulfate in Water by IC subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA BOD subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Total Metals in Water by CCC ICPMS subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Please contact your Account Manager immediately should you have questions or concerns regarding this arrangement. Approval of this arrangement shall be implied unless otherwise notified by you.

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ALS Group appreciates your business. Thank you for the opportunity to work with you.



### Chain of Custody (COC) / Analytical

Request Form



COC Number: LON-180129

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#### Canada Toll Free: 1 800 668 9878

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



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### Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878



COC Number: LON-190128/

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### Chain of Custody (COC) / Analytical

Request Form



COC Number: LON-180129

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#### Canada Toll Free: 1 800 668 9878

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



HUTCHINSON ENVIRONMENTAL SCIENCES LTD ATTN: Brent Parsons 501 Krug St. Suite 202 Kitchener ON N2B 1L3 Date Received: 14-FEB-19 Report Date: 28-MAY-19 12:48 (MT) Version: FINAL

Client Phone: 519-576-1711

## Certificate of Analysis

Lab Work Order #: L2232735 Project P.O. #: NOT SUBMITTED Job Reference: 180050 C of C Numbers: Legal Site Desc:

Gayle Braun Senior Account Manager

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ADDRESS: 1329 Niakwa Road East, Unit 12, Winnipeg, MB R2J 3T4 Canada | Phone: +1 204 255 9720 | Fax: +1 204 255 9721 ALS CANADA LTD Part of the ALS Group An ALS Limited Company

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### ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2232735-1 OL-1 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER							
Bacteriological Tests							
Fecal Streptococcus	1	PEHR	1	CFU/100mL		14-FEB-19	R4511527
Pseudomonas aeruginosa	<1		1	CFU/100mL		14-FEB-19	R4511940
Taxonomy			·				
Phytoplankton	See attached.					28-MAY-19	R4645585
Plant Pigments							
Chlorophyll a	1.63		0.10	ug/L	14-FEB-19	14-FEB-19	R4530568
L2232735-2 OL-2 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER							
Bacteriological Tests							
Fecal Streptococcus	3	PEHR	1	CFU/100mL		14-FEB-19	R4511527
Pseudomonas aeruginosa	<1		1	CFU/100mL		14-FEB-19	R4511940
Plant Pigments							
Chlorophyll a	13.5		0.10	ug/L	14-FEB-19	14-FEB-19	R4530568
L2232735-3 OL-4 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER							
Bacteriological Tests							
Fecal Streptococcus	4	PEHR	1	CFU/100mL		14-FEB-19	R4511527
Pseudomonas aeruginosa	<1		1	CFU/100mL		14-FEB-19	R4511940
Plant Pigments							
Chlorophyll a	4.65		0.10	ug/L	14-FEB-19	14-FEB-19	R4530568
L2232735-4 OL-7 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER							
Bacteriological Tests							
Fecal Streptococcus	4	PEHR	1	CFU/100mL		14-FEB-19	R4511527
Pseudomonas aeruginosa	<1		1	CFU/100mL		14-FEB-19	R4511940
Plant Pigments							
Chlorophyll a	10.2		0.10	ug/L	14-FEB-19	14-FEB-19	R4530568
L2232735-5 OL-9 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER							
Bacteriological Tests							
Fecal Streptococcus	59	PEHR	1	CFU/100mL		14-FEB-19	R4511527
Pseudomonas aeruginosa	<1		1	CFU/100mL		14-FEB-19	R4511940
Plant Pigments							
Chlorophyll a	9.23		0.10	ug/L	14-FEB-19	14-FEB-19	R4530568
L2232735-6 OL-3 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER							
Bacteriological Tests							
			1	CFU/100mL		14-EEB-10	R4510407
Escherichia Coli	1		1	CF0/100IIIL		14-1 LD-13	114510407

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

### ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2232735-6 OL-3 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER							
Bacteriological Tests							
Fecal Streptococcus	37	PEHR	1	CFU/100mL		14-FEB-19	R4511527
L2232735-7 OL-5 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER							
Bacteriological Tests							
Escherichia Coli	2		1	CFU/100mL		14-FEB-19	R4510407
Fecal Coliforms	<1	PEHR	1	CFU/100mL		14-FEB-19	R4510391
Fecal Streptococcus	4	PEHR	1	CFU/100mL		14-FEB-19	R4511527
L2232735-8 OL-6 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER							
Bacteriological Tests							
Escherichia Coli	4		1	CFU/100mL		14-FEB-19	R4510407
Fecal Coliforms	2	PEHR	1	CFU/100mL		14-FEB-19	R4510391
Fecal Streptococcus	26	PEHR	1	CFU/100mL		14-FEB-19	R4511527
L2232735-9 OL-8 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER							
Bacteriological Tests							
Escherichia Coli	6		1	CFU/100mL		14-FEB-19	R4510407
Fecal Coliforms	<1	PEHR	1	CFU/100mL		14-FEB-19	R4510391
Fecal Streptococcus	51	PEHR	1	CFU/100mL		14-FEB-19	R4511527
Report Remarks : Approximate result: suspected inte Report Remarks : Approximate result, interference su							
L2232735-10 OL-10 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER							
Bacteriological Tests							
Escherichia Coli	18		1	CFU/100mL		14-FEB-19	R4510407
Fecal Coliforms	7	PEHR	1	CFU/100mL		14-FEB-19	R4510391
Fecal Streptococcus	113	PEHR	1	CFU/100mL		14-FEB-19	R4511527
Report Remarks : Approximate result: suspected inte Report Remarks : Approximate result, interference su							
L2232735-11 OL-11 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER							
Bacteriological Tests							
Escherichia Coli	1		1	CFU/100mL		14-FEB-19	R4510407
Fecal Coliforms	<1	PEHR	1	CFU/100mL		14-FEB-19	R4510391
Fecal Streptococcus	<1	PEHR	1	CFU/100mL		14-FEB-19	R4511527
Refer to Referenced Information for Qualifiers (if any) an							

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

### **Reference Information**

#### **Qualifiers for Individual Samples Listed:**

Sample Numbe	Client ID	Qualifier	Description	
L2232735-1	OL-1	UIC	Unreliable: Improper Container	
L2232735-2	OL-2	UIC	Unreliable: Improper Container	
L2232735-3	OL-4	UIC	Unreliable: Improper Container	
L2232735-4	OL-7	UIC	Unreliable: Improper Container	
L2232735-5	OL-9	UIC	Unreliable: Improper Container	
Sample Param	eter Qualifier key lis	ted:		
Qualifier	Description			

PEHR Parameter Exceeded Recommended Holding Time On Receipt: Proceed With Analysis As Requested.

Test Method Reference	es:		
ALS Test Code	Matrix	Test Description	Method Reference**
CHL/A-ACET-FLUORO- WP	Water	Chlorophyll a by fluorometry	EPA 445.0 ACET

This analysis is done using procedures modified from EPA method 445.0. Chlorophyll a is determined by a 90 % acetone extraction followed with analysis by fluorometry using the non-acidification procedure. This method is not subject to interferences from chlorophyll b.

EC-DCMF-WP Water

E. coli by DC agar APHA 9222 J (modified) An aliquot of sample water (usually 100 mL) is passed through a sterile .45 micron membrane filter. The filter is placed on media which contains lactose and a nonselective dye, plus a chromogenic agent (BCIG) to differentiate E. coli spp. from other coliforms. Samples are incubated at 35 C for 23 +/- 1 hours. Colonies exhibiting the expected metabolic reactions for the target groups on the filter after incubation are counted and results are reported as Colony Forming Units (CFU) per 100 mL. For this test, E. coli will appear blue to purple and other coliforms will appear reddish-pink. The detection limit for this test is 1 when 100 mL of sample is processed, and is adjusted accordingly, with report notes as required, when less than 100 mL is processed.

FC-MF-WP Water

An aliquot of sample water (usually 100 mL) is passed through a sterile .45 micron membrane filter. The filter is placed on selective media and incubated at 35C for 23 +/- 1 hours. Colonies exhibiting characteristic morphology for the target group on the filter after incubation are counted and results are reported as Colony Forming Units (CFU) per 100 mL. Additional confirmation tests can be performed upon request. The detection limit for this test is 1 when 100 mL of sample is processed, and is adjusted accordingly, with report notes as required, when less than 100 mL is processed.

FECALSTREP-MF-WP Water Fecal streptococcus

An aliquot of sample water (usually 100 mL) is passed through a sterile .45 micron membrane filter. The filter is placed on selective media and incubated at 35°C for 47 +/- 1 hour. Colonies exhibiting characteristic morphology for the target group on the filter after incubation are counted and results are reported as Colony Forming Units (CFU) per 100 mL. The detection limit for this test is 1 when 100 mL of sample is processed, and is adjusted accordingly, with report notes as required, when less than 100 mL is processed. Due to taxonomic fluidity, the term "Fecal Streptococcus" is applied here to include all members of genus names Streptococcus and Enterococcus as described in the reference method.

PHYTO-WP Water Phytoplankton APHA 10200 C & F Samples are prepared by sedimentation/settling and examined using a compound phase contrast inverted microscope. Phytoplankters are identified to species where possible and enumerated.

PSA-MF-WP Water

A known volume of sample (typically 100 mL) is filtered through a 0.45 micron membrane filter. The filter is placed on the surface of a selective agar

\*\* ALS test methods may incorporate modifications from specified reference methods to improve performance.

Pseudomonas aeruginosa

Fecal Coliform

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WP	ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA
Chain of Create du Numbers	

Chain of Custody Numbers:

APHA 9222D

APHA 9230C (modified)

counted. Results are reported as the number of presumptive P. aeruginosa CFU/100 mL. Additional confirmation tests can be performed upon request.

plate and incubated for 72 hours at 41.5 +/- 0.5 C. Plates are examined under low magnification and colonies exhibiting typical morphology are

### APHA 9213E

### **Reference Information**

#### **GLOSSARY OF REPORT TERMS**

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid weight of sample

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory. UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION. Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



			Qualit	y Contr	ol Report			
		Workorder:	L223273	5	Report Date: 28-N	/IAY-19		Page 1 of 4
501 k Kitch	CHINSON ENVIRON Krug St. Suite 202 ener ON N2B 1L3	MENTAL SCIEN	CES LTD					
Contact: Brent	t Parsons							
Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CHL/A-ACET-FLUORO Batch R4530 WG2996476-3 DI Chlorophyll a		<b>L2232473-1</b> 20.8	20.9		ug/L	0.5	35	14-FEB-19
WG2996476-2 LC Chlorophyll a	cs		101.1		%		80-120	27-FEB-19
WG2996476-1 M Chlorophyll a	В		<0.10		ug/L		0.1	14-FEB-19
EC-DCMF-WP	Water							
Batch R4510 WG2989200-1 M Escherichia Coli	-		<1		CFU/100mL		1	14-FEB-19
FC-MF-WP	Water							
Batch R4510 WG2989036-2 DI Fecal Coliforms	391 JP	<b>L2232735-6</b> <1	<1	RPD-NA	CFU/100mL	N/A	65	14-FEB-19
WG2989036-1 M Fecal Coliforms	В		<1		CFU/100mL		1	14-FEB-19
FECALSTREP-MF-WP Batch R4511 WG2989022-1 M Fecal Streptococcu	527 B		<1		CFU/100mL		1	14-FEB-19
PSA-MF-WP Batch R4511 WG2989035-1 M Pseudomonas aeru	B		<1		CFU/100mL		1	14-FEB-19

Workorder: L2232735

Client:	HUTCHINSON ENVIRONMENTAL SCIENCES LTD
	501 Krug St. Suite 202
	Kitchener ON N2B 1L3
Contact:	Brent Parsons

### Contact:

### Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate
Sample I	Parameter Qualifier Definitions:

Qualifier	Description
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Report Date: 28-MAY-19

Workorder: L2232735

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD 501 Krug St. Suite 202 Kitchener ON N2B 1L3 Contact: Brent Parsons

Page 3 of 4

#### Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Bacteriological Tests							
E. coli by DC agar							
, ,	6	11-FEB-19	14-FEB-19 16:55	30	77	hours	EHTR
	7	11-FEB-19	14-FEB-19 16:55	30	77	hours	EHTR
	8	11-FEB-19	14-FEB-19 16:55	30	77	hours	EHTR
	9	11-FEB-19	14-FEB-19 16:55	30	77	hours	EHTR
	10	11-FEB-19	14-FEB-19 16:55	30	77	hours	EHTR
	11	11-FEB-19	14-FEB-19 16:55	30	77	hours	EHTR
Fecal Coliform							
	6	11-FEB-19	14-FEB-19 16:10	30	76	hours	EHTR
	7	11-FEB-19	14-FEB-19 16:10	30	76	hours	EHTR
	8	11-FEB-19	14-FEB-19 16:10	30	76	hours	EHTR
	9	11-FEB-19	14-FEB-19 16:10	30	76	hours	EHTR
	10	11-FEB-19	14-FEB-19 16:10	30	76	hours	EHTR
	11	11-FEB-19	14-FEB-19 16:10	30	76	hours	EHTR
Fecal streptococcus							
	1	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	2	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	3	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	4	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	5	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	6	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	7	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	8	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	9	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	10	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	11	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
Pseudomonas aeruginosa							
	1	11-FEB-19	14-FEB-19 14:50	30	75	hours	EHTR
	2	11-FEB-19	14-FEB-19 14:50	30	75	hours	EHTR
	3	11-FEB-19	14-FEB-19 14:50	30	75	hours	EHTR
	4	11-FEB-19	14-FEB-19 14:50	30	75	hours	EHTR
	5	11-FEB-19	14-FEB-19 14:50	30	75	hours	EHTR
Plant Pigments	Ū.						
Chlorophyll a by fluorometry							
	1	11-FEB-19	14-FEB-19 13:05	48	73	hours	EHTR
	2	11-FEB-19	14-FEB-19 13:05	48	73	hours	EHTR
	3	11-FEB-19	14-FEB-19 13:05	40	73	hours	EHTR
	4	11-FEB-19	14-FEB-19 13:05	48	73	hours	EHTR
	5	11-FEB-19	14-FEB-19 13:05	48	73	hours	EHTR
	0			10	10	nouis	LIIIX

#### Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.

EHTR: Exceeded ALS recommended hold time prior to sample receipt.

EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.EHT: Exceeded ALS recommended hold time prior to analysis.

Rec. HT: ALS recommended hold time (see units).

Notes\*:

Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.

Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2232735 were received on 14-FEB-19 09:00.

Workorder: L2232735

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD 501 Krug St. Suite 202 Kitchener ON N2B 1L3 Contact: Brent Parsons

Page 4 of 4

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



ALS Environmental 1329 Niakwa Road E - Unit 12 Winnipeg, Manitoba R2J 3T4 (204) 255-9720

## Phytoplankton Sample Results

Lab Number:	L2232735-1	Work Order	Sar	nple Type	WATER		
Date Sampled: Sample ID:	February 11, 2019 OL-1		Biovolun	ne	Biovolume		
Class	Genus	Species	Unit:	Units/L	Unit	µm3	Total µm3
Chlorophyceae	Schroederia	sp.	Single Cell	4000	0		0
Chlorophyceae	Unidentified		Single Cell	6000	0		0
Chrysophyceae	small chrysophytes		Single Cell	158000	0		0
Cryptophyceae	Cryptomonas	sp.	Single Cell	55000	0		0
Cryptophyceae	Unidentified		Single Cell	198000	0		0
Cyanophyceae	Aphanizomenon	sp.	Filament	200	0		0
Dinophyceae	Peridinium	sp.	Single Cell	2000	0		0



#### Chain of Custody (COC) / Analy Request Form

Canada Toll Free: 1 800 668 9878



#### COC Number: LON-190128/

Page

Report To Contact and company name below will appear on the final report Report Format / Distribution Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply) Company HUTCHINSON ENV Select Report Format: PpF From From COGTAL Regular IR1 V Standard TAT if received by 3 pm - business days - no surcharges apoly Contact: BRENT PARSONS Quality Control (QC) Report with Report 17 yes 1 NO 4 day [P4-20%] Π Business day (E - 100%) Ē Compare Results to Criteria on Report - provide details below if box checked Phone: 519-576-1711 3 day [P3-25%] Same Day, Weekend or Statutory holiday IE2 -200% FIEMAIL THAIL FIFAX Company address below will appear on the final report Select Distribution: 2 day [P2-50%] (Laboratory opening fees may apply) 1 501 KRUG ST ST 202 Date and Time Required for all E&P TATS Email 1 or Eax deborah sinclain@environmentalsciences.ca dd-mmm-vy hh:mm Street: KTICHENER ON City/Province Email 2 brent parsons@environmentalsciences.ca For tests that can not be nettormed according to the service level selected, you will be contacted. Postal Code: N2B 1L3 Email 3 Analysis Request HOLD Same as Report To I/I YES INO Invoice Distribution Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below Invoice To S ECTED HAZARD (see Special Instructions) Myes INO Copy of Invoice with Report Select Invoice Distribution: 7 BMAIL MAIL T FAX ñ ш Email 1 or Fax accounting@environmentalsciences.ca Company: AIN Contact: Email 2 Project Information Z O Oil and Gas Required Fields (client use) È ALS Account # / Quote # Q69690 PO# AFF/Cost Center ខ្ល 180050 iob # Routing Code: Major/Minor Code: S Ш PO/AFE: LL\_ Requisitioner: ō AMPLI SD: Location: HYTOPLANKTON n c SEUDOMONAS CHLOROPHYLL ш STREP ALS Lab Work Order # (lab use only): ALS Contact: Gayle Sampler: Ξ NUM ECAL Sample Identification and/or Coordinates Date Time ALS Sample # Sample Type ഹ (lab use only) (This description will appear on the report) (dd-mmm-yy) (hh:mm) OL-1 11-02-19 WATER 3 R R R R ..... 01.2 WATER 2 R R R OL-4 R WATER 2 R R 01-7 2 R WATER R R OL-9 WATER 2 R R R OL-3 R WATER 1 OL-5 WATER R 1 OL-6 R WATER 1 OL-8 R WATER OL-10 WATER R 1 OI -11 R WATER SAMPLE CONDITION AS RECEIVED (lab use only) Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below Drinking Water (DW) Samples<sup>1</sup> (client use) (electronic COC only) SIF Observations Yes Frozen No . Are samples taken from a Regulated DW System? Ice Packs Ice Cubes 
Custody seal intact Π Yeş No TYES THO Cooling Initiated Are samples for human consumption/ use? INIITIAL COOLER TEMPERATURES \*C FINAL COOLER TEMPERATURES \*C Пиез Пию 1.7 **INITIAL SHIPMENT RECEPTION (lab use only)** SHIPMENT RELEASE (client use) FINAL SHIPMENT RECEPTION (lab use only) Time: Released by: Date: Received by: Time: Received by: Date: Date: Time: M 900

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

D SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

DCT 2018 FROM



HUTCHINSON ENVIRONMENTAL SCIENCES LTD ATTN: Brent Parsons 501 Krug St. Suite 202 Kitchener ON N2B 1L3 Date Received:09-MAY-19Report Date:17-MAY-19 09:16 (MT)Version:DRAFT

Client Phone: 519-576-1711

# Certificate of Analysis

Lab Work Order #: L2270097 Project P.O. #: NOT SUBMITTED Job Reference: 180050 C of C Numbers: Legal Site Desc:

Gayle Braun Senior Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 1329 Niakwa Road East, Unit 12, Winnipeg, MB R2J 3T4 Canada | Phone: +1 204 255 9720 | Fax: +1 204 255 9721 ALS CANADA LTD Part of the ALS Group An ALS Limited Company

Environmental 🕽

www.alsglobal.com

**RIGHT SOLUTIONS** RIGHT PARTNER

### ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2270097-1 OL-1 Sampled By: CLIENT on 08-MAY-19 @ 12:20 Matrix: WATER							
Bacteriological Tests							
Fecal Streptococcus	<1		1	CFU/100mL		09-MAY-19	R4631229
Pseudomonas aeruginosa	<1		1	CFU/100mL			R4631399
Plant Pigments				0.0,100			
Chlorophyll a	2.68		0.10	ug/L	09-MAY-19	09-MAY-19	R4636627
L2270097-2 OL-2 Sampled By: CLIENT on 08-MAY-19 @ 11:25 Matrix: WATER							
Bacteriological Tests							
Fecal Streptococcus	<1		1	CFU/100mL		09-MAY-19	R4631229
Pseudomonas aeruginosa	<1		1	CFU/100mL		09-MAY-19	R4631399
Plant Pigments							
Chlorophyll a	2.55		0.10	ug/L	09-MAY-19	09-MAY-19	R4636627
L2270097-3 OL-4 Sampled By: CLIENT on 08-MAY-19 @ 11:57 Matrix: WATER	1						
Bacteriological Tests							
Fecal Streptococcus	<1		1	CFU/100mL		09-MAY-19	R4631229
Pseudomonas aeruginosa	<1		1	CFU/100mL		09-MAY-19	R4631399
Plant Pigments							
Chlorophyll a	2.65		0.10	ug/L	09-MAY-19	09-MAY-19	R4636627
L2270097-4 OL-7 Sampled By: CLIENT on 08-MAY-19 @ 11:45 Matrix: WATER							
Bacteriological Tests							
Fecal Streptococcus	1		1	CFU/100mL		09-MAY-19	R4631229
Pseudomonas aeruginosa	14		1	CFU/100mL		09-MAY-19	R4631399
Plant Pigments							
Chlorophyll a	5.72		0.10	ug/L	09-MAY-19	09-MAY-19	R4636627
L2270097-5         OL-9           Sampled By:         CLIENT on 08-MAY-19 @ 11:36           Matrix:         WATER							
Bacteriological Tests							
Fecal Streptococcus	2		1	CFU/100mL		09-MAY-19	R4631229
Pseudomonas aeruginosa	16		1	CFU/100mL		09-MAY-19	R4631399
Plant Pigments							
Chlorophyll a	3.40		0.10	ug/L	09-MAY-19	09-MAY-19	R4636627
L2270097-6         TRIB-2           Sampled By:         CLIENT on 08-MAY-19 @ 13:25           Matrix:         WATER							
Bacteriological Tests							
Fecal Streptococcus	2		1	CFU/100mL		09-MAY-19	R4631229
Pseudomonas aeruginosa Plant Pigments	3		1	CFU/100mL		09-MAY-19	
Chlorophyll a	6.09		0.10	ug/L	09-MAY-19	09-MAY-19	R4636627

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

L2270097 CONTD.... PAGE 3 of 5 Version: DRAFT

### ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	3	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2270097-7 TRIB-4 Sampled By: CLIENT on Matrix: WATER	08-MAY-19 @ 13:15							
Bacteriological Tests								
Fecal Streptococcus		7		1	CFU/100mL		09-MAY-19	R4631229
Pseudomonas aerugino	\$2	43		1	CFU/100mL			R4631399
Plant Pigments				I			00 10// 10	114001000
Chlorophyll a		14.2		0.10	ug/L	09-MAY-19	09-MAY-19	R4636627
L2270097-8 TRIB-5	08-MAY-19 @ 13:10							
Bacteriological Tests								
Fecal Streptococcus		6		1	CFU/100mL		09-MAY-19	R4631229
Pseudomonas aerugino	sa	41		1	CFU/100mL		09-MAY-19	R4631399
Plant Pigments								
Chlorophyll a		16.0		0.10	ug/L	09-MAY-19	09-MAY-19	R4636627
L2270097-10 OL-3 Sampled By: CLIENT on Matrix: WATER	08-MAY-19 @ 12:04	1						
Bacteriological Tests								
Fecal Streptococcus		<1		1	CFU/100mL		09-MAY-19	R4631229
Pseudomonas aerugino	sa	<1		1	CFU/100mL		09-MAY-19	R4631399
L2270097-11 OL-5 Sampled By: CLIENT on Matrix: WATER	08-MAY-19 @ 11:52							
<b>Bacteriological Tests</b>								
Fecal Streptococcus		1		1	CFU/100mL		09-MAY-19	R4631229
Pseudomonas aerugino	sa	4		1	CFU/100mL		09-MAY-19	R4631399
L2270097-12 OL-6 Sampled By: CLIENT on Matrix: WATER	08-MAY-19 @ 11:49							
<b>Bacteriological Tests</b>								
Fecal Streptococcus		<1		1	CFU/100mL		09-MAY-19	R4631229
Pseudomonas aerugino	sa	4		1	CFU/100mL		09-MAY-19	R4631399
L2270097-13 OL-8 Sampled By: CLIENT on Matrix: WATER	08-MAY-19 @ 11:40							
Bacteriological Tests								
Fecal Streptococcus		3		1	CFU/100mL		09-MAY-19	R4631229
Pseudomonas aerugino	sa	4		1	CFU/100mL		09-MAY-19	R4631399
L2270097-14 OL-10 Sampled By: CLIENT on Matrix: WATER	08-MAY-19 @ 11:33							
<b>Bacteriological Tests</b>								
Fecal Streptococcus		3		1	CFU/100mL		09-MAY-19	R4631229
Pseudomonas aerugino	sa	3		1	CFU/100mL		09-MAY-19	
L2270097-15 OL-11	08-MAY-19 @ 11:30							

 $^{\ast}$  Refer to Referenced Information for Qualifiers (if any) and Methodology.

### ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2270097-15 OL-11 Sampled By: CLIENT on 08-MAY-19 @ 11:30 Matrix: WATER							
Bacteriological Tests							
Fecal Streptococcus	<1		1	CFU/100mL		09-MAY-19	
Pseudomonas aeruginosa	1		1	CFU/100mL		09-MAY-19	R4631399
Pseudomonas aeruginosa			1	CFU/100mL		09-MAY-19	R4631399

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

### **Reference Information**

L2270097 CONTD.... PAGE 5 of 5 Version: DRAFT

ALS Test Code	Matrix	Test Description	Method Reference**
CHL/A-ACET-FLUORO- WP	Water	Chlorophyll a by fluorometry	EPA 445.0 ACET
			Chlorophyll a is determined by a 90 % acetone extraction followed with d is not subject to interferences from chlorophyll b.
incubated at 35°C for 47 results are reported as C adjusted accordingly, with	+/- 1 hour. Colony Formi th report not y, the term "F	Colonies exhibiting characteristic moling Units (CFU) per 100 mL. The detes as required, when less than 100 m	APHA 9230C (modified) 5 micron membrane filter. The filter is placed on selective media and rphology for the target group on the filter after incubation are counted and ection limit for this test is 1 when 100 mL of sample is processed, and is L is processed. o include all members of genus names Streptococcus and Enterococcus as
plate and incubated for 7	2 hours at 4	1.5 +/- 0.5 C. Plates are examined u	APHA 9213E cron membrane filter. The filter is placed on the surface of a selective agar nder low magnification and colonies exhibiting typical morphology are sa CFU/100 mL. Additional confirmation tests can be performed upon request
ALS test methods may ir	ncorporate m	odifications from specified reference	methods to improve performance.
The last two letters of the	above test o	code(s) indicate the laboratory that pe	rformed analytical analysis for that test. Refer to the list below:
Laboratory Definition Co	ode Lab	oratory Location	
WP	ALS	ENVIRONMENTAL - WINNIPEG, M	ANITOBA, CANADA
hain of Custody Numbe	rs:		

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory. UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



				-		•			
			Workorder:	L2270097	7	Report Date: 17-N	/IAY-19		Page 1 of 2
Client:	501 Krug	ISON ENVIRON St. Suite 202 ON N2B 1L3	MENTAL SCIENC	CES LTD					
Contact:	Brent Par	sons							
Test		Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CHL/A-ACET-FL	UORO-WP	Water							
Batch WG3051786-	R4636627 3 DUP		L2270097-2						
Chlorophyll a	a		2.55	2.78		ug/L	8.9	35	09-MAY-19
WG3051786- Chlorophyll a				108.1		%		80-120	16-MAY-19
WG3051786- Chlorophyll a				<0.10		ug/L		0.1	09-MAY-19
FECALSTREP-N	IF-WP	Water							
	R4631229								
WG3045740- Fecal Strepto				<1		CFU/100mL		1	09-MAY-19
PSA-MF-WP		Water							
WG3045737-					2				
Pseudomona	as aeruginos	sa		<1		CFU/100mL		1	09-MAY-19

Workorder: L2270097

Report Date: 17-MAY-19

Client:	HUTCHINSON ENVIRONMENTAL SCIENCES LTD
	501 Krug St. Suite 202
	Kitchener ON N2B 1L3
Contact:	Brent Parsons

### Leaend:

_	- 3	
	Limit	ALS Control Limit (Data Quality Objectives)
	DUP	Duplicate
	RPD	Relative Percent Difference
	N/A	Not Available
	LCS	Laboratory Control Sample
	SRM	Standard Reference Material
	MS	Matrix Spike
	MSD	Matrix Spike Duplicate
	ADE	Average Desorption Efficiency
	MB	Method Blank
	IRM	Internal Reference Material
	CRM	Certified Reference Material
	CCV	Continuing Calibration Verification
	CVS	Calibration Verification Standard
	LCSD	Laboratory Control Sample Duplicate

#### Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



#### Chain of Custody (COC) / Analytical Request Form



COC Number: LON-190128/

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Canada Toll Free: 1 800 668 9878

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

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HUTCHINSON ENVIRONMENTAL SCIENCES LTD ATTN: Brent Parsons 501 Krug St. Suite 202 Kitchener ON N2B 1L3 Date Received:09-MAY-19Report Date:17-MAY-19 12:24 (MT)Version:FINAL

Client Phone: 519-576-1711

# Certificate of Analysis

Lab Work Order #:L2270255Project P.O. #:NOT SUBMITTEDJob Reference:180050C of C Numbers:LON-190503Legal Site Desc:Vertice

Gayle Braun Senior Account Manager

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## ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2270255-1 OL-1 Sampled By: CLIENT on 08-MAY-19 @ 12:20 Matrix: WATER							
Physical Tests							
Hardness (as CaCO3)	85.6	HTC	0.50	mg/L		10-MAY-19	
рН	8.29		0.10	pH units		10-MAY-19	R4631164
Total Suspended Solids	<2.0		2.0	mg/L	11-MAY-19	12-MAY-19	R4631444
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	83		10	mg/L		10-MAY-19	R4631164
Ammonia, Total (as N)	0.134		0.010	mg/L		10-MAY-19	R4632460
Chloride (Cl)	49.6		0.50	mg/L		10-MAY-19	R4632137
Nitrate (as N)	<0.020		0.020	mg/L		10-MAY-19	R4632137
Total Kjeldahl Nitrogen	0.53		0.15	mg/L	14-MAY-19	15-MAY-19	R4635594
Phosphorus, Total	0.0104		0.0030	mg/L	13-MAY-19	14-MAY-19	R463458
Sulfate (SO4)	1.85		0.30	mg/L		10-MAY-19	R463213
Organic / Inorganic Carbon				_			
Dissolved Carbon Filtration Location	LAB					10-MAY-19	R463043
Dissolved Organic Carbon	5.91		0.50	mg/L	10-MAY-19	10-MAY-19	R463232
Bacteriological Tests							
E. Coli	0		0	CFU/100mL		10-MAY-19	R463048
Fecal Coliforms	0		0	CFU/100mL		10-MAY-19	R463048
Total Metals							
Aluminum (Al)-Total	0.0119		0.0050	mg/L	09-MAY-19	09-MAY-19	R463024
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R463024
Arsenic (As)-Total	0.00050		0.00010	mg/L	09-MAY-19	09-MAY-19	R463024
Barium (Ba)-Total	0.0162		0.00010	mg/L	09-MAY-19	09-MAY-19	R463024
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R463024
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	09-MAY-19	09-MAY-19	R463024
Boron (B)-Total	<0.010		0.010	mg/L	09-MAY-19	09-MAY-19	R463024
Cadmium (Cd)-Total	<0.000050		0.0000050	mg/L	09-MAY-19	09-MAY-19	R463024
Calcium (Ca)-Total	29.6		0.050	mg/L	09-MAY-19	09-MAY-19	R463024
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	09-MAY-19	09-MAY-19	R463024
Chromium (Cr)-Total	<0.00050		0.00050	mg/L	09-MAY-19	09-MAY-19	R463024
Cobalt (Co)-Total	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R463024
Copper (Cu)-Total	<0.0010		0.0010	mg/L	09-MAY-19	09-MAY-19	R463024
Iron (Fe)-Total	0.033		0.010	mg/L	09-MAY-19	09-MAY-19	R463024
Lead (Pb)-Total	<0.000050		0.000050	mg/L	09-MAY-19	09-MAY-19	R463024
Lithium (Li)-Total	<0.0010		0.0010	mg/L	09-MAY-19	09-MAY-19	R463024
Magnesium (Mg)-Total	2.84		0.0050	mg/L	09-MAY-19	09-MAY-19	R463024
Manganese (Mn)-Total	0.00560		0.00050	mg/L	09-MAY-19	09-MAY-19	R463024
Molybdenum (Mo)-Total	0.000108		0.000050	mg/L	09-MAY-19	09-MAY-19	R463024
Nickel (Ni)-Total	<0.00050		0.00050	mg/L	09-MAY-19	09-MAY-19	R463024
Phosphorus (P)-Total	<0.050		0.050	mg/L	09-MAY-19	09-MAY-19	R463024
Potassium (K)-Total	1.75		0.050	mg/L	09-MAY-19	09-MAY-19	R463024
Rubidium (Rb)-Total	0.00132		0.00020	mg/L	09-MAY-19	09-MAY-19	R463024
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 $^{\ast}$  Refer to Referenced Information for Qualifiers (if any) and Methodology.

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2270255-1 OL-1 Sampled By: CLIENT on 08-MAY-19 @ 12:20 Matrix: WATER							
Matrix: WATER Total Metals							
Silicon (Si)-Total	0.10		0.40		00 MAX 10	09-MAY-19	D 40000 40
	<0.10		0.10	mg/L	09-MAY-19	09-MAY-19	R4630240
Silver (Ag)-Total	<0.000050		0.000050	mg/L	09-MAY-19 09-MAY-19		R4630240
Sodium (Na)-Total	27.9		0.050	mg/L			R4630240
Strontium (Sr)-Total	0.0661		0.0010	mg/L	09-MAY-19	09-MAY-19	R4630240
Sulfur (S)-Total	0.78		0.50	mg/L	09-MAY-19	09-MAY-19	R4630240
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	09-MAY-19	09-MAY-19	R4630240
Thallium (TI)-Total	<0.000010		0.000010	mg/L	09-MAY-19	09-MAY-19	R463024
Thorium (Th)-Total	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Tin (Sn)-Total	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Titanium (Ti)-Total	< 0.0070	DLUI	0.0070	mg/L	09-MAY-19	09-MAY-19	R463024
Tungsten (W)-Total	< 0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R463024
Uranium (U)-Total	0.000027		0.000010	mg/L	09-MAY-19	09-MAY-19	R463024
Vanadium (V)-Total	<0.00050		0.00050	mg/L	09-MAY-19	09-MAY-19	R463024
Zinc (Zn)-Total	<0.0030		0.0030	mg/L	09-MAY-19	09-MAY-19	R463024
Zirconium (Zr)-Total Aggregate Organics	<0.00030		0.00030	mg/L	09-MAY-19	09-MAY-19	R463024
BOD	<2.0		2.0	ma/l	10-MAY-19	15-MAY-19	R463554
L2270255-2 OL-2	<2.0		2.0	mg/L	10-IMA 1-19	13-IVIA1-19	K403004
Sampled By: CLIENT on 08-MAY-19 @ 11:25 Matrix: WATER							
Physical Tests							
Hardness (as CaCO3)	83.6	нтс	0.50	mg/L		10-MAY-19	
рН	8.33		0.10	pH units		10-MAY-19	R463116
Total Suspended Solids	<2.0		2.0	mg/L	11-MAY-19	12-MAY-19	R463144
Anions and Nutrients				Ŭ			
Alkalinity, Total (as CaCO3)	81		10	mg/L		10-MAY-19	R463116
Ammonia, Total (as N)	<0.010		0.010	mg/L		10-MAY-19	R463246
Chloride (CI)	49.6		0.50	mg/L		10-MAY-19	R463213
Nitrate (as N)	<0.020		0.020	mg/L		10-MAY-19	R463213
Total Kjeldahl Nitrogen	0.53		0.15	mg/L	14-MAY-19	15-MAY-19	R463559
Phosphorus, Total	0.0111		0.0030	mg/L	13-MAY-19	14-MAY-19	R463458
Sulfate (SO4)	1.84		0.30	mg/L		10-MAY-19	R463213
Organic / Inorganic Carbon							
Dissolved Carbon Filtration Location	LAB					10-MAY-19	R463043
Dissolved Organic Carbon	4.89		0.50	mg/L	10-MAY-19	10-MAY-19	R463232
Bacteriological Tests							
E. Coli	0		0	CFU/100mL		10-MAY-19	R463048
Fecal Coliforms	1		0	CFU/100mL		10-MAY-19	R463048
Total Metals							
Aluminum (AI)-Total	0.0066		0.0050	mg/L	09-MAY-19	09-MAY-19	R463024
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R463024
Arsenic (As)-Total	0.00048		0.00010	mg/L	09-MAY-19	09-MAY-19	R463024

Beryllium (Be)-Total         <	Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
Barium (Ba)-Total         0.0155         0.00010         mg/L         09-MAY-19	Sampled By: CLIENT on 08-MAY-19 @ 11:25							
Beryllium (Be)-Total         c.0.0010         mgL         09-MAY-19         09-MAY-19         R46302           Bismuth (B)-Total         c.0.00050         0.010         0.011         mgL         09-MAY-19         09-MAY-19         08-MAY-19         R46302           Cadmium (Ca)-Total         c.0.010         0.010         mgL         09-MAY-19         09-MAY-19 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>								
Bismuth (B)-Total         -0.000050         mgL         09-MAY-19         09-MAY-19         R46302           Boron (B)-Total         <.0.010	Barium (Ba)-Total	0.0155		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Boron (B)-Total         -0.010         mg/L         0.9-MAY-19         0.9-MAY-19         R46302           Cadium (Cq)-Total         -0.0000050         0.0000050         mg/L         0.9-MAY-19         <	Beryllium (Be)-Total	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Cadmium (Cd)-Total <ul> <li>0.0000050</li> <li>mg/L</li> <li>09-MAY-19</li> <li>09-MAY-19</li> <li>R46302</li> <li>Casium (Cs)-Total</li> <li>28.9</li> <li>0.050</li> <li>mg/L</li> <li>09-MAY-19</li> /ul>	Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Calcium (Ca)-Total         28.9         0.050         mg/L         09-MAY-19         04-MAY-19         R46302           Censium (Cs)-Total         <0.000010	Boron (B)-Total	<0.010		0.010	mg/L	09-MAY-19	09-MAY-19	R4630240
Cesium (Cs)-Total         -0.000010         mg/L         09-MAY-19         09-MAY-19         R46302           Chromium (Cr)-Total         -0.00050         0.00050         mg/L         09-MAY-19         09-M	Cadmium (Cd)-Total	<0.000050		0.0000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Chromium (Cr)-Total         <0.00050         mg/L         09-MAY-19         09-MAY-19         R46302           Cobper (Cu)-Total         0.0013         0.0010         mg/L         09-MAY-19         09-MAY-19         R46302           Copper (Cu)-Total         0.0113         0.0010         mg/L         09-MAY-19         09-MAY-19         R46302           Lead (Pb)-Total         0.0101         0.010         mg/L         09-MAY-19         09-MAY-19         R46302           Lead (Pb)-Total         0.00051         0.00050         mg/L         09-MAY-19         09-MAY-19         R4302           Magnesse (Mh)-Total         0.00051         0.00050         mg/L         09-MAY-19         09-MAY-19         R4302           Magnesse (Mh)-Total         0.000124         0.00050         mg/L         09-MAY-19         09-MAY-19         R46302           Nicke (N)-Total         0.00050         0.0050         mg/L         09-MAY-19         R46302           Phosphorus (P)-Total         -0.0050         0.0050         mg/L         09-MAY-19         R46302           Rubidium (Rb)-Total         0.00146         0.00020         mg/L         09-MAY-19         R46302           Silicon (S)-Total         -0.000050         0.00000         mg/L </td <td>Calcium (Ca)-Total</td> <td>28.9</td> <td></td> <td>0.050</td> <td>mg/L</td> <td>09-MAY-19</td> <td>09-MAY-19</td> <td>R4630240</td>	Calcium (Ca)-Total	28.9		0.050	mg/L	09-MAY-19	09-MAY-19	R4630240
Cobalt (Co)-Total         -0.00010         mg/L         09-MAY-19         09-MAY-19         R4302           Copper (Cu)-Total         0.0013         0.0010         mg/L         09-MAY-19         R4302           Iron (Fe)-Total         0.010         0.010         mg/L         09-MAY-19         R4302           Lead (Pb)-Total         0.00051         0.00050         mg/L         09-MAY-19         R4302           Lithium (Li)-Total         -0.0010         0.0010         mg/L         09-MAY-19         R4302           Magnessium (Mg)-Total         2.76         0.0050         mg/L         09-MAY-19         R4302           Malybdenum (Mo)-Total         0.00050         mg/L         09-MAY-19         R46302           Nickel (N)-Total         0.00050         mg/L         09-MAY-19         R46302           Nickel (N)-Total         -0.00050         0.00050         mg/L         09-MAY-19         R46302           Photashirum (K)-Total         -0.00050         0.00050         mg/L         09-MAY-19         R46302           Selenium (Se)-Total         -0.00146         0.00050         mg/L         09-MAY-19         R46302           Silver (Ap)-Total         -0.00050         0.000050         mg/L         09-MAY-19	Cesium (Cs)-Total	<0.000010		0.000010	mg/L	09-MAY-19	09-MAY-19	R4630240
Copper (Cu)-Total         0.0013         0.0010         mg/L         09-MAY-19         09-MAY-19         R43302           Iron (Fe)-Total         0.019         0.010         mg/L         09-MAY-19         09-MAY-19         R43302           Lead (Pb)-Total         0.000051         0.000050         mg/L         09-MAY-19         09-MAY-19         R43302           Magnesium (Mg)-Total         2.76         0.0050         mg/L         09-MAY-19         09-MAY-19         R43302           Magnesium (Mg)-Total         0.000509         0.00050         mg/L         09-MAY-19         09-MAY-19         R43302           Molybdenum (Mo)-Total         0.000509         0.00050         mg/L         09-MAY-19         09-MAY-19         R43302           Nickel (Ni)-Total         0.00050         0.00050         mg/L         09-MAY-19         09-MAY-19         R46302           Phosphorus (P)-Total         <0.00050	Chromium (Cr)-Total	<0.00050		0.00050	mg/L	09-MAY-19	09-MAY-19	R4630240
Iron (Fe)-Total         0.019         0.010         mg/L         09-MAY-19         09-MAY-19         R46302           Lead (Pb)-Total         0.000051         0.000050         mg/L         09-MAY-19	Cobalt (Co)-Total	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Lead (Pb)-Total         0.000051         0.000050         mg/L         09-MAY-19         09-MAY-19         R46302           Lithium (Li)-Total         <0.0010	Copper (Cu)-Total	0.0013		0.0010	mg/L	09-MAY-19	09-MAY-19	R4630240
Lithium (L)-Total         -0.0010         mg/L         09-MAY-19         09-MAY-19         R43022           Magnessium (Mg)-Total         2.76         0.0050         mg/L         09-MAY-19         09-MAY-19         R46302           Manganese (Mn)-Total         0.00509         0.00050         mg/L         09-MAY-19         09-MAY-19         R46302           Molybdenum (Mo)-Total         0.00050         mg/L         09-MAY-19         09-MAY-19         R46302           Mickel (Ni)-Total         0.00050         0.00050         mg/L         09-MAY-19         09-MAY-19         R46302           Phosphorus (P)-Total         <0.00050	Iron (Fe)-Total	0.019		0.010	mg/L	09-MAY-19	09-MAY-19	R4630240
Magnesium (Mg)-Total         2.76         0.0050         mg/L         09-MAY-19         09-MAY-19         R46302           Manganese (Mn)-Total         0.000509         0.00050         mg/L         09-MAY-19         09-MAY-19         R46302           Mickel (Ni)-Total         0.000501         0.00050         mg/L         09-MAY-19         09-MAY-19         R46302           Nickel (Ni)-Total         -0.0500         0.050         mg/L         09-MAY-19         09-MAY-19         R46302           Phosphorus (P)-Total         -0.0500         0.050         mg/L         09-MAY-19         09-MAY-19         R46302           Potassium (Kb)-Total         -0.0500         0.0500         mg/L         09-MAY-19         09-MAY-19         R46302           Selenium (Se)-Total         -0.00050         0.000050         mg/L         09-MAY-19         09-MAY-19         R46302           Sillor (Ag)-Total         -0.000050         0.000050         mg/L         09-MAY-19         09-MAY-19         R46302           Soldum (Na)-Total         -0.000050         0.000050         mg/L         09-MAY-19         09-MAY-19         R46302           Subtr (M)-Total         -0.00020         0.00020         mg/L         09-MAY-19         09-MAY-19         R46302	Lead (Pb)-Total	0.000051		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Manganese (Mn)-Total         0.00509         mg/L         09-MAY-19         09-MAY-19         R46302           Molybdenum (Mo)-Total         0.000124         0.000050         mg/L         09-MAY-19         09-MAY-19         R46302           Nickel (Ni)-Total         <0.0050	Lithium (Li)-Total	<0.0010		0.0010	mg/L	09-MAY-19	09-MAY-19	R4630240
Molybdenum (Mo)-Total         0.000124         0.000050         mg/L         09-MAY-19         09-MAY-19         R46302           Nickel (Ni)-Total         <0.00050	Magnesium (Mg)-Total	2.76		0.0050	mg/L	09-MAY-19	09-MAY-19	R4630240
Nickel (Ni)-Total         c-0.0050         mg/L         09-MAY-19         09-MAY-19         R46302           Phosphorus (P)-Total         1.86         0.050         mg/L         09-MAY-19         09-MAY-19         R46302           Potassium (K)-Total         1.86         0.050         mg/L         09-MAY-19         09-MAY-19         R46302           Rubidium (Rb)-Total         0.00146         0.00050         mg/L         09-MAY-19         09-MAY-19         R46302           Selenium (Se)-Total         -0.00050         0.000050         mg/L         09-MAY-19         09-MAY-19         R46302           Silicon (Si)-Total         -0.000050         0.000050         mg/L         09-MAY-19         09-MAY-19         R46302           Sodium (Na)-Total         -0.000050         0.00050         mg/L         09-MAY-19         09-MAY-19         R46302           Sodium (Na)-Total         -0.000050         0.00050         mg/L         09-MAY-19         09-MAY-19         R46302           Sufur (S)-Total         -0.00020         0.00010         mg/L         09-MAY-19         09-MAY-19         R46302           Thalium (Ti)-Total         -0.00020         0.00010         mg/L         09-MAY-19         09-MAY-19         R46302           <	Manganese (Mn)-Total	0.00509		0.00050	mg/L	09-MAY-19	09-MAY-19	R4630240
Phosphorus (P)-Total         <0.050         mg/L         09-MAY-19         09-MAY-19         R46302           Potassium (K)-Total         1.86         0.050         mg/L         09-MAY-19         09-MAY-19         R46302           Rubidium (Rb)-Total         0.00146         0.00020         mg/L         09-MAY-19         09-MAY-19         R46302           Selenium (Se)-Total         <0.00050	Molybdenum (Mo)-Total	0.000124		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Potassium (K)-Total         1.86         0.050         mg/L         09-MAY-19         09-MAY-19         R46302           Rubidium (Rb)-Total         0.00146         0.00020         mg/L         09-MAY-19         09-MAY-19         R46302           Selenium (Se)-Total         <0.00050	Nickel (Ni)-Total	<0.00050		0.00050	mg/L	09-MAY-19	09-MAY-19	R4630240
Rubidium (Rb)-Total         0.00146         0.00020         mg/L         09-MAY-19         09-MAY-19         R46302           Selenium (Se)-Total         <0.00050	Phosphorus (P)-Total	<0.050		0.050	mg/L	09-MAY-19	09-MAY-19	R4630240
Selenium (Se)-Total         <0.000050         mg/L         09-MAY-19         09-MAY-19         R46302           Silicon (Si)-Total         <0.10	Potassium (K)-Total	1.86		0.050	mg/L	09-MAY-19	09-MAY-19	R4630240
Silicon (Si)-Total         Q.10         D.10         mg/L         09-MAY-19         Q9-MAY-19         R4322           Silver (Ag)-Total         <0.00050	Rubidium (Rb)-Total	0.00146		0.00020	mg/L	09-MAY-19	09-MAY-19	R4630240
Silver (Ag)-Total       <0.000050	Selenium (Se)-Total	<0.000050		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Sodium (Na)-Total         27.5         0.050         mg/L         09-MAY-19         09-MAY-19         R46302           Strontium (Sr)-Total         0.0650         0.0010         mg/L         09-MAY-19         09-MAY-19         R46302           Sulfur (S)-Total         0.83         0.50         mg/L         09-MAY-19         09-MAY-19         R46302           Tellurium (Te)-Total         <0.00020	Silicon (Si)-Total	<0.10		0.10	mg/L	09-MAY-19	09-MAY-19	R4630240
Strontium (Sr)-Total         0.0650         0.0010         mg/L         09-MAY-19         09-MAY-19         R46302           Sulfur (S)-Total         0.83         0.50         mg/L         09-MAY-19         09-MAY-19         R46302           Tellurium (Te)-Total         <0.00020	Silver (Ag)-Total	<0.000050		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Sulfur (S)-Total       0.83       0.50       mg/L       09-MAY-19       09-MAY-19       R46302         Tellurium (Te)-Total       <0.00020	Sodium (Na)-Total	27.5		0.050	mg/L	09-MAY-19	09-MAY-19	R4630240
Tellurium (Te)-Total       <0.00020	Strontium (Sr)-Total	0.0650		0.0010	mg/L	09-MAY-19	09-MAY-19	R4630240
Thallium (TI)-Total       <0.000010	Sulfur (S)-Total	0.83		0.50	mg/L	09-MAY-19	09-MAY-19	R4630240
Thorium (Th)-Total       <0.00010	Tellurium (Te)-Total	<0.00020		0.00020	U	09-MAY-19	09-MAY-19	R4630240
Tin (Sn)-Total       <0.00010		<0.000010		0.000010	mg/L		09-MAY-19	R4630240
Titanium (Ti)-Total       0.00032       0.00030       mg/L       09-MAY-19       09-MAY-19       R46302         Tungsten (W)-Total       <0.00010		<0.00010		0.00010	mg/L			R4630240
Tungsten (W)-Total       <0.00010					•			R4630240
Uranium (U)-Total       0.000029       0.000010       mg/L       09-MAY-19       09-MAY-19       R46302         Vanadium (V)-Total       <0.00050		0.00032		0.00030	mg/L			R4630240
Vanadium (V)-Total       <0.00050	0 ( )	<0.00010		0.00010	•			R4630240
Zinc (Zn)-Total       0.0057       0.0030       mg/L       09-MAY-19       09-MAY-19       R46302         Zirconium (Zr)-Total       <0.00030		0.000029		0.000010	mg/L			R4630240
Zirconium (Zr)-Total       <0.00030       0.00030       mg/L       09-MAY-19       09-MAY-19       R46302         Aggregate Organics       <0.00030       mg/L       10-MAY-19       15-MAY-19       R46302         BOD       <2.0       mg/L       10-MAY-19       15-MAY-19       R46355         L2270255-3       OL-4       CLIENT on 08-MAY-19 @ 11:57       L22       L22 <td></td> <td></td> <td></td> <td></td> <td>•</td> <td></td> <td></td> <td>R4630240</td>					•			R4630240
Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Organics     Aggregate Org					•			R4630240
BOD         <2.0         2.0         mg/L         10-MAY-19         15-MAY-19         R46355           L2270255-3         OL-4         Sampled By:         CLIENT on 08-MAY-19 @ 11:57         Image: CLIENT on 08-MAY-19 @ 11:57         Image: CLIENT on 08-MAY-19 @ 11:57         Image: CLIENT on 08-MAY-19 @ 11:57         Image: CLIENT on 08-MAY-19 @ 11:57         Image: CLIENT on 08-MAY-19 @ 11:57         Image: CLIENT on 08-MAY-19 @ 11:57         Image: CLIENT on 08-MAY-19 @ 11:57         Image: CLIENT on 08-MAY-19 @ 11:57         Image: CLIENT on 08-MAY-19 @ 11:57         Image: CLIENT on 08-MAY-19 @ 11:57         Image: CLIENT on 08-MAY-19 @ 11:57         Image: CLIENT on 08-MAY-19 @ 11:57         Image: CLIENT on 08-MAY-19 @ 11:57         Image: CLIENT on 08-MAY-19 @ 11:57         Image: CLIENT on 08-MAY-19 @ 11:57         Image: CLIENT on 08-MAY-19 @ 11:57         Image: CLIENT on 08-MAY-19 @ 11:57         Image: CLIENT on 08-MAY-19 @ 11:57         Image: CLIENT on 08-MAY-19 @ 11:57         Image: CLIENT on 08-MAY-19 @ 11:57         Image: CLIENT on 08-MAY-19 @ 11:57         Image: CLIENT on 08-MAY-19 @ 11:57         Image: CLIENT on 08-MAY-19 @ 11:57         Image: CLIENT on 08-MAY-19 @ 11:57         Image: CLIENT on 08-MAY-19 @ 11:57         Image: CLIENT on 08-MAY-19 @ 11:57         Image: CLIENT on 08-MAY-19 @ 11:57         Image: CLIENT on 08-MAY-19 @ 11:57         Image: CLIENT on 08-MAY-19 @ 11:57         Image: CLIENT on 08-MAY-19 @ 11:57         Image: CLIENT on 08-MAY-19 @ 11:57         Image: CLIENT on 08-MAY-19 @ 11:57         Image: CLIENT on 08-MAY-19 @ 11:57		<0.00030		0.00030	mg/L	09-MAY-19	09-MAY-19	R4630240
L2270255-3 OL-4 Sampled By: CLIENT on 08-MAY-19 @ 11:57 Matrix: WATER				0.0				D 40055 45
Sampled By: CLIENT on 08-MAY-19 @ 11:57 Matrix: WATER		<2.0		2.0	mg/L	10-MAY-19	15-MAY-19	R4635543
Physical Tests	Sampled By: CLIENT on 08-MAY-19 @ 11:57							
	Physical Tests							

83.6 8.30 <2.0 81 0.019 49.6 <0.020 0.50	нтс	0.50 0.10 2.0 10 0.010 0.50	mg/L pH units mg/L mg/L	11-MAY-19		R4631164 R4631444
8.30 <2.0 81 0.019 49.6 <0.020	нтс	0.10 2.0 10 0.010	pH units mg/L mg/L	11-MAY-19	10-MAY-19 12-MAY-19	
8.30 <2.0 81 0.019 49.6 <0.020	нтс	0.10 2.0 10 0.010	pH units mg/L mg/L	11-MAY-19	10-MAY-19 12-MAY-19	
8.30 <2.0 81 0.019 49.6 <0.020	нтс	0.10 2.0 10 0.010	pH units mg/L mg/L	11-MAY-19	10-MAY-19 12-MAY-19	
<2.0 81 0.019 49.6 <0.020		2.0 10 0.010	mg/L mg/L	11-MAY-19	12-MAY-19	
81 0.019 49.6 <0.020		10 0.010	mg/L	11-MAY-19		R4631444
0.019 49.6 <0.020		0.010	mg/L			
0.019 49.6 <0.020		0.010			1	
49.6 <0.020			ma/l		10-MAY-19	R4631164
<0.020		0.50	mg/L		10-MAY-19	R4632460
			mg/L		10-MAY-19	R4632137
0.50		0.020	mg/L		10-MAY-19	R4632137
		0.15	mg/L	14-MAY-19	15-MAY-19	R4635594
0.0114		0.0030	mg/L	13-MAY-19	14-MAY-19	R4634585
1.86		0.30	mg/L		10-MAY-19	R4632137
			-			
LAB					10-MAY-19	R463043
4.85		0.50	mg/L	10-MAY-19	10-MAY-19	R463232
0		0	CFU/100mL		10-MAY-19	R463048
0		0	CFU/100mL		10-MAY-19	R463048
0.0059		0.0050	mg/L	09-MAY-19	10-MAY-19	R463024
<0.00010		0.00010	mg/L	09-MAY-19	10-MAY-19	R463024
0.00046		0.00010	mg/L	09-MAY-19	10-MAY-19	R463024
0.0158		0.00010	mg/L	09-MAY-19	10-MAY-19	R463024
<0.00010		0.00010	mg/L	09-MAY-19	10-MAY-19	R463024
<0.000050		0.000050	mg/L	09-MAY-19	10-MAY-19	R463024
<0.010		0.010	mg/L	09-MAY-19	10-MAY-19	R463024
<0.000050		0.0000050	mg/L	09-MAY-19	10-MAY-19	R463024
28.8		0.050	mg/L	09-MAY-19	10-MAY-19	R463024
<0.000010		0.000010	mg/L	09-MAY-19	10-MAY-19	R463024
0.00055		0.00050	mg/L	09-MAY-19	10-MAY-19	R463024
<0.00010		0.00010	mg/L	09-MAY-19	10-MAY-19	R463024
<0.0010		0.0010	mg/L	09-MAY-19	10-MAY-19	R463024
0.018		0.010	mg/L	09-MAY-19	10-MAY-19	R463024
<0.000050		0.000050	mg/L	09-MAY-19	10-MAY-19	R463024
<0.0010		0.0010	mg/L	09-MAY-19		
2.84		0.0050	mg/L	09-MAY-19	10-MAY-19	R463024
0.00504		0.00050	mg/L	09-MAY-19	10-MAY-19	R463024
0.000102		0.000050	mg/L	09-MAY-19		
<0.00050		0.00050	-	09-MAY-19	10-MAY-19	R463024
<0.050		0.050	mg/L	09-MAY-19	10-MAY-19	R463024
			•	09-MAY-19		
			•			R463024
						R463024
	1.86 LAB 4.85 0 0 0.0059 <0.00010 0.00046 0.0158 <0.00010 <0.000050 28.8 <0.000010 0.00055 <0.00010 0.00055 <0.00010 0.0010 2.84 0.000102 <0.00050 <0.050 1.74 0.00125 <0.000050	1.86 LAB 4.85 0 0 0 0 0.0059 <0.00010 0.00046 0.0158 <0.00010 <0.000050 <0.010 <0.000050 28.8 <0.000010 <0.000055 <0.00010 0.00055 <0.00010 0.00055 <0.00010 0.0012 <0.00050 <0.050 1.74 0.00125 <0.000050	1.86       0.30         LAB       0.50         0       0         0       0         0       0         0.0059       0.0050         <0.00010	1.86       0.30       mg/L         LAB       0.50       mg/L         4.85       0.50       mg/L         0       0       CFU/100mL         0       0       CFU/100mL         0       0       CFU/100mL         0       0       mg/L         0.0059       0.0050       mg/L         0.00046       0.00010       mg/L         0.00010       0.00010       mg/L         0.000050       0.000050       mg/L         <0.000050	1.86         0.30         mg/L           LAB         0.50         mg/L         10-MAY-19           0         0         CFU/100mL         0           0         0         CFU/100mL         0           0.0059         0.0050         mg/L         09-MAY-19           <0.00010	1.86         0.30         mg/L         10-MAY-19           LAB         0.50         mg/L         10-MAY-19         10-MAY-19           4.85         0.50         mg/L         10-MAY-19         10-MAY-19           0         0         CFU/100mL         10-MAY-19         10-MAY-19           0.0059         0.0050         mg/L         09-MAY-19         10-MAY-19           0.00046         0.00010         mg/L         09-MAY-19         10-MAY-19           0.00050         0.000050         mg/L         09-MAY-19         10-MAY-19           <0.00010

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2270255-3 OL-4 Sampled Bv: CLIENT on 08-MAY-19 @ 11:57							
Sampled By: CLIENT on 08-MAY-19 @ 11:57 Matrix: WATER							
Total Metals							
Silicon (Si)-Total	<0.10		0.10	mg/L	09-MAY-19	10-MAY-19	R4630240
Silver (Ag)-Total	<0.000050		0.000050	mg/L	09-MAY-19	10-MAY-19	R4630240
Sodium (Na)-Total	27.6		0.050	mg/L	09-MAY-19	10-MAY-19	R4630240
Strontium (Sr)-Total	0.0643		0.0010	mg/L	09-MAY-19	10-MAY-19	R4630240
Sulfur (S)-Total	0.71		0.50	mg/L	09-MAY-19	10-MAY-19	R463024
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	09-MAY-19	10-MAY-19	R463024
Thallium (TI)-Total	<0.000010		0.000010	mg/L	09-MAY-19	10-MAY-19	R463024
Thorium (Th)-Total	<0.00010		0.00010	mg/L	09-MAY-19	10-MAY-19	R463024
Tin (Sn)-Total	<0.00010		0.00010	mg/L	09-MAY-19	10-MAY-19	R463024
Titanium (Ti)-Total	<0.00030		0.00030	mg/L	09-MAY-19	10-MAY-19	R463024
Tungsten (W)-Total	<0.00010		0.00010	mg/L	09-MAY-19	10-MAY-19	R463024
Uranium (U)-Total	0.000030		0.000010	mg/L	09-MAY-19	10-MAY-19	R463024
Vanadium (V)-Total	<0.00050		0.00050	mg/L	09-MAY-19	10-MAY-19	R463024
Zinc (Zn)-Total	0.0033		0.0030	mg/L	09-MAY-19	10-MAY-19	R463024
Zirconium (Zr)-Total	<0.00030		0.00030	mg/L	09-MAY-19	10-MAY-19	R463024
Aggregate Organics	10.00000		0.00000				11100021
BOD	<2.0		2.0	mg/L	10-MAY-19	15-MAY-19	R463554
L2270255-4 OL-7 Sampled By: CLIENT on 08-MAY-19 @ 11:45 Matrix: WATER Physical Tests							
Hardness (as CaCO3)	83.5	нтс	0.50	mg/L		10-MAY-19	
pH	8.38		0.50	pH units		10-MAY-19	R463116
Total Suspended Solids	<2.0		2.0	mg/L	11-MAY-19	12-MAY-19	R463144
Anions and Nutrients	<2.0		2.0	ing/∟	11-101A1-19	12-10141-19	K403144
Alkalinity, Total (as CaCO3)	80		10	mg/L		10-MAY-19	R463116
Ammonia, Total (as N)	0.372		0.010	mg/L		10-MAY-19	
Chloride (Cl)	50.2		0.50	mg/L		10-MAY-19	R463213
Nitrate (as N)	<0.020		0.020	mg/L		10-MAY-19	R463213
Total Kjeldahl Nitrogen	0.71		0.15	mg/L	14-MAY-19	15-MAY-19	
Phosphorus, Total	0.0133		0.0030	mg/L	13-MAY-19	14-MAY-19	
Sulfate (SO4)	1.86		0.30	mg/L		10-MAY-19	R463213
Organic / Inorganic Carbon	1.00		0.00				11100210
Dissolved Carbon Filtration Location	LAB					10-MAY-19	R463043
Dissolved Organic Carbon	5.30		0.50	mg/L	10-MAY-19	10-MAY-19	R463232
Bacteriological Tests				_			
E. Coli	3		0	CFU/100mL		10-MAY-19	R463048
Fecal Coliforms Total Metals	2		0	CFU/100mL		10-MAY-19	R463048
Aluminum (Al)-Total	0.0093		0.0050	mg/L	09-MAY-19	09-MAY-19	R463024
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	
		1		-	1	1	1

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2270255-4 OL-7 Sampled By: CLIENT on 08-MAY-19 @ 11:45 Matrix: WATER							
Total Metals							
Barium (Ba)-Total	0.0159		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Boron (B)-Total	<0.010		0.010	mg/L	09-MAY-19	09-MAY-19	R4630240
Cadmium (Cd)-Total	<0.000050		0.0000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Calcium (Ca)-Total	28.6		0.050	mg/L	09-MAY-19	09-MAY-19	R4630240
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	09-MAY-19	09-MAY-19	R4630240
Chromium (Cr)-Total	0.00139		0.00050	mg/L	09-MAY-19	09-MAY-19	R4630240
Cobalt (Co)-Total	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Copper (Cu)-Total	<0.0010		0.0010	mg/L	09-MAY-19	09-MAY-19	R4630240
Iron (Fe)-Total	0.044		0.010	mg/L	09-MAY-19	09-MAY-19	R4630240
Lead (Pb)-Total	<0.000050		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Lithium (Li)-Total	<0.0010		0.0010	mg/L	09-MAY-19	09-MAY-19	R4630240
Magnesium (Mg)-Total	2.90		0.0050	mg/L	09-MAY-19	09-MAY-19	R4630240
Manganese (Mn)-Total	0.0101		0.00050	mg/L	09-MAY-19	09-MAY-19	R4630240
Molybdenum (Mo)-Total	0.000123		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Nickel (Ni)-Total	<0.00050		0.00050	mg/L	09-MAY-19	09-MAY-19	R4630240
Phosphorus (P)-Total	<0.050		0.050	mg/L	09-MAY-19	09-MAY-19	R4630240
Potassium (K)-Total	1.70		0.050	mg/L	09-MAY-19	09-MAY-19	R4630240
Rubidium (Rb)-Total	0.00132		0.00020	mg/L	09-MAY-19	09-MAY-19	R4630240
Selenium (Se)-Total	<0.000050		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Silicon (Si)-Total	<0.10		0.10	mg/L	09-MAY-19	09-MAY-19	R4630240
Silver (Ag)-Total	<0.000050		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Sodium (Na)-Total	28.6		0.050	mg/L	09-MAY-19	09-MAY-19	R4630240
Strontium (Sr)-Total	0.0659		0.0010	mg/L	09-MAY-19	09-MAY-19	R4630240
Sulfur (S)-Total	0.84		0.50	mg/L	09-MAY-19	09-MAY-19	R4630240
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	09-MAY-19	09-MAY-19	
Thallium (TI)-Total	<0.000010		0.000010	mg/L	09-MAY-19	09-MAY-19	R4630240
Thorium (Th)-Total	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Tin (Sn)-Total	<0.00010		0.00010	mg/L	09-MAY-19		R4630240
Titanium (Ti)-Total	<0.00030		0.00030	mg/L	09-MAY-19	09-MAY-19	R4630240
Tungsten (W)-Total	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Uranium (U)-Total	0.000034		0.000010	mg/L	09-MAY-19		R4630240
Vanadium (V)-Total	<0.00050		0.00050	mg/L	09-MAY-19	09-MAY-19	R4630240
Zinc (Zn)-Total	<0.0030		0.0030	mg/L	09-MAY-19	09-MAY-19	R4630240
Zirconium (Zr)-Total Aggregate Organics	<0.00030		0.00030	mg/L	09-MAY-19	09-MAY-19	R4630240
BOD	<2.0		2.0	mg/L	10-MAY-19	15-MAY-19	R4635543
L2270255-5 OL-9	~2.0		2.0	iiig/L	10 10/21-13	10 10/1-13	117000040
Sampled By: CLIENT on 08-MAY-19 @ 11:36 Matrix: WATER							
Physical Tests							
Refer to Referenced Information for Qualifiers (if any) an	d Mathadalaau				I		

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2270255-5 OL-9 Sampled By: CLIENT on 08-MAY-19 @ 11:36 Matrix: WATER							
Physical Tests							
Hardness (as CaCO3)	87.9	HTC	0.50	mg/L		10-MAY-19	
pH	8.27		0.10	pH units		10-MAY-19	R4631164
Total Suspended Solids	<2.0		2.0	mg/L	11-MAY-19	12-MAY-19	R4631444
Anions and Nutrients				Ū			
Alkalinity, Total (as CaCO3)	83		10	mg/L		10-MAY-19	R4631164
Ammonia, Total (as N)	0.738	DLHC	0.020	mg/L		10-MAY-19	R4632460
Chloride (Cl)	49.3		0.50	mg/L		10-MAY-19	R4632137
Nitrate (as N)	0.027		0.020	mg/L		10-MAY-19	R4632137
Total Kjeldahl Nitrogen	0.78		0.15	mg/L	14-MAY-19	15-MAY-19	R4635594
Phosphorus, Total	0.0215		0.0030	mg/L	13-MAY-19	14-MAY-19	R463458
Sulfate (SO4)	1.88		0.30	mg/L		10-MAY-19	R463213
Organic / Inorganic Carbon				_			
Dissolved Carbon Filtration Location	LAB					10-MAY-19	R463043
Dissolved Organic Carbon	5.02		0.50	mg/L	10-MAY-19	10-MAY-19	R463232
Bacteriological Tests							
E. Coli	1		0	CFU/100mL		10-MAY-19	R463048
Fecal Coliforms	0		0	CFU/100mL		10-MAY-19	R463048
Total Metals							
Aluminum (Al)-Total	0.0083		0.0050	mg/L	09-MAY-19	09-MAY-19	R463024
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R463024
Arsenic (As)-Total	0.00053		0.00010	mg/L	09-MAY-19	09-MAY-19	R463024
Barium (Ba)-Total	0.0158		0.00010	mg/L	09-MAY-19	09-MAY-19	R463024
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R463024
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	09-MAY-19	09-MAY-19	R463024
Boron (B)-Total	<0.010		0.010	mg/L	09-MAY-19	09-MAY-19	R463024
Cadmium (Cd)-Total	<0.0000050		0.0000050	mg/L	09-MAY-19	09-MAY-19	R463024
Calcium (Ca)-Total	30.3		0.050	mg/L	09-MAY-19	09-MAY-19	R463024
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	09-MAY-19	09-MAY-19	R463024
Chromium (Cr)-Total	<0.00050		0.00050	mg/L	09-MAY-19	09-MAY-19	R463024
Cobalt (Co)-Total	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R463024
Copper (Cu)-Total	<0.0010		0.0010	mg/L	09-MAY-19	09-MAY-19	R463024
Iron (Fe)-Total	0.020		0.010	mg/L	09-MAY-19	09-MAY-19	R463024
Lead (Pb)-Total	<0.000050		0.000050	mg/L	09-MAY-19	09-MAY-19	R463024
Lithium (Li)-Total	<0.0010		0.0010	mg/L	09-MAY-19	09-MAY-19	R463024
Magnesium (Mg)-Total	2.99		0.0050	mg/L	09-MAY-19	09-MAY-19	R463024
Manganese (Mn)-Total	0.00652		0.00050	mg/L	09-MAY-19	09-MAY-19	R463024
Molybdenum (Mo)-Total	0.000103		0.000050	mg/L	09-MAY-19	09-MAY-19	R463024
Nickel (Ni)-Total	<0.00050		0.00050	mg/L	09-MAY-19	09-MAY-19	R463024
Phosphorus (P)-Total	<0.050		0.050	mg/L	09-MAY-19	09-MAY-19	R463024
Potassium (K)-Total	1.78		0.050	mg/L	09-MAY-19	09-MAY-19	R463024
Rubidium (Rb)-Total	0.00130		0.00020	mg/L	09-MAY-19	09-MAY-19	R463024
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Sample Details/	/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
	OL-9 CLIENT on 08-MAY-19 @ 11:36							
Total Metals	WATER							
Silicon (Si)-1		-0.10		0.10	ma/l	00 MAX 10	09-MAY-19	D 4620240
( )		<0.10 <0.000050		0.10	mg/L	09-MAY-19		R4630240
Silver (Ag)-T				0.000050	mg/L	09-MAY-19 09-MAY-19	09-MAY-19	R4630240
Sodium (Na)		28.2		0.050	mg/L		09-MAY-19	R4630240
Strontium (S	,	0.0671		0.0010	mg/L	09-MAY-19	09-MAY-19	R4630240
Sulfur (S)-To		0.82		0.50	mg/L	09-MAY-19	09-MAY-19	R463024
Tellurium (Te		<0.00020		0.00020	mg/L	09-MAY-19	09-MAY-19	R463024
Thallium (TI)		<0.000010		0.000010	mg/L	09-MAY-19	09-MAY-19	R463024
Thorium (Th	,	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R463024
Tin (Sn)-Tota		<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R463024
Titanium (Ti)		< 0.00030		0.00030	mg/L	09-MAY-19	09-MAY-19	R463024
Tungsten (W	,	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R463024
Uranium (U)		0.000035		0.000010	mg/L	09-MAY-19	09-MAY-19	R463024
Vanadium (\ Zing (Zn) To	,	<0.00050		0.00050	mg/L	09-MAY-19	09-MAY-19	R463024
Zinc (Zn)-To		<0.0030		0.0030	mg/L	09-MAY-19	09-MAY-19	R463024
Zirconium (Z Aggregate O	,	<0.00030		0.00030	mg/L	09-MAY-19	09-MAY-19	R463024
BOD	biganics	<2.0		2.0	mg/L	10-MAY-19	15-MAY-19	R463554
Sampled By: Matrix: <b>Physical Tes</b>	CLIENT on 08-MAY-19 @ 13:25 WATER sts							
Hardness (a		84.8	нтс	0.50	mg/L		10-MAY-19	
pH	3 04000)	8.23		0.30	pH units		10-MAY-19	R463116
Total Susper	nded Solids	<2.0		2.0	mg/L	11-MAY-19	12-MAY-19	R463144
Anions and		<2.0		2.0	ing/∟	11-101A1-19	12-10141-19	K403144
	otal (as CaCO3)	83		10	mg/L		10-MAY-19	R463116
Ammonia, T	( <i>'</i>	0.026		0.010	mg/L		10-MAY-19	
Chloride (Cl)		51.1		0.50	mg/L		10-MAY-19	R463213
Nitrate (as N		<0.020		0.020	mg/L		10-MAY-19	R463213
Total Kjeldal	,	0.37		0.15	mg/L	14-MAY-19	15-MAY-19	
Phosphorus,	-	0.0197		0.0030	mg/L	13-MAY-19	14-MAY-19	
Sulfate (SO4		1.85		0.30	mg/L		10-MAY-19	R463213
	organic Carbon	1.00		0.00				11100210
Dissolved Ca	arbon Filtration Location	LAB					10-MAY-19	R463043
Dissolved O	rganic Carbon	5.20		0.50	mg/L	10-MAY-19	10-MAY-19	R463232
Bacteriologi	cal Tests				_			
E. Coli		22		0	CFU/100mL		10-MAY-19	R463048
Fecal Colifor Total Metals		50	DLM	10	CFU/100mL		10-MAY-19	R463048
Aluminum (A	Al)-Total	0.0108		0.0050	mg/L	09-MAY-19	09-MAY-19	R463024
Antimony (S	b)-Total	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R463024
		1	1		1	1	1	1

L2270255-6         TRIB-2 Sampled By:         CLIENT on 08-MAY-19 @ 13:25 Matrix:         WATER           Total Metals         0.0157         0.000           Barium (Ba)-Total         0.0157         0.000           Beryllium (Be)-Total         <0.00010         0.000           Bismuth (Bi)-Total         <0.000050         0.0000           Boron (B)-Total         <0.000050         0.0000           Cadmium (Cd)-Total         <0.000010         0.0000           Calcium (Ca)-Total         29.2         0.05           Cesium (Cs)-Total         <0.00010         0.0000           Chromium (Cr)-Total         <0.00010         0.0000           Cobalt (Co)-Total         <0.00010         0.0000           Copper (Cu)-Total         <0.0010         0.000           Iron (Fe)-Total         <0.00010         0.000           Iron (Fe)-Total         <0.00050         0.0000           Iron (Fe)-Total         <0.000050         0.0000           Lead (Pb)-Total         <0.000050         0.0000           Lithium (Li)-Total         <0.0010         0.000           Magnesium (Mg)-Total         2.90         0.000	010     mg/L       0050     mg/L       10     mg/L       0050     mg/L       50     mg/L       0010     mg/L       0050     mg/L       010     mg/L	09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19	09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19	R4630240 R4630240 R4630240 R4630240 R4630240 R4630240 R4630240 R4630240 R4630240 R4630240
Total Metals         0.0157         0.000           Barium (Ba)-Total         <0.00010	010         mg/L           0050         mg/L           10         mg/L           0050         mg/L           0050         mg/L           50         mg/L           0010         mg/L           010         mg/L	09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19	09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19	R4630240 R4630240 R4630240 R4630240 R4630240 R4630240 R4630240 R4630240 R4630240
Barium (Ba)-Total         0.0157         0.000           Beryllium (Be)-Total         <0.00010	010         mg/L           0050         mg/L           10         mg/L           0050         mg/L           0050         mg/L           50         mg/L           0010         mg/L           010         mg/L	09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19	09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19	R4630240 R4630240 R4630240 R4630240 R4630240 R4630240 R4630240 R4630240 R4630240
Beryllium (Be)-Total         <0.00010         0.000           Bismuth (Bi)-Total         <0.000050	010         mg/L           0050         mg/L           10         mg/L           0050         mg/L           0050         mg/L           50         mg/L           0010         mg/L           010         mg/L	09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19	09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19	R4630240 R4630240 R4630240 R4630240 R4630240 R4630240 R4630240 R4630240 R4630240
Bismuth (Bi)-Total         <0.000050         0.0000           Boron (B)-Total         <0.010	NO50         mg/L           10         mg/L           0050         mg/L           0050         mg/L           0010         mg/L           0010         mg/L           010         mg/L	09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19	09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19	R4630240 R4630240 R4630240 R4630240 R4630240 R4630240 R4630240 R4630240
Boron (B)-Total         <0.010         0.01           Cadmium (Cd)-Total         <0.0000050	10         mg/L           0050         mg/L           50         mg/L           0010         mg/L           050         mg/L           010         mg/L           0050         mg/L           0050         mg/L	09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19	09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19	R4630240 R4630240 R4630240 R4630240 R4630240 R4630240 R4630240
Cadmium (Cd)-Total         <0.000050         0.0000           Calcium (Ca)-Total         29.2         0.05           Cesium (Cs)-Total         <0.00010	0050         mg/L           50         mg/L           0010         mg/L           0010         mg/L           010         mg/L	09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19	09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19	R4630240 R4630240 R4630240 R4630240 R4630240 R4630240
Cesium (Cs)-Total         <0.00010         0.000           Chromium (Cr)-Total         0.00140         0.000           Cobalt (Co)-Total         <0.00010	50 mg/L 0010 mg/L 050 mg/L 010 mg/L 010 mg/L 10 mg/L 0050 mg/L 010 mg/L	09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19	09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19	R4630240 R4630240 R4630240 R4630240 R4630240 R4630240
Chromium (Cr)-Total         0.00140         0.000           Cobalt (Co)-Total         <0.00010	D010         mg/L           050         mg/L           010         mg/L           010         mg/L           10         mg/L           050         mg/L           010         mg/L           010         mg/L           010         mg/L           010         mg/L           010         mg/L	09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19	09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19	R4630240 R4630240 R4630240 R4630240
Cobalt (Co)-Total         <0.00010         0.000           Copper (Cu)-Total         <0.0010	010 mg/L 010 mg/L 10 mg/L 0050 mg/L 010 mg/L	09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19	09-MAY-19 09-MAY-19 09-MAY-19 09-MAY-19	R4630240 R4630240 R4630240
Copper (Cu)-Total         <0.0010         0.00           Iron (Fe)-Total         0.065         0.01           Lead (Pb)-Total         <0.00050	010 mg/L 10 mg/L 0050 mg/L 010 mg/L	09-MAY-19 09-MAY-19 09-MAY-19	09-MAY-19 09-MAY-19 09-MAY-19	R4630240 R4630240
Iron (Fe)-Total     0.065     0.01       Lead (Pb)-Total     <0.000050	10 mg/L 0050 mg/L 010 mg/L	09-MAY-19 09-MAY-19	09-MAY-19 09-MAY-19	R4630240
Lead (Pb)-Total         <0.000050         0.0000           Lithium (Li)-Total         <0.0010	10 mg/L 0050 mg/L 010 mg/L	09-MAY-19	09-MAY-19	
Lead (Pb)-Total         <0.000050         0.0000           Lithium (Li)-Total         <0.0010	)10 mg/L			1_
	-	09-MAY-19		R4630240
Magnesium (Mg)-Total	)50 ma/L	1	09-MAY-19	R4630240
		09-MAY-19	09-MAY-19	R4630240
Manganese (Mn)-Total 0.00965 0.000	050 mg/L	09-MAY-19	09-MAY-19	R4630240
Molybdenum (Mo)-Total 0.000133 0.000	0050 mg/L	09-MAY-19	09-MAY-19	R4630240
Nickel (Ni)-Total <0.00050 0.000	050 mg/L	09-MAY-19	09-MAY-19	R4630240
Phosphorus (P)-Total <0.050 0.05	50 mg/L	09-MAY-19	09-MAY-19	R4630240
Potassium (K)-Total 1.72 0.05	50 mg/L	09-MAY-19	09-MAY-19	R4630240
Rubidium (Rb)-Total 0.00133 0.000	020 mg/L	09-MAY-19	09-MAY-19	R4630240
Selenium (Se)-Total         0.000051         0.0000	0050 mg/L	09-MAY-19	09-MAY-19	R4630240
Silicon (Si)-Total <0.10 0.10	0 mg/L	09-MAY-19	09-MAY-19	R4630240
Silver (Ag)-Total <0.000050 0.000	0050 mg/L	09-MAY-19	09-MAY-19	R4630240
Sodium (Na)-Total 29.3 0.05	50 mg/L	09-MAY-19	09-MAY-19	R4630240
Strontium (Sr)-Total         0.0673         0.00	)10 mg/L	09-MAY-19	09-MAY-19	R4630240
Sulfur (S)-Total         0.81         0.50	50 mg/L	09-MAY-19	09-MAY-19	R4630240
Tellurium (Te)-Total <0.00020 0.000	020 mg/L	09-MAY-19	09-MAY-19	R4630240
Thallium (TI)-Total         <0.000010         0.0000	010 mg/L	09-MAY-19	09-MAY-19	R4630240
Thorium (Th)-Total         <0.00010         0.000	010 mg/L	09-MAY-19	09-MAY-19	R4630240
Tin (Sn)-Total         <0.00010         0.000	010 mg/L	09-MAY-19	09-MAY-19	R4630240
Titanium (Ti)-Total         0.00037         0.000	030 mg/L	09-MAY-19	09-MAY-19	R4630240
Tungsten (W)-Total         <0.00010         0.000	010 mg/L	09-MAY-19	09-MAY-19	R4630240
Uranium (U)-Total 0.000031 0.0000	0010 mg/L	09-MAY-19	09-MAY-19	R4630240
Vanadium (V)-Total <0.00050 0.000	050 mg/L	09-MAY-19	09-MAY-19	R4630240
Zinc (Zn)-Total <0.0030 0.003	)30 mg/L	09-MAY-19	09-MAY-19	R4630240
Zirconium (Zr)-Total <0.00030 0.000	030 mg/L	09-MAY-19	09-MAY-19	R4630240
Aggregate Organics				
BOD <3.0 BODL 3.0	0 mg/L	10-MAY-19	15-MAY-19	R4635543
L2270255-7         TRIB-4           Sampled By:         CLIENT on 08-MAY-19 @ 13:15           Matrix:         WATER				
Physical Tests				

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
.2270255-7 TRIB-4							
Sampled By: CLIENT on 08-MAY-19 @ 13:15 Matrix: WATER							
Physical Tests							
Hardness (as CaCO3)	280	нтс	0.50	mg/L		10-MAY-19	
pH	7.63	mo	0.50	pH units		10-MAY-19	R4631164
Total Suspended Solids	15.3		2.0	mg/L	12-MAY-19		
Anions and Nutrients	15.5		2.0	IIIg/L	12-101A1-19	13-101A1-19	R4032318
Alkalinity, Total (as CaCO3)	267		10	mg/L		10-MAY-19	R4631164
Ammonia, Total (as N)	1.19	DLHC	0.10	mg/L		10-MAY-19	R4632460
Chloride (Cl)	10.1	-	0.50	mg/L		10-MAY-19	
Nitrate (as N)	6.72		0.020	mg/L		10-MAY-19	R463213
Total Kjeldahl Nitrogen	2.33		0.15	mg/L	14-MAY-19	15-MAY-19	R463559
Phosphorus, Total	0.153		0.0030	mg/L	13-MAY-19		
Sulfate (SO4)	8.28		0.30	mg/L		10-MAY-19	R463213
Organic / Inorganic Carbon	0.20		0.00	ing/E			11400210
Dissolved Carbon Filtration Location	LAB					10-MAY-19	R463043
Dissolved Organic Carbon	6.53		0.50	mg/L	10-MAY-19	10-MAY-19	R463232
Bacteriological Tests							
E. Coli	19		0	CFU/100mL		10-MAY-19	R463048
Fecal Coliforms	20		0	CFU/100mL		10-MAY-19	R463048
Total Metals							
Aluminum (AI)-Total	0.0495		0.0050	mg/L	09-MAY-19	09-MAY-19	R463024
Antimony (Sb)-Total	0.00011		0.00010	mg/L	09-MAY-19	09-MAY-19	R463024
Arsenic (As)-Total	0.00087		0.00010	mg/L	09-MAY-19	09-MAY-19	R463024
Barium (Ba)-Total	0.0442		0.00010	mg/L	09-MAY-19	09-MAY-19	R463024
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R463024
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	09-MAY-19	09-MAY-19	R463024
Boron (B)-Total	0.018		0.010	mg/L	09-MAY-19	09-MAY-19	R463024
Cadmium (Cd)-Total	0.0000110		0.0000050	mg/L	09-MAY-19	09-MAY-19	R463024
Calcium (Ca)-Total	99.0		0.050	mg/L	09-MAY-19	09-MAY-19	R463024
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	09-MAY-19	09-MAY-19	R463024
Chromium (Cr)-Total	0.00053		0.00050	mg/L	09-MAY-19	09-MAY-19	R463024
Cobalt (Co)-Total	0.00030		0.00010	mg/L	09-MAY-19	09-MAY-19	R463024
Copper (Cu)-Total	0.0015		0.0010	mg/L	09-MAY-19	09-MAY-19	R463024
Iron (Fe)-Total	0.246		0.010	mg/L	09-MAY-19	09-MAY-19	R463024
Lead (Pb)-Total	0.000100		0.000050	mg/L	09-MAY-19	09-MAY-19	R463024
Lithium (Li)-Total	<0.0010		0.0010	mg/L	09-MAY-19	09-MAY-19	
Magnesium (Mg)-Total	7.92		0.0050	mg/L	09-MAY-19	09-MAY-19	R463024
Manganese (Mn)-Total	0.194		0.00050	mg/L	09-MAY-19	09-MAY-19	
Molybdenum (Mo)-Total	0.000491		0.000050	mg/L	09-MAY-19		
Nickel (Ni)-Total	0.00056		0.00050	mg/L	09-MAY-19	09-MAY-19	R463024
Phosphorus (P)-Total	0.146		0.050	mg/L	09-MAY-19	09-MAY-19	R463024
Potassium (K)-Total	6.38		0.050	mg/L	09-MAY-19		R463024
	0.00		0.000	-			
Rubidium (Rb)-Total	0.00159		0.00020	mg/L	09-MAY-19	09-MAY-19	R463024

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2270255-7 TRIB-4 Sampled By: CLIENT on 08-MAY-19 @ 13:15 Matrix: WATER							
Total Metals							
Silicon (Si)-Total	3.35		0.10	mg/L	09-MAY-19	09-MAY-19	R4630240
Silver (Ag)-Total	<0.000050		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Sodium (Na)-Total	6.75		0.050	mg/L	09-MAY-19	09-MAY-19	R4630240
Strontium (Sr)-Total	0.183		0.0010	mg/L	09-MAY-19	09-MAY-19	R4630240
Sulfur (S)-Total	2.97		0.50	mg/L	09-MAY-19	09-MAY-19	R4630240
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	09-MAY-19	09-MAY-19	R4630240
Thallium (TI)-Total	<0.000010		0.000010	mg/L	09-MAY-19	09-MAY-19	R4630240
Thorium (Th)-Total	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Tin (Sn)-Total	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Titanium (Ti)-Total	0.00228		0.00030	mg/L	09-MAY-19	09-MAY-19	R4630240
Tungsten (W)-Total	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Uranium (U)-Total	0.000714		0.000010	mg/L	09-MAY-19	09-MAY-19	R4630240
Vanadium (V)-Total	0.00134		0.00050	mg/L	09-MAY-19	09-MAY-19	R4630240
Zinc (Zn)-Total	0.0040		0.0030	mg/L	09-MAY-19	09-MAY-19	R4630240
Zirconium (Zr)-Total	<0.00030		0.00030	mg/L	09-MAY-19	09-MAY-19	R4630240
Aggregate Organics	<0.00000		0.00000		00 100 10		114000240
BOD	<2.0		2.0	mg/L	10-MAY-19	15-MAY-19	R4635543
L2270255-8 TRIB-5 Sampled By: CLIENT on 08-MAY-19 @ 13:10 Matrix: WATER							
Physical Tests							
Hardness (as CaCO3)	279	HTC	0.50	mg/L		10-MAY-19	
рН	7.98		0.10	pH units		10-MAY-19	R4631164
Total Suspended Solids	<2.0		2.0	mg/L	12-MAY-19	13-MAY-19	R4632319
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	262		10	mg/L		10-MAY-19	R4631164
Ammonia, Total (as N)	0.641	DLHC	0.020	mg/L		10-MAY-19	R4632460
Chloride (Cl)	10.2		0.50	mg/L		10-MAY-19	R4632137
Nitrate (as N)	6.58		0.020	mg/L		10-MAY-19	R4632137
Total Kjeldahl Nitrogen	1.60		0.15	mg/L	16-MAY-19	16-MAY-19	R4636713
Phosphorus, Total	0.148		0.0030	mg/L	13-MAY-19	14-MAY-19	R4634585
Sulfate (SO4)	7.97		0.30	mg/L		10-MAY-19	R4632137
Organic / Inorganic Carbon							
Dissolved Carbon Filtration Location	LAB					10-MAY-19	R4630430
Dissolved Organic Carbon	6.69		0.50	mg/L	10-MAY-19	10-MAY-19	R4632322
Bacteriological Tests							
E. Coli	12		0	CFU/100mL		10-MAY-19	R4630483
Fecal Coliforms	11		0	CFU/100mL		10-MAY-19	R4630489
	0.0001		0.0050		00 MAY 40	40 MAX 40	D 40000 45
Aluminum (Al)-Total	0.0224		0.0050	mg/L	09-MAY-19	10-MAY-19	
Antimony (Sb)-Total	0.00012		0.00010	mg/L	09-MAY-19	10-MAY-19	R4630240
Arsenic (As)-Total	0.00080		0.00010	mg/L	09-MAY-19	10-MAY-19	R4630240

L2270255-8 TRIB-5							
Sampled By: CLIENT on 08-MAY-19 @ 13:10 Matrix: WATER							
Total Metals							
Barium (Ba)-Total	0.0427		0.00010	mg/L	09-MAY-19	10-MAY-19	R4630240
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	09-MAY-19	10-MAY-19	R4630240
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	09-MAY-19	10-MAY-19	R4630240
Boron (B)-Total	0.020		0.010	mg/L	09-MAY-19	10-MAY-19	R4630240
Cadmium (Cd)-Total	0.0000122		0.0000050	mg/L	09-MAY-19	10-MAY-19	R4630240
Calcium (Ca)-Total	98.5		0.050	mg/L	09-MAY-19	10-MAY-19	R4630240
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	09-MAY-19	10-MAY-19	R4630240
Chromium (Cr)-Total	0.00058		0.00050	mg/L	09-MAY-19	10-MAY-19	R4630240
Cobalt (Co)-Total	0.00023		0.00010	mg/L	09-MAY-19	10-MAY-19	R4630240
Copper (Cu)-Total	0.0015		0.0010	mg/L	09-MAY-19	10-MAY-19	R4630240
Iron (Fe)-Total	0.133		0.010	mg/L	09-MAY-19	10-MAY-19	R4630240
Lead (Pb)-Total	0.000054		0.000050	mg/L	09-MAY-19	10-MAY-19	R4630240
Lithium (Li)-Total	<0.0010		0.0010	mg/L	09-MAY-19	10-MAY-19	R4630240
Magnesium (Mg)-Total	7.93		0.0050	mg/L	09-MAY-19	10-MAY-19	R4630240
Manganese (Mn)-Total	0.112		0.00050	mg/L	09-MAY-19	10-MAY-19	R4630240
Molybdenum (Mo)-Total	0.000558		0.000050	mg/L	09-MAY-19	10-MAY-19	R4630240
Nickel (Ni)-Total	0.00051		0.00050	mg/L	09-MAY-19	10-MAY-19	R4630240
Phosphorus (P)-Total	0.136		0.050	mg/L	09-MAY-19	10-MAY-19	R4630240
Potassium (K)-Total	6.48		0.050	mg/L	09-MAY-19	10-MAY-19	R4630240
Rubidium (Rb)-Total	0.00152		0.00020	mg/L	09-MAY-19	10-MAY-19	R4630240
Selenium (Se)-Total	0.000230		0.000050	mg/L	09-MAY-19	10-MAY-19	R4630240
Silicon (Si)-Total	2.70		0.10	mg/L	09-MAY-19	10-MAY-19	R4630240
Silver (Ag)-Total	<0.000050		0.000050	mg/L	09-MAY-19	10-MAY-19	R4630240
Sodium (Na)-Total	7.10		0.050	mg/L	09-MAY-19	10-MAY-19	R4630240
Strontium (Sr)-Total	0.183		0.0010	mg/L	09-MAY-19	10-MAY-19	R4630240
Sulfur (S)-Total	2.86		0.50	mg/L	09-MAY-19	10-MAY-19	R4630240
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	09-MAY-19	10-MAY-19	R4630240
Thallium (TI)-Total	<0.000010		0.000010	mg/L	09-MAY-19	10-MAY-19	R4630240
Thorium (Th)-Total	<0.00010		0.00010	mg/L	09-MAY-19	10-MAY-19	R4630240
Tin (Sn)-Total	<0.00010		0.00010	mg/L	09-MAY-19	10-MAY-19	R4630240
Titanium (Ti)-Total	0.00093		0.00030	mg/L	09-MAY-19	10-MAY-19	R4630240
Tungsten (W)-Total	<0.00010		0.00010	mg/L	09-MAY-19	10-MAY-19	R4630240
Uranium (U)-Total	0.000737		0.000010	mg/L	09-MAY-19	10-MAY-19	R4630240
Vanadium (V)-Total	0.00121		0.00050	mg/L	09-MAY-19	10-MAY-19	R4630240
Zinc (Zn)-Total	0.0049		0.0030	mg/L	09-MAY-19	10-MAY-19	R4630240
Zirconium (Zr)-Total	<0.00030		0.00030	mg/L	09-MAY-19	10-MAY-19	R4630240
Aggregate Organics	_						
BOD	<3.0	BODL	3.0	mg/L	10-MAY-19	15-MAY-19	R4635543
L2270255-9OL-1-BOTTOMSampled By:CLIENT on 08-MAY-19 @ 12:25Matrix:WATER							
Physical Tests							

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2270255-9 OL-1-BOTTOM Sampled By: CLIENT on 08-MAY-19 @ 12:25 Matrix: WATER							
Physical Tests							
Total Suspended Solids	<2.0		2.0	mg/L	12-MAY-19	13-MAY-19	R4632319
Anions and Nutrients							
Phosphorus, Total <b>Total Metals</b>	0.0137		0.0030	mg/L	13-MAY-19	14-MAY-19	R4634585
Iron (Fe)-Total	<0.050		0.050	mg/L	10-MAY-19	10-MAY-19	R4630517
L2270255-10 OL-3 Sampled By: CLIENT on 08-MAY-19 @ 12:04 Matrix: WATER							
Bacteriological Tests							
E. Coli	1		0	CFU/100mL		10-MAY-19	R4630483
Fecal Coliforms	1		0	CFU/100mL		10-MAY-19	R4630489
L2270255-11 OL-5 Sampled By: CLIENT on 08-MAY-19 @ 11:52 Matrix: WATER							
Bacteriological Tests							
E. Coli	1		0	CFU/100mL		10-MAY-19	R4630483
Fecal Coliforms	0		0	CFU/100mL		10-MAY-19	R4630489
L2270255-12 OL-6 Sampled By: CLIENT on 08-MAY-19 @ 11:49 Matrix: WATER							
Bacteriological Tests							
E. Coli	0		0	CFU/100mL		10-MAY-19	R4630483
Fecal Coliforms	0		0	CFU/100mL		10-MAY-19	R4630489
L2270255-13         OL-8           Sampled By:         CLIENT on 08-MAY-19 @ 11:40           Matrix:         WATER							
Bacteriological Tests							
E. Coli	0		0	CFU/100mL		10-MAY-19	R4630483
Fecal Coliforms	1		0	CFU/100mL		10-MAY-19	R4630489
L2270255-14         OL-10           Sampled By:         CLIENT on 08-MAY-19 @ 11:33           Matrix:         WATER							
Bacteriological Tests							
E. Coli	0		0	CFU/100mL		10-MAY-19	R4630483
Fecal Coliforms	0		0	CFU/100mL		10-MAY-19	R4630489
L2270255-15 OL-11 Sampled By: CLIENT on 08-MAY-19 @ 11:30 Matrix: WATER							
Bacteriological Tests							
E. Coli	0		0	CFU/100mL		10-MAY-19	R4630483
Fecal Coliforms	0		0	CFU/100mL		10-MAY-19	
			-				
Pater to Pateranced Information for Qualifiers (if any) a							

## **Reference Information**

#### **QC Samples with Qualifiers & Comments:**

	iption	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike		Barium (Ba)-Total	MS-B	L2270255-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike		Calcium (Ca)-Total	MS-B	L2270255-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike		Copper (Cu)-Total	MS-B	L2270255-1, -2, -3, -4, -5, -6, -7, -8
Vatrix Spike		Iron (Fe)-Total	MS-B	L2270255-9
Matrix Spike		Magnesium (Mg)-Total	MS-B	L2270255-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike		Silicon (Si)-Total	MS-B	L2270255-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike		Sodium (Na)-Total	MS-B	L2270255-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike		Strontium (Sr)-Total	MS-B	L2270255-1, -2, -3, -4, -5, -6, -7, -8
ample Param	eter Qualifier key lis	sted:		
Qualifier	Description			
BODL	Limit of Reporting for	BOD was increased to account for the	e largest volume o	f sample tested.
DLHC	Detection Limit Raised	d: Dilution required due to high concer	ntration of test and	alyte(s).
DLM	Detection Limit Adjust	ted due to sample matrix effects (e.g.	chemical interfere	nce, colour, turbidity).
DLUI	Detection Limit Raise	d: Unknown Interference generated ar	n apparent false p	ositive test result.
нтс	Hardness was calcula	ted from Total Ca and/or Mg concentr	rations and may b	e biased high (dissolved Ca/Mg results unavailable).
MS-B	Matrix Spike recovery	could not be accurately calculated du	ie to high analyte	background in sample.
est Method R	eferences:			
ALS Test Code	Matrix	Test Description	Method Refere	ence**
ALK-WT	Water	Alkalinity, Total (as CaCO3)	EPA 310.2	
colourimetric m BOD-WT This analysis is oxygen demand	water Water s carried out using proce d (BOD) are determined	BOD edures adapted from APHA Method 5 d by diluting and incubating a sample t	APHA 5210 B 210B - "Biochemic for a specified tim	tal Alkalinity is determined using the methyl orange cal Oxygen Demand (BOD)". All forms of biochemical e period, and measuring the oxygen depletion using a
colourimetric m BOD-WT This analysis is oxygen demano dissolved oxyge	water s carried out using proce d (BOD) are determined en meter. Dissolved BC	BOD edures adapted from APHA Method 5 d by diluting and incubating a sample t	APHA 5210 B 210B - "Biochemio for a specified tim ng the sample thr	cal Oxygen Demand (BOD)". All forms of biochemical e period, and measuring the oxygen depletion using a bugh a glass fibre filter prior to dilution. Carbonaceous
colourimetric m BOD-WT This analysis is oxygen demand dissolved oxyge BOD (CBOD) is CL-IC-N-WT	Water s carried out using proce d (BOD) are determined en meter. Dissolved BC s determined by adding Water	BOD edures adapted from APHA Method 53 d by diluting and incubating a sample f DD (SOLUBLE) is determined by filterin a nitrification inhibitor to the diluted sa Chloride by IC	APHA 5210 B 210B - "Biochemic for a specified tim ng the sample thr ample prior to inco EPA 300.1 (m	cal Oxygen Demand (BOD)". All forms of biochemical e period, and measuring the oxygen depletion using a bugh a glass fibre filter prior to dilution. Carbonaceous ubation.
colourimetric m BOD-WT This analysis is oxygen demand dissolved oxyge BOD (CBOD) is CL-IC-N-WT	Water s carried out using proce d (BOD) are determined en meter. Dissolved BC s determined by adding Water	BOD edures adapted from APHA Method 5 d by diluting and incubating a sample f DD (SOLUBLE) is determined by filterin a nitrification inhibitor to the diluted s	APHA 5210 B 210B - "Biochemic for a specified tim ng the sample thr ample prior to inco EPA 300.1 (m	cal Oxygen Demand (BOD)". All forms of biochemical e period, and measuring the oxygen depletion using a bugh a glass fibre filter prior to dilution. Carbonaceous ubation.
colourimetric m BOD-WT This analysis is oxygen demand dissolved oxyge BOD (CBOD) is CL-IC-N-WT Inorganic anion	Water S carried out using proce d (BOD) are determined en meter. Dissolved BC s determined by adding Water ns are analyzed by Ion C ucted in accordance with	BOD edures adapted from APHA Method 52 d by diluting and incubating a sample f DD (SOLUBLE) is determined by filterin a nitrification inhibitor to the diluted sa Chloride by IC Chromatography with conductivity and	APHA 5210 B 210B - "Biochemic for a specified tim ng the sample thr ample prior to inco EPA 300.1 (m /or UV detection.	cal Oxygen Demand (BOD)". All forms of biochemical e period, and measuring the oxygen depletion using a bugh a glass fibre filter prior to dilution. Carbonaceous ubation.
colourimetric m BOD-WT This analysis is oxygen demand dissolved oxyge BOD (CBOD) is CL-IC-N-WT Inorganic anion Analysis condu Protection Act (	Water S carried out using proce d (BOD) are determined en meter. Dissolved BC s determined by adding Water ns are analyzed by Ion C ucted in accordance with	BOD edures adapted from APHA Method 52 d by diluting and incubating a sample f DD (SOLUBLE) is determined by filterin a nitrification inhibitor to the diluted sa Chloride by IC Chromatography with conductivity and	APHA 5210 B 210B - "Biochemic for a specified tim ng the sample thr ample prior to inco EPA 300.1 (m /or UV detection.	cal Oxygen Demand (BOD)". All forms of biochemical e period, and measuring the oxygen depletion using a bugh a glass fibre filter prior to dilution. Carbonaceous ubation.
colourimetric m BOD-WT This analysis is oxygen demand dissolved oxyge BOD (CBOD) is CL-IC-N-WT Inorganic anion Analysis condu Protection Act ( DOC-WT Sample is filter	water s carried out using proce d (BOD) are determined en meter. Dissolved BC s determined by adding Water ns are analyzed by Ion ( icted in accordance with (July 1, 2011). Water red through a 0.45um fill the organic carbon is ow	BOD edures adapted from APHA Method 52 d by diluting and incubating a sample of DD (SOLUBLE) is determined by filterin a nitrification inhibitor to the diluted sa Chloride by IC Chromatography with conductivity and the Protocol for Analytical Methods I Dissolved Organic Carbon ter, then injected into a heated reaction	APHA 5210 B 210B - "Biochemic for a specified tim ng the sample thr ample prior to incu EPA 300.1 (m /or UV detection. Jsed in the Asses APHA 5310B on chamber which	cal Oxygen Demand (BOD)". All forms of biochemical e period, and measuring the oxygen depletion using a bugh a glass fibre filter prior to dilution. Carbonaceous ubation. od) sment of Properties under Part XV.1 of the Environmen is packed with an oxidative catalyst. The water is
colourimetric m BOD-WT This analysis is oxygen demand dissolved oxyge BOD (CBOD) is CL-IC-N-WT Inorganic anion Analysis condu Protection Act ( DOC-WT Sample is filter vaporized and t infrared detecto EC-MF-WT	water s carried out using proce d (BOD) are determined en meter. Dissolved BC s determined by adding Water as are analyzed by Ion C ucted in accordance with (July 1, 2011). Water ed through a 0.45um fill the organic carbon is ov or. Water me of sample is filtered	BOD edures adapted from APHA Method 53 d by diluting and incubating a sample of DD (SOLUBLE) is determined by filterin a nitrification inhibitor to the diluted sa Chloride by IC Chromatography with conductivity and in the Protocol for Analytical Methods IC Dissolved Organic Carbon ter, then injected into a heated reaction idized to carbon dioxide. The carbon E. coli	APHA 5210 B 210B - "Biochemic for a specified tim ng the sample thr ample prior to incu EPA 300.1 (m /or UV detection. Jsed in the Asses APHA 5310B on chamber which dioxide is transpo	cal Oxygen Demand (BOD)". All forms of biochemical e period, and measuring the oxygen depletion using a bugh a glass fibre filter prior to dilution. Carbonaceous ubation. od) sment of Properties under Part XV.1 of the Environmen is packed with an oxidative catalyst. The water is rted in a carrier gas and is measured by a non-dispersiv
colourimetric m BOD-WT This analysis is oxygen demand dissolved oxyge BOD (CBOD) is CL-IC-N-WT Inorganic anion Analysis condu Protection Act ( DOC-WT Sample is filter vaporized and t infrared detecto EC-MF-WT A 100 mL volur Method ID: WT FC-MF-WT	water s carried out using proce d (BOD) are determined en meter. Dissolved BC s determined by adding Water ns are analyzed by lon C acted in accordance with (July 1, 2011). Water red through a 0.45um fill the organic carbon is ov or. Water me of sample is filtered '-TM-1200 Water	BOD edures adapted from APHA Method 53 d by diluting and incubating a sample i DD (SOLUBLE) is determined by filteri a nitrification inhibitor to the diluted sa Chloride by IC Chromatography with conductivity and in the Protocol for Analytical Methods IC Dissolved Organic Carbon ter, then injected into a heated reaction idized to carbon dioxide. The carbon E. coli through a membrane, the membrane Fecal Coliforms	APHA 5210 B 210B - "Biochemic for a specified tim ng the sample thm ample prior to inco EPA 300.1 (m /or UV detection. Jsed in the Asses APHA 5310B on chamber which dioxide is transpo SM 9222D is placed on mFC SM 9222D	cal Oxygen Demand (BOD)". All forms of biochemical e period, and measuring the oxygen depletion using a bugh a glass fibre filter prior to dilution. Carbonaceous ubation. od) sment of Properties under Part XV.1 of the Environmen is packed with an oxidative catalyst. The water is rted in a carrier gas and is measured by a non-dispersiv c-BCIG agar and incubated at 44.5 –0 .2 °C for 24 – 2 h
colourimetric m BOD-WT This analysis is oxygen demand dissolved oxyge BOD (CBOD) is CL-IC-N-WT Inorganic anion Analysis condu Protection Act ( DOC-WT Sample is filter vaporized and t infrared detecto EC-MF-WT A 100 mL volur Method ID: WT FC-MF-WT A 100mL volur WT-TM-1200 HARDNESS-CAI Hardness (also	water s carried out using proce d (BOD) are determined en meter. Dissolved BC s determined by adding Water ns are analyzed by Ion C ucted in accordance with (July 1, 2011). Water ed through a 0.45um filt the organic carbon is ov or. Water me of sample is filtered '-TM-1200 Water ne of sample is filtered to LC-WT Water	BOD edures adapted from APHA Method 53 d by diluting and incubating a sample of DD (SOLUBLE) is determined by filterin a nitrification inhibitor to the diluted sa Chloride by IC Chromatography with conductivity and in the Protocol for Analytical Methods IC Dissolved Organic Carbon ter, then injected into a heated reaction idized to carbon dioxide. The carbon E. coli through a membrane, the membrane Fecal Coliforms through a membrane, the membrane in Hardness	APHA 5210 B 210B - "Biochemic for a specified tim ng the sample thr ample prior to incu EPA 300.1 (m /or UV detection. Jsed in the Asses APHA 5310B on chamber which dioxide is transpo SM 9222D is placed on mFC SM 9222D is placed on mFC APHA 2340 B cium and Magnes	cal Oxygen Demand (BOD)". All forms of biochemical e period, and measuring the oxygen depletion using a bugh a glass fibre filter prior to dilution. Carbonaceous ubation. od) sment of Properties under Part XV.1 of the Environmen is packed with an oxidative catalyst. The water is rted in a carrier gas and is measured by a non-dispersiv E-BCIG agar and incubated at 44.5 –0 .2 °C for 24 – 2 h agar and incubated at 24–2h@44.5–0.2°C. Method ID: ium concentrations, expressed in CaCO3 equivalents.
colourimetric m BOD-WT This analysis is oxygen demand dissolved oxyge BOD (CBOD) is CL-IC-N-WT Inorganic anion Analysis condu Protection Act ( DOC-WT Sample is filter vaporized and t infrared detecto EC-MF-WT A 100 mL volur Method ID: WT FC-MF-WT A 100mL volur WT-TM-1200 HARDNESS-CAI Hardness (also	water s carried out using proce d (BOD) are determined en meter. Dissolved BC s determined by adding Water ns are analyzed by Ion C acted in accordance with (July 1, 2011). Water water the organic carbon is ov or. Water me of sample is filtered T-TM-1200 Water ne of sample is filtered t LC-WT Water o known as Total Hardne ium and Magnesium co	BOD edures adapted from APHA Method 53 d by diluting and incubating a sample of DD (SOLUBLE) is determined by filterin a nitrification inhibitor to the diluted sa Chloride by IC Chromatography with conductivity and in the Protocol for Analytical Methods IC Dissolved Organic Carbon ter, then injected into a heated reaction idized to carbon dioxide. The carbon E. coli through a membrane, the membrane Fecal Coliforms through a membrane, the membrane in Hardness ess) is calculated from the sum of Cal	APHA 5210 B 210B - "Biochemic for a specified tim ng the sample thr ample prior to incu EPA 300.1 (m /or UV detection. Jsed in the Asses APHA 5310B on chamber which dioxide is transpo SM 9222D is placed on mFC SM 9222D is placed on mFC APHA 2340 B cium and Magnes	cal Oxygen Demand (BOD)". All forms of biochemical e period, and measuring the oxygen depletion using a bugh a glass fibre filter prior to dilution. Carbonaceous ubation. od) sment of Properties under Part XV.1 of the Environmen is packed with an oxidative catalyst. The water is rted in a carrier gas and is measured by a non-dispersiv E-BCIG agar and incubated at 44.5 –0 .2 °C for 24 – 2 h. agar and incubated at 24–2h@44.5–0.2°C. Method ID: ium concentrations, expressed in CaCO3 equivalents. Iculation.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

NH3-F-WT Water Ammonia in Water by Fluorescence J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

Nitrate in Water by IC

EPA 300.1 (mod)

## **Reference Information**

NO3-IC-WT	Water		
Inorganic anions are and	alyzed by Ion (	Chromatography with conductivity and/	or UV detection.
P-T-COL-WT	Water	Total P in Water by Colour	APHA 4500-P PHOSPHORUS
This analysis is carried o after persulphate digesti			500-P "Phosphorus". Total Phosphorus is deteremined colourimetrically
PH-WT Water samples are anal	Water yzed directly b	pH by a calibrated pH meter.	APHA 4500 H-Electrode
5		h the Protocol for Analytical Methods L e for samples under this regulation is 2	lsed in the Assessment of Properties under Part XV.1 of the Environmental 8 days
SO4-IC-N-WT	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are and	alyzed by Ion (	Chromatography with conductivity and/	or UV detection.
SOLIDS-TSS-WT	Water	Suspended solids	APHA 2540 D-Gravimetric
A well-mixed sample is f four hours or until a const			and the residue retained is dried in an oven at 104–1°C for a minimum of
TKN-WT	Water	Total Kjeldahl Nitrogen	APHA 4500-Norg D
		, 0	500-Norg "Nitrogen (Organic)". Total Kjeldahl Nitrogen is determined by
* ALS test methods may ir	ncorporate mo	difications from specified reference me	ethods to improve performance.
The last two letters of the	above test co	de(s) indicate the laboratory that perfo	rmed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

#### **Chain of Custody Numbers:**

LON-190503

#### **GLOSSARY OF REPORT TERMS**

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid weight of sample

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory. UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION. Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



		Workorder: I	_2270255	Rep	oort Date: 17-MA	Y-19	F	Page 1 of 11
Client:	HUTCHINSON ENVIRONM 501 Krug St. Suite 202 Kitchener ON N2B 1L3	IENTAL SCIENC	ES LTD					
Contact:	Brent Parsons							
Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALK-WT	Water							
WG3046162-1	R4631164 2 DUP al (as CaCO3)	<b>WG3046162-11</b> 679	679		mg/L	0.0	20	10-MAY-19
WG3046162-8 Alkalinity, Tota	B DUP al (as CaCO3)	<b>WG3046162-7</b> 91	91		mg/L	0.2	20	10-MAY-19
-	al (as CaCO3)		101.2		%		85-115	10-MAY-19
WG3046162-6 Alkalinity, Tota WG3046162-5	al (as CaCO3)		102.2		%		85-115	10-MAY-19
Alkalinity, Tota	al (as CaCO3)		<10		mg/L		10	10-MAY-19
WG3046162-9 Alkalinity, Tota	al (as CaCO3)		<10		mg/L		10	10-MAY-19
BOD-WT	Water							
Batch F WG3046396-1	R4635543	L2270255-5						
BOD		<2.0	<2.0	RPD-NA	mg/L	N/A	20	15-MAY-19
WG3046396-2 BOD	2 DUP	<b>L2270255-1</b> <2.0	<2.0	RPD-NA	mg/L	N/A	20	15-MAY-19
WG3046396-6 BOD	5 DUP	<b>L2270255-4</b> <2.0	<2.0	RPD-NA	mg/L	N/A	20	15-MAY-19
WG3046396-1 BOD	1 LCS		92.4		%		85-115	15-MAY-19
WG3046396-3 BOD	LCS		89.9		%		85-115	15-MAY-19
WG3046396-7 BOD	LCS		94.9		%		85-115	15-MAY-19
WG3046396-1 BOD	МВ		<2.0		mg/L		2	15-MAY-19
WG3046396-5 BOD	5 MB		<2.0		mg/L		2	15-MAY-19
WG3046396-9 BOD	MB		<2.0		mg/L		2	15-MAY-19
CL-IC-N-WT	Water							
	R4632137							
WG3046374-1 Chloride (Cl)		<b>WG3046374-13</b> 10.6	10.6		mg/L	0.3	20	10-MAY-19
WG3046374-1 Chloride (Cl)	2 LCS		101.9		%		90-110	10-MAY-19



				Quality	Control	Report			
			Workorder: I	_2270255	Re	eport Date: 17	7-MAY-19		Page 2 of 11
Client:	501 Krug S		IENTAL SCIENC	ES LTD					
Contact:	Brent Parso	ons							
Test		Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CL-IC-N-WT		Water							
Batch WG3046374- Chloride (Cl)				<0.50		mg/L		0.5	10-MAY-19
WG3046374- Chloride (Cl)	-		WG3046374-13	102.9		%		75-125	10-MAY-19
DOC-WT		Water							
Batch	R4632322								
	rganic Carbor	ı	<b>L2269835-9</b> 1.02	1.00		mg/L	1.3	25	10-MAY-19
WG3046454- Dissolved Or	2 LCS rganic Carbor	ı		97.3		%		70-130	10-MAY-19
WG3046454- Dissolved Or	1 MB rganic Carbor	ı		<0.50		mg/L		0.5	10-MAY-19
WG3046454- Dissolved Or	4 MS rganic Carbor	ı	L2269835-9	99.6		%		70-130	10-MAY-19
EC-MF-WT		Water							
Batch WG3045577- E. Coli	R4630483 3 DUP		<b>L2270255-10</b> 1	<10		CFU/100mL	N1/A	<b>6</b> 5	
E. Coli WG3045577- E. Coli	1 MB		I	0	RPD-NA	CFU/100mL	N/A	65 1	10-MAY-19 10-MAY-19
		Water		0				I	10-MAT-19
FC-MF-WT Batch	R4630489	Waler							
WG3045578- Fecal Colifor	3 DUP		<b>L2270255-6</b> 50	31		CFU/100mL	47	65	10-MAY-19
WG3045578- Fecal Colifor				0		CFU/100mL		1	10-MAY-19
MET-T-CCMS-W	л	Water							
	R4630240								
WG3045634- Aluminum (A			WG3045634-3 0.0226	0.0222		mg/L	1.6	20	00 MAY 10
Antimony (Sl			<0.0220	<0.00010	RPD-NA	mg/L	1.6 N/A	20	09-MAY-19 09-MAY-19
Arsenic (As)			0.00025	0.00024		mg/L	2.6	20	09-MAY-19
Barium (Ba)-			0.0287	0.0294		mg/L	2.7	20	09-MAY-19
Beryllium (Be			<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	09-MAY-19
Bismuth (Bi)	-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	09-MAY-19
Boron (B)-To	otal		<0.010	<0.010	RPD-NA	mg/L	N/A	20	09-MAY-19



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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD 501 Krug St. Suite 202

Workorder: L2270255

Kitchener ON N2B 1L3

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT	Water							
Batch R4630240								
WG3045634-4 DUP Cadmium (Cd)-Total		WG3045634-3 <0.0000050	<0.000005	C RPD-NA	mg/L	N/A	20	09-MAY-19
Calcium (Ca)-Total		35.6	37.9		mg/L	6.4	20 20	09-MAY-19
Chromium (Cr)-Total		<0.00050	<0.00050	RPD-NA	mg/L	0.4 N/A	20	09-MAY-19
Cesium (Cs)-Total		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	09-MAY-19
Cobalt (Co)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	09-MAY-19
Copper (Cu)-Total		0.0429	0.0434		mg/L	1.1	20	09-MAY-19
Iron (Fe)-Total		0.022	0.023		mg/L	3.1	20	09-MAY-19
Lead (Pb)-Total		0.000406	0.000435		mg/L	6.8	20	09-MAY-19
Lithium (Li)-Total		<0.0010	<0.0010	RPD-NA	mg/L	0.0 N/A	20	09-MAY-19
Magnesium (Mg)-Total		3.25	3.32	NI DINA	mg/L	2.1	20	09-MAY-19
Manganese (Mn)-Total		0.00077	0.00081		mg/L	6.0	20	09-MAY-19
Molybdenum (Mo)-Total		0.000169	0.000185		mg/L	9.6	20	09-MAY-19
Nickel (Ni)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	09-MAY-19
Phosphorus (P)-Total		<0.050	<0.050	RPD-NA	mg/L	N/A	20	09-MAY-19
Potassium (K)-Total		1.21	1.24		mg/L	1.8	20	09-MAY-19
Rubidium (Rb)-Total		0.00129	0.00132		mg/L	2.2	20	09-MAY-19
Selenium (Se)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	09-MAY-19
Silicon (Si)-Total		1.52	1.56		mg/L	2.7	20	09-MAY-19
Silver (Ag)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	09-MAY-19
Sodium (Na)-Total		10.3	10.5		mg/L	2.2	20	09-MAY-19
Strontium (Sr)-Total		0.109	0.116		mg/L	6.5	20	09-MAY-19
Sulfur (S)-Total		2.41	2.41		mg/L	0.1	25	09-MAY-19
Thallium (TI)-Total		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	09-MAY-19
Tellurium (Te)-Total		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	09-MAY-19
Thorium (Th)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	25	09-MAY-19
Tin (Sn)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	09-MAY-19
Titanium (Ti)-Total		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	09-MAY-19
Tungsten (W)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	09-MAY-19
Uranium (U)-Total		0.000045	0.000047		mg/L	5.5	20	09-MAY-19
Vanadium (V)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	09-MAY-19
Zinc (Zn)-Total		0.0181	0.0166		mg/L	8.3	20	09-MAY-19
Zirconium (Zr)-Total		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	09-MAY-19
WG3045634-2 LCS								



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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD 501 Krug St. Suite 202

Workorder: L2270255

Kitchener ON N2B 1L3

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT	Water							
Batch R4630240								
WG3045634-2 LCS Aluminum (Al)-Total			104.2		%		90 400	40 MAX 40
Antimony (Sb)-Total			104.2		%		80-120 80-120	10-MAY-19 10-MAY-19
Arsenic (As)-Total			104.0		%		80-120 80-120	
Barium (Ba)-Total			99.6		%		80-120 80-120	10-MAY-19 10-MAY-19
Beryllium (Be)-Total			104.4		%		80-120 80-120	
Bismuth (Bi)-Total			104.4		%		80-120 80-120	10-MAY-19 10-MAY-19
Boron (B)-Total			102.2		%		80-120 80-120	10-MAY-19
Cadmium (Cd)-Total			102.7		%		80-120 80-120	10-MAY-19
Calcium (Ca)-Total			101.8		%		80-120 80-120	
Chromium (Cr)-Total			101.0		%		80-120 80-120	10-MAY-19 10-MAY-19
Cesium (Cs)-Total			98.3		%		80-120	10-MAY-19
Cobalt (Co)-Total			98.7		%		80-120	10-MAY-19
Copper (Cu)-Total			98.7		%		80-120	10-MAY-19
Iron (Fe)-Total			101.9		%		80-120	10-MAY-19
Lead (Pb)-Total			101.9		%		80-120	10-MAY-19
Lithium (Li)-Total			103.8		%		80-120	10-MAY-19
Magnesium (Mg)-Total			105.0		%		80-120	10-MAY-19
Manganese (Mn)-Total			102.8		%		80-120	10-MAY-19
Molybdenum (Mo)-Total			101.8		%		80-120	10-MAY-19
Nickel (Ni)-Total			100.8		%		80-120	10-MAY-19
Phosphorus (P)-Total			104.8		%		70-130	10-MAY-19
Potassium (K)-Total			102.6		%		80-120	10-MAY-19
Rubidium (Rb)-Total			103.6		%		80-120	10-MAY-19
Selenium (Se)-Total			97.2		%		80-120	10-MAY-19
Silicon (Si)-Total			105.9		%		60-140	10-MAY-19
Silver (Ag)-Total			99.8		%		80-120	10-MAY-19
Sodium (Na)-Total			101.6		%		80-120	10-MAY-19
Strontium (Sr)-Total			104.2		%		80-120	10-MAY-19
Sulfur (S)-Total			97.6		%		80-120	10-MAY-19
Thallium (TI)-Total			102.9		%		80-120	10-MAY-19
Tellurium (Te)-Total			99.3		%		80-120	10-MAY-19
Thorium (Th)-Total			99.3		%		70-130	10-MAY-19
Tin (Sn)-Total			101.0		%		80-120	10-MAY-19



Workorder: L2270255

Report Date: 17-MAY-19

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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD 501 Krug St. Suite 202

Kitchener ON N2B 1L3

MET-T-COMS-WT         Water           Batch         R4530240           WG3045634-2         LCS           Titanium (T)-Total         100.5         %         80-120         10-MAY-19           Uranstein (W)-Total         100.4         %         80-120         10-MAY-19           Vanadum (V)-Total         102.8         %         80-120         10-MAY-19           Zinc (Zn)-Total         102.6         %         80-120         10-MAY-19           Zinc (Zn)-Total         102.6         %         80-120         10-MAY-19           Zinc (Zn)-Total         99.7         %         80-120         10-MAY-19           Aluminum (A)-Total         -0.0050         mg/L         0.0001         09-MAY-19           Atminory (Sp)-Total         -0.00010         mg/L         0.0001         09-MAY-19           Assenic (As)-Total         -0.00010         mg/L         0.0001         09-MAY-19           Benjlium (Be)-Total         -0.00010         mg/L         0.0001         09-MAY-19           Beryllium (Be)-Total         -0.000050         mg/L         0.0001         09-MAY-19           Cadminum (Cd)-Total         -0.000050         mg/L         0.001         09-MAY-19           Cadmiu	Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
Batch         R430240           WG346534-2         LCS           Titanium (1)-Total         100.5         %         80-120         10-MAY-19           Ungsten (W)-Total         100.5         %         80-120         10-MAY-19           Uranulum (1)-Total         100.8         %         80-120         10-MAY-19           Zinc (2n)-Total         102.8         %         80-120         10-MAY-19           Zinc (2n)-Total         102.6         %         80-120         10-MAY-19           Zinc (2n)-Total         98.7         %         80-120         10-MAY-19           Autimum (A)-Total         -0.0050         mg/L         0.005         0-MAY-19           Autimum (A)-Total         -0.00010         mg/L         0.001         0-MAY-19           Autimum (A)-Total         -0.00010         mg/L         0.001         0-MAY-19           Barium (B)-Total         -0.00010         mg/L         0.001         0-MAY-19           Barium (B)-Total         -0.000050         mg/L         0.0005         0-MAY-19           Cadmium (Cd)-Total         -0.000050         mg/L         0.0005         0-MAY-19           Cadmium (Cd)-Total         -0.000050         mg/L         0.0001									•
Workspace         Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second Second S									
Tungsten (W)-Total         100.5         %         80-12.0         TOMAX-19           Urandium (U)-Total         100.8         %         80-12.0         10-MAY-19           Vanadium (V)-Total         102.8         %         80-12.0         10-MAY-19           Zinc (2n)-Total         102.6         %         80-12.0         10-MAY-19           Zirconium (Z)-Total         99.7         %         80-12.0         10-MAY-19           Marimum (A)-Total         0.0050         mg/L         0.0050         09-MAY-19           Aluminum (A)-Total         <0.00510									
Uranium (U)-Total         100.8         %         80.120         10.MAY-19           Vanadium (V)-Total         102.8         %         80-120         10.MAY-19           Zinc (Zn)-Total         102.6         %         80-120         10.MAY-19           Zinconium (Zr)-Total         99.7         %         80-120         10.MAY-19           WG3046354-1         MB          0.0050         mg/L         0.005         0.9.MAY-19           Auminum (A)-Total          0.00010         mg/L         0.0001         0.9.MAY-19           Auminum (A)-Total          0.00010         mg/L         0.0001         0.9.MAY-19           Barium (Ba)-Total          0.00010         mg/L         0.0001         0.9.MAY-19           Barium (Ba)-Total           0.00010         mg/L         0.0001         0.9.MAY-19           Barium (Ba)-Total            0.00010         mg/L         0.0001         0.9.MAY-19           Caticium (Ca)-Total            0.00050         mg/L         0.0005         0.9.MAY-19           Caticium (Ca)-Total            0.00010         mg/L				100.5		%		80-120	10-MAY-19
Vanadium (V)-Total         102.8         %         80.120         10-MAY-19           Zinc (Zn)-Total         102.6         %         80.120         10-MAY-19           Zinc (Zn)-Total         97         %         80.120         10-MAY-19           Aurninum (Al)-Total         -0.0050         mg/L         0.0051         09-MAY-19           Aurninum (Al)-Total         -0.00010         mg/L         0.0001         09-MAY-19           Barium (Ba)-Total         -0.00050         mg/L         0.00005         09-MAY-19           Boron (B)-Total         -0.00050         mg/L         0.00005         09-MAY-19           Caldium (Ca)-Total         -0.00050         mg/L         0.0001         09-MAY-19           Cabat (Ca)-Total         -0.00050         mg/L         0.001         09-MAY-19           Cabat (Ca)-Total         -0.00050         mg/L         0.001         09-MAY-19           Cabat (Ca)-Total         -0.00050 <t< td=""><td>Tungsten (W)-Total</td><td></td><td></td><td>100.5</td><td></td><td>%</td><td></td><td>80-120</td><td>10-MAY-19</td></t<>	Tungsten (W)-Total			100.5		%		80-120	10-MAY-19
Zinc (Zh)-Total         102.6         %         80-120         10-MAY-19           Zinconium (Zh)-Total         99.7         %         80-120         10-MAY-19           WG304563-4         MB	Uranium (U)-Total			100.8		%		80-120	10-MAY-19
Zirconium (Zr)-Total         99.7         %         80-120         10-MAY-19           WG304563-1         MB           Aluminum (A)-Total         <0.0050	Vanadium (V)-Total			102.8		%		80-120	10-MAY-19
WG304563-1         MB           Aluminum (A)-Total         <0.0050	Zinc (Zn)-Total			102.6		%		80-120	10-MAY-19
Aluminum (Al)-Total         <0.0050         mg/L         0.005         0.9-MAY-19           Antimony (Sb)-Total         <0.00010	Zirconium (Zr)-Total			99.7		%		80-120	10-MAY-19
Antimory (Sb)-Total         c0.00010         mg/L         0.0001         09-MAY-19           Arsenic (As)-Total         <0.00010	WG3045634-1 MB								
Arsenic (As)-Total          0.00010         mg/L         0.0001         09-MAY-19           Barium (Ba)-Total         <0.00010	Aluminum (Al)-Total			<0.0050		mg/L		0.005	09-MAY-19
Barium (Ba)-Total           0.0001         0.9-MAY-19           Beryllium (Be)-Total         <0.00010	Antimony (Sb)-Total			<0.00010	)	mg/L		0.0001	09-MAY-19
Beryllium (Be)-Total         <         0.00010         mg/L         0.0001         0.9-MAY-19           Bismuth (Bi)-Total         <	Arsenic (As)-Total			<0.00010	)	mg/L		0.0001	09-MAY-19
Bismuth (B)-Total         c.000050         mg/L         0.00005         09-MAY-19           Boron (B)-Total         c.0010         mg/L         0.01         09-MAY-19           Cadmium (Cd)-Total         c.000005C         mg/L         0.00005         09-MAY-19           Calcium (Ca)-Total         c.00005C         mg/L         0.05         09-MAY-19           Calcium (Ca)-Total         c.00050         mg/L         0.0005         09-MAY-19           Chromium (Cr)-Total         c.000010         mg/L         0.0001         09-MAY-19           Cobalt (Co)-Total         c.00010         mg/L         0.001         09-MAY-19           Cobalt (Co)-Total         c.00010         mg/L         0.001         09-MAY-19           Copper (Cu)-Total         c.00010         mg/L         0.001         09-MAY-19           Iron (Fe)-Total         c.0010         mg/L         0.001         09-MAY-19           Lead (Pb)-Total         c.00050         mg/L         0.001         09-MAY-19           Lead (Pb)-Total         c.00050         mg/L         0.001         09-MAY-19           Magnesium (Mg)-Total         c.00050         mg/L         0.005         09-MAY-19           Magnesium (Mo)-Total         c.00050	Barium (Ba)-Total			<0.00010	)	mg/L		0.0001	09-MAY-19
Boron (B)-Total         0.010         mg/L         0.01         0.9-MAY-19           Cadmium (Cd)-Total         <0.00005C	Beryllium (Be)-Total			<0.00010	)	mg/L		0.0001	09-MAY-19
Cadmium (Cd)-Total         <0.000005C         mg/L         0.000005         09-MAY-19           Calcium (Ca)-Total         <0.050	Bismuth (Bi)-Total			<0.00005	50	mg/L		0.00005	09-MAY-19
Calcium (Ca)-Total         <0.050         mg/L         0.05         09-MAY-19           Chromium (Cr)-Total         <0.00050	Boron (B)-Total			<0.010		mg/L		0.01	09-MAY-19
Chromium (Cr)-Total         <0.00050         mg/L         0.00050         09-MAY-19           Cesium (Cs)-Total         <0.00010	Cadmium (Cd)-Total			<0.00000	)5C	mg/L		0.000005	09-MAY-19
Cesium (Cs)-Total               Cobalt (Co)-Total         <0.00010	Calcium (Ca)-Total			<0.050		mg/L		0.05	09-MAY-19
Cobalt (Co)-Total         c0.00010         mg/L         0.0001         09-MAY-19           Copper (Cu)-Total         <0.0010	Chromium (Cr)-Total			<0.00050	)	mg/L		0.0005	09-MAY-19
Copper (Cu)-Total         <0.0010         mg/L         0.001         09-MAY-19           Iron (Fe)-Total         <0.010	Cesium (Cs)-Total			<0.00001	0	mg/L		0.00001	09-MAY-19
Iron (Fe)-Total         <0.010         mg/L         0.01         09-MAY-19           Lead (Pb)-Total         <0.00050	Cobalt (Co)-Total			<0.00010	)	mg/L		0.0001	09-MAY-19
Lead (Pb)-Total<0.000050mg/L0.00005009-MAY-19Lithium (Li)-Total<0.0010	Copper (Cu)-Total			<0.0010		mg/L		0.001	09-MAY-19
Lithium (Li)-Total<0.0010mg/L0.00109-MAY-19Magnesium (Mg)-Total<0.0050	Iron (Fe)-Total			<0.010		mg/L		0.01	09-MAY-19
Magnesium (Mg)-Total<0.0050mg/L0.00509-MAY-19Manganese (Mn)-Total<0.00050	Lead (Pb)-Total			<0.00005	50	mg/L		0.00005	09-MAY-19
Manganese (Mn)-Total<0.00050mg/L0.000509-MAY-19Molybdenum (Mo)-Total<0.00050	Lithium (Li)-Total			<0.0010		mg/L		0.001	09-MAY-19
Molybdenum (Mo)-Total         <0.000050         mg/L         0.000050         09-MAY-19           Nickel (Ni)-Total         <0.00050	Magnesium (Mg)-Tota	al		<0.0050		mg/L		0.005	09-MAY-19
Nickel (Ni)-Total<0.00050mg/L0.000509-MAY-19Phosphorus (P)-Total<0.050	Manganese (Mn)-Tota	al		<0.00050	)	mg/L		0.0005	09-MAY-19
Phosphorus (P)-Total         <0.050         mg/L         0.05         09-MAY-19           Potassium (K)-Total         <0.050	Molybdenum (Mo)-To	tal		<0.00005	50	mg/L		0.00005	09-MAY-19
Potassium (K)-Total         <0.050         mg/L         0.05         09-MAY-19           Rubidium (Rb)-Total         <0.00020	Nickel (Ni)-Total			<0.00050	)	mg/L		0.0005	09-MAY-19
Rubidium (Rb)-Total<0.00020mg/L0.000209-MAY-19Selenium (Se)-Total<0.000050	Phosphorus (P)-Total			<0.050		mg/L		0.05	09-MAY-19
Selenium (Se)-Total         <0.000050         mg/L         0.00005         09-MAY-19           Silicon (Si)-Total         <0.10	Potassium (K)-Total			<0.050		mg/L		0.05	09-MAY-19
Silicon (Si)-Total         <0.10         mg/L         0.1         09-MAY-19           Silver (Ag)-Total         <0.000050	Rubidium (Rb)-Total			<0.00020	)	mg/L		0.0002	09-MAY-19
Silicon (Si)-Total         <0.10         mg/L         0.1         09-MAY-19           Silver (Ag)-Total         <0.000050	Selenium (Se)-Total			<0.00005	50	mg/L		0.00005	09-MAY-19
Silver (Ag)-Total <0.000050 mg/L 0.00005 09-MAY-19	Silicon (Si)-Total			<0.10		mg/L		0.1	
	Silver (Ag)-Total			<0.00005	50	mg/L		0.00005	09-MAY-19
	Sodium (Na)-Total			<0.050				0.05	09-MAY-19



 Workorder:
 L2270255
 Report Date:
 17-MAY-19
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 HUTCHINSON ENVIRONMENTAL SCIENCES LTD
 Fold Viron 2010
 Fold Viron 2010
 Fold Viron 2010
 Fold Viron 2010

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD 501 Krug St. Suite 202 Kitchener ON N2B 1L3

Brent Parsons

Contact:

Test	Μ	latrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT	v	Vater							
Batch R	4630240								
WG3045634-1	MB			0.0040				0.004	
Strontium (Sr)-				<0.0010		mg/L		0.001	09-MAY-19
Sulfur (S)-Tota				<0.50		mg/L		0.5	09-MAY-19
Thallium (TI)-T				<0.000010		mg/L		0.00001	09-MAY-19
Tellurium (Te)-				<0.00020		mg/L		0.0002	09-MAY-19
Thorium (Th)-1	otal			<0.00010		mg/L		0.0001	09-MAY-19
Tin (Sn)-Total				<0.00010		mg/L		0.0001	09-MAY-19
Titanium (Ti)-T				<0.00030		mg/L		0.0003	09-MAY-19
Tungsten (W)-				<0.00010		mg/L		0.0001	09-MAY-19
Uranium (U)-T				<0.000010		mg/L		0.00001	09-MAY-19
Vanadium (V)-				<0.00050		mg/L		0.0005	09-MAY-19
Zinc (Zn)-Total				<0.0030		mg/L		0.003	09-MAY-19
Zirconium (Zr)-	Total			<0.00030		mg/L		0.0003	09-MAY-19
WG3045634-5 Aluminum (Al)-	<b>MS</b> Total		WG3045634-3	96.6		%		70-130	09-MAY-19
Antimony (Sb)-				107.2		%		70-130	09-MAY-19
Arsenic (As)-T				102.2		%		70-130	09-MAY-19
Barium (Ba)-To				N/A	MS-B	%		-	09-MAY-19
Beryllium (Be)-				99.4		%		70-130	09-MAY-19
Bismuth (Bi)-T				98.7		%		70-130	09-MAY-19
Boron (B)-Tota	ıl			98.0		%		70-130	09-MAY-19
Cadmium (Cd)				99.2		%		70-130	09-MAY-19
Calcium (Ca)-1				N/A	MS-B	%		-	09-MAY-19
Chromium (Cr)				100.1		%		70-130	09-MAY-19
Cesium (Cs)-T	otal			101.1		%		70-130	09-MAY-19
Cobalt (Co)-To	otal			100.3		%		70-130	09-MAY-19
Copper (Cu)-T	otal			N/A	MS-B	%		-	09-MAY-19
Iron (Fe)-Total				95.8		%		70-130	09-MAY-19
Lead (Pb)-Tota				99.0		%		70-130	09-MAY-19
Lithium (Li)-To				94.9		%		70-130	09-MAY-19
Magnesium (M				N/A	MS-B	%		-	09-MAY-19
Manganese (M				98.6		%		70-130	09-MAY-19
Molybdenum (I				106.0		%		70-130	09-MAY-19
Nickel (Ni)-Tot				98.6		%		70-130	09-MAY-19
Phosphorus (P				105.8		%		70-130	09-MAY-19
-r (-									



Workorder: L2270255

Report Date: 17-MAY-19

Page 7 of 11

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD 501 Krug St. Suite 202 Kitchener ON N2B 1L3

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT	Water							
Batch R4630240								
WG3045634-5 MS		WG3045634-3			0/			
Potassium (K)-Total			98.8		%		70-130	09-MAY-19
Rubidium (Rb)-Total			103.7		%		70-130	09-MAY-19
Selenium (Se)-Total			104.9		%		70-130	09-MAY-19
Silicon (Si)-Total			N/A	MS-B	%		-	09-MAY-19
Silver (Ag)-Total			98.2		%		70-130	09-MAY-19
Sodium (Na)-Total			N/A	MS-B	%		-	09-MAY-19
Strontium (Sr)-Total			N/A	MS-B	%		-	09-MAY-19
Sulfur (S)-Total			105.3		%		70-130	09-MAY-19
Thallium (TI)-Total			99.1		%		70-130	09-MAY-19
Tellurium (Te)-Total			99.5		%		70-130	09-MAY-19
Thorium (Th)-Total			98.6		%		70-130	09-MAY-19
Tin (Sn)-Total			101.8		%		70-130	09-MAY-19
Titanium (Ti)-Total			98.5		%		70-130	09-MAY-19
Tungsten (W)-Total			99.3		%		70-130	09-MAY-19
Uranium (U)-Total			99.0		%		70-130	09-MAY-19
Vanadium (V)-Total			101.8		%		70-130	09-MAY-19
Zinc (Zn)-Total			86.5		%		70-130	09-MAY-19
Zirconium (Zr)-Total			100.2		%		70-130	09-MAY-19
Batch R4630517								
WG3046043-4 DUP		WG3046043-3						
Iron (Fe)-Total		0.195	0.193		mg/L	0.7	20	10-MAY-19
WG3046043-2 LCS Iron (Fe)-Total			93.9		%		80-120	10-MAY-19
WG3046043-1 MB Iron (Fe)-Total			<0.010		mg/L		0.01	10-MAY-19
WG3046043-5 MS Iron (Fe)-Total		WG3046043-6	N/A	MS-B	%		_	10-MAY-19
NH3-F-WT	Water							
Batch R4632460								
WG3046447-7 DUP		L2270255-2						
Ammonia, Total (as N)		<0.010	<0.010	RPD-NA	mg/L	N/A	20	10-MAY-19
WG3046447-6 LCS								
Ammonia, Total (as N)			96.5		%		85-115	10-MAY-19
WG3046447-5 MB Ammonia, Total (as N)			<0.010		mg/L		0.01	10-MAY-19



				Quality	Contro	ы кероп			
			Workorder: L	_2270255		Report Date: 1	I7-MAY-19		Page 8 of 11
Client:	501 Krug S	SON ENVIRONN St. Suite 202 ON N2B 1L3	IENTAL SCIENCI	ES LTD					
Contact:	Brent Pars	sons							
Test		Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NH3-F-WT		Water							
Batch F WG3046447-8 Ammonia, To	-		L2270255-2	99.2		%		75-125	10-MAY-19
NO3-IC-WT		Water							
Batch F	R4632137								
WG3046374-1 Nitrate (as N)			<b>WG3046374-13</b> 0.396	0.393		mg/L	0.7	20	10-MAY-19
WG3046374-1 Nitrate (as N)				100.7		%		90-110	10-MAY-19
WG3046374-1 Nitrate (as N)				<0.020		mg/L		0.02	10-MAY-19
WG3046374-1 Nitrate (as N)	-		WG3046374-13	101.5		%		75-125	10-MAY-19
P-T-COL-WT		Water							
Batch F WG3048538-3 Phosphorus,			<b>L2270255-5</b> 0.0215	0.0233		mg/L	8.1	20	14-MAY-19
WG3048538-2 Phosphorus,				100.7		%		80-120	14-MAY-19
WG3048538-1 Phosphorus,				<0.0030		mg/L		0.003	14-MAY-19
WG3048538-4 Phosphorus,			L2270255-5	79.2		%		70-130	14-MAY-19
PH-WT		Water							
	R4631164								
<b>WG3046162-1</b> рН	2 DUP		<b>WG3046162-11</b> 7.66	7.67	J	pH units	0.01	0.2	10-MAY-19
<b>WG3046162-8</b> рН	DUP		<b>WG3046162-7</b> 7.68	7.65	J	pH units	0.03	0.2	10-MAY-19
<b>WG3046162-1</b> рН	0 LCS			7.01		pH units		6.9-7.1	10-MAY-19
<b>WG3046162-6</b> pH	LCS			7.03		pH units		6.9-7.1	10-MAY-19
SO4-IC-N-WT		Water							



			Workorder:	L227025	5	Report Date:	17-MAY-19		Page 9 of 11
Client:	501 Krug	ISON ENVIRONI St. Suite 202 ON N2B 1L3	MENTAL SCIENC	ES LTD					
Contact:	Brent Pars	sons							
Test		Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SO4-IC-N-WT		Water							
Batch F WG3046374-1 Sulfate (SO4)			<b>WG3046374-1</b> 16.1	<b>3</b> 16.0		mg/L	0.3	20	10-MAY-19
WG3046374-1 Sulfate (SO4)				102.3		%		90-110	10-MAY-19
WG3046374-1 Sulfate (SO4)				<0.30		mg/L		0.3	10-MAY-19
WG3046374-1 Sulfate (SO4)			WG3046374-1	<b>3</b> 103.4		%		75-125	10-MAY-19
SOLIDS-TSS-WT		Water							
	84631444								
WG3047410-3 Total Suspend	ded Solids		<b>L2269721-1</b> 163	158		mg/L	2.6	20	12-MAY-19
WG3047410-2 Total Suspend				92.9		%		85-115	12-MAY-19
WG3047410-1 Total Suspend				<2.0		mg/L		2	12-MAY-19
Batch F WG3047531-3 Total Suspend	-		<b>L2271356-1</b> 219	211		mg/L	3.7	20	13-MAY-19
WG3047531-2 Total Suspend				99.4		%		85-115	13-MAY-19
WG3047531-1 Total Suspend				<2.0		mg/L		2	13-MAY-19
TKN-WT		Water							
	R4635594		1 0074000 4						
WG3049674-3 Total Kjeldahl	Nitrogen		<b>L2271029-1</b> 2.05	2.12		mg/L	3.1	20	15-MAY-19
WG3049674-2 Total Kjeldahl	Nitrogen			109.0		%		75-125	15-MAY-19
WG3049674-1 Total Kjeldahl	Nitrogen			<0.15		mg/L		0.15	15-MAY-19
WG3049674-4 Total Kjeldahl			L2271029-1	103.4		%		70-130	15-MAY-19
Batch F WG3051128-3 Total Kjeldahl WG3051128-2	Nitrogen		<b>L2273562-1</b> 3.33	3.47		mg/L	4.2	20	16-MAY-19



				-		-			
			Workorder:	L2270255	1	Report Date:	17-MAY-19		Page 10 of 11
Client:	501 Krug	ISON ENVIRON St. Suite 202 ON N2B 1L3	MENTAL SCIEN	CES LTD					
Contact:	Brent Par								
Test		Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TKN-WT		Water							
Batch WG3051128- Total Kjeldah				97.5		%		75-125	16-MAY-19
WG3051128- Total Kjeldah	1 MB			<0.15		mg/L		0.15	16-MAY-19
<b>WG3051128-</b> Total Kjeldah	-		L2273562-1	109.2		%		70-130	16-MAY-19

Workorder: L2270255

Report Date: 17-MAY-19

Client:	HUTCHINSON ENVIRONMENTAL SCIENCES LTD
	501 Krug St. Suite 202
	Kitchener ON N2B 1L3
Contact:	Brent Parsons

Contact:

#### Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

#### Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

#### Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



## Chain of Custody (COC) / Analytical

Request Form

Canada Toll Free: 1 800 668 9878



|COC Number: LON-190503

Page 1 of

2

Report To	Contact and company name below will ap	pear on the final report		Report Format	/ D	-	ſ	Selec	t Serv	ice Le	vel Be	low -	Contac	rt you	r AM to	o confi	irm all	E&P T	ATs (su	ırcharge	s may apply	iy)
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Contact:	BRENT PARSONS		Quality Control (	QC) Report with R	eport 🖸 YES	DNO 🖸	2		ıy (P4				ENCY	1 Bu	sines	s day	(E - 1	00%]				
Phone:	519-576-1711		Compare Results	s to Criteria on Report -	provide details below	r if box checked	TORN 1	3 da	iy [P3-	·25%]			NERG.	Same	ə Day,	Weel	kend (	or Stat	tutory l	holiday	[E2 -200%	" п
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Street:	501 KRUG ST ST 202		Email 1 or Fax	deborah.sinclair@	environmentalsc	iences.ca		Date a	nd Tiaw	Requi	red for	all E&	P TATe	<b>د</b> شيخ				dd-mi	mm-yy	hh:mm		
City/Province:	KTICHENER, ON		Email 2	brent.parsons@en	vironmentalscie	nces.ca	For tes	sts that	can not	be perfe	a bernic	ccordin	g to the	service	i level se	lected,	you will	be cont	ected.			
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ALS Sample #		n and/or Coordinates		Date	Time		ΙĘ	E.COLUFE	ALKALINITY			CI NO3		NH3/TKN/TP	SS		Б. Г				Ī	PEC 1
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<u> </u>	OL-7			ł,	11:45	WATER	6	R	R	R	R	R	R	R	R							_
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Are samples tak	en from a Regulated DW System?		· · · · · · · · · · · ·												ëal int			Ē		💛 💛 No	) <sup>1</sup>	
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Are samples for	human consumption/ use?							, j	NIITIAL	COOL	ER TEI	<b>IPERA</b>	TURES	•C	- 	هد رعد	F	INAL CO	DOLER T	EMPERA	TURES *C	-
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#### Chain of Custody (COC) / Analytical

Request Form

Canada Toll Free: 1 800 668 9878



COC Number: LON-190503

Page 2 of

2

Report To	Contact and company	y name below will a	opear on the final report		Report Format	/b.						onta -	ct your	AM to o	onfirm a	I E&P 7	'ATs (s	urcharge	may apply	
Company:	HUTCHINSON ENV			Select Report F	Format: 🗸 PDF [		D (DIGITAL)		Regu	ilar [R]	Standa	rd TAT if	received l	by 3 pm	business	days - no	surchar	ges apply		
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Phone:	519-576-1711			Compare Resul	ts to Criteria on Report -	provide details below	w if box checked		3 day (	P3-26%		ERO1	Same	Day, V	Veekend	or Sta	tutory	holiday	E2 -200%	
	Company address below w	ill appear on the f	inal report	Select Distribut	tion: 🗹 Email		FAX	ig he be	2 day (	P2-60%		ű	(Labo	ratory	opening	fees m	nay ap	ply)]		Ч
Street:	501 KRUG ST ST 202			Email 1 or Fax	deborah.sinclair@	environmentalsc	iences.ca	C	ate and '	fime Requ	dred for all	E&P TAT	<b>s:</b> 32	_		dd-m	mm-yy	hh:mm		
City/Province:	KTICHENER, ON			Email 2	brent_parsons@en	vironmentalscie	nces.ca	For test	ts that can	not be per	formed acco	ding to the	service I	evol solo	cted, you wi	li be cont	acted.			
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Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of this white - report copy. 1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



#### Sample Receipt Confirmation

Report Dis	stribution: Company Name:	HUTCHINSON EN	VIRONMENTAL		Invoice I Acct Name:		NSON ENVIRC	DNMENTAL
	Contact:				Contact:	ACCOU	NTS PAYABLE	
	Address:	501 Krug St., Suite	e 202				ncery Lane,	
		Kitchener, ON, N2	2B 1L3		/ 44/ 0001		dge, ON, P1L 2	)E3
		519-576-1711			Phone:		5	
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	Email:		environmentalscience		Fax:			
			nvironmentalsciences.	ca li	nvoice Email:	deborah.	.sinclair@envir	onmentalsciences.
	EDD Email:					Ca accounti	ng@environme	entalsciences.ca
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ADDRESS 1329 Niakwa Road East, Unit 12, Winnipeg, MB, Canada R2J 3T4 PHONE +1 204 255 9720 FAX +1 204 255 9721 MANITOBA TECHNOLOGY CENTRE LTD. Part of the ALS Group A Campbell Brothers Limited Company



Analysis Requested :	Chlorophyll a by fluorometry	Fecal streptococcus	Phytoplankton	Pseudomonas aeruginosa	Sample Handling and Disposal Fee
OL-1	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
OL-2	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$
OL-4	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$
OL-7	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$
OL-9	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$
TRIB-2	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$
TRIB-4	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$
TRIB-5	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$
ALGAE 1			$\checkmark$		$\checkmark$
OL-3		$\checkmark$		$\checkmark$	$\checkmark$
OL-5		$\checkmark$		$\checkmark$	$\checkmark$
OL-6		$\checkmark$		$\checkmark$	$\checkmark$
OL-8		$\checkmark$		$\checkmark$	$\checkmark$
OL-10		$\checkmark$		$\checkmark$	$\checkmark$
OL-11		$\checkmark$		$\checkmark$	$\checkmark$

Sample Integrity Observations: No observations were identified for this work order submission.

#### Sample Disposal Information:

Where possible, ALS will store samples for the following durations, measured from date of sample submission: 45 days for Soil and Water samples; 6 months for Tissue/Biota samples; 14 days for air samples collected on re-usable media; and 3 days for water samples submitted for microbiological testing. Longer storage times are available upon request.

For information about ALS accreditations and certifications please contact your Account Manager or visit our webpage at www.alsglobal.com (see Canada downloads).

ALS Group strives to deliver on-time results to our clients at all times. However, there are times when due to capacity issues or other unforeseen circumstances we are unable to meet our expected turnaround times. The information above is related to a recent workorder you have submitted to our laboratory. In the event that you have an inquiry, please refer to the Lab Work Order # when calling your Account Manager.

ALS Group appreciates your business. Thank you for the opportunity to work with you.



#### Chain of Custody (COC) / Analytical Request Form



COC Number: LON-190128/

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Canada Toll Free: 1 800 668 9878

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Report To	Contact and company nam	e below will app	sar on the final report		Report Format	701		Г <u> </u>	Selec	t Serv	ice Le	evel Be	low - Ç	ontac	t your	AM to	confir	m all E	&P TAT	's (surr	harges	may apply	r)
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Contact:	BRENT PARSONS			Quality Control	(QC) Report with Re	eport 🔽 YES	NO	7	4 da	y (P4	-20%]			λow	1 Bus	iness	day	(E - 10	0%]				
Phone:	519-576-1711			Compare Result	s to Criteria on Report -	provide details below	vif box checked	FIGHT FIGHT	3 da	y [P3	-25%]			EROE	Same	Day, N	Week	end or	Statut	ory he	oliday (i	E2 -200%	
	Company address below will ap	pear on the fin	al report	Select Distributi	ion: 🗹 Email	🗍 MAJL 🗍 F	AX	R ind	2 da	y [P2·	-50%]			S.					es may				
Street	501 KRUG ST ST 202			Email 1 or Fax	deborah.sinclair@	environmentalsc	iences.ca		Date a	nd Time	e Requ	ured for	all E&P	TATS	:			d	d-mmn	n-yy h	h:mm		
City/Province:	KTICHENER, ON			Email 2	brent.parsons@en	vironmentalscie	nces.ca	For ter	sts that	can not	be per	formed a	ccording	to the	service i	levei sek	ected, y	ou wili b	e contacta	sd.			
Postal Code:	N28 1L3	_		Email 3											Anai	lysis F	Reque	st					
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ALS Lab Wo	rk Order # (lab use only):	1 		ALS Contact:	Gayle	Sampler:			STREP	PSEUDOMONAS	CHLOROPHYLL	PHYTOPLANKTON							ĺ			AMP	SUSPECTED HAZARD (see Special Instructions)
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(lab use only)			appear on the report)		(dd-mmm-yy)	(hh:mm)	Sample Type	Ĩ	FECAL	PSE	Ī	ΗÅ										Ś	SUS
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2	OL-2				1,	11:25	WATER	2	R	R	R												
5	OL-4				- Ii	11:51	WATER	2	R	R	R												
<u> </u>	OL-7				17	11:45	WATER	2	R	R	R				[			-+		+	+		+
	OL-9				1/	1/:34	WATER	2	R	R	R	+									+		+
	T <del>RIB-1</del>						WATER	2	R	R		<u> </u>		_			+		··	+			+
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Failure to complete all portions of this form may detay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

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Report To	Contact and company name below will app	cear on the final report		Report Form								. w - C	Contac	t your	AM to	o confi	irm all	E&P 1	ATs (	urchan	jes may i	apply)	
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ALS Lab Wor	rk Order # (lab use only):		ALS Contact:	Gayle	Sampler:		NUMBER	FECAL STREP	PSEUDOMONAS	CHLOROPHYLL	PHYTOPLANKTON												SUSPECTED HAZARD (see Special Instructions)
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Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy. 1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



#### Sample Receipt Confirmation

Report Distri	bution: pany Name:		NVIRONMENTAL		Invoice D Acct Name:	HUTCHINSC	N ENVIRONMENTAL
		SCIENCES LTD				SCIENCES L	
	Contact:	Brent Parsons				ACCOUNTS	
	Address:	501 Krug St., Sui			Address:	1-5 Chancery	-
	Phone:	Kitchener, ON, N 519-576-1711	ZB 1L3			Bracebridge,	ON, P1L 2E3
	Fax:	866-205-7766			Phone:	705-645-002	1
	Email:	deborah.sinclair@	environmentalscience	es.ca	Fax:	705-457-581	1
		brent.parsons@e	environmentalsciences.	.ca	nvoice Email:	deborah.sinc	lair@environmentalsciences
	EDD Email:					са	
	Distribution:	Hard Copy: N	Email: Y Fax:	N EDD: N		accounting@	environmentalsciences.ca
					Project #:	N/A	
					Account #:	20126	
Client Inform	otion						
	Reference #:	180050			Date Sampled:	08-MAY-19	
	roject PO #:	100030			Date Received:		
	Description:	N/A			Sampled By:		
-	Quote #:	Q69690		Cha	in Of Custody:	LON-190503	3
Workorder S	Summary	•			Client Job #:	180050	
	ork Order #:			Acc	ount Manager:		
Estimated com		16-MAY-19				-	Disposal Information section
15 Samples receiv	ed at ALS in	LONDON				below.	
•		t <b>y issues</b> with you	r samples submitted. I	Please see Sample	Integrity Observa	ations below fo	or more details.
Lab (	Client		Date	Date			
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ADDRESS 309 Exeter Road, Unit #29, London, ON, Canada N6L 1C1 PHONE +1 519 652 6044 FAX +1 519 652 0671 ALS CANADA LTD. Part of the ALS Group A Campbell Brothers Limited Company

#### www.alsglobal.com



Analysis Requested :																	
	Alkalinity, Total [as CaCO3]	BOD	Chloride by IC	Dissolved Organic Carbon	E. coli	Fecal Coliforms	Hardness	One Metal in Water by ICPMS [Total]	Total Metals in Water by CRC ICPMS	Ammonia in Water by Fluorescence	Nitrate in Water by IC	Total P in Water by Colour	Hd	Sulfate in Water by IC	Suspended solids	TKN and Total Phosphorus	Sample Handling and Disposal Fee
OL-1	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	√	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	√	$\checkmark$
OL-2	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
OL-4	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
OL-7	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
OL-9	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
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**Login Comments:** Your samples were at 6.6 °C when unpacked at the laboratory.

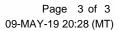
#### Sample Integrity Observations:

#### Observation

Details

Discrepancy between CofC and label

All three bottles for Fraction -09 (OL-1-BOTTOM) were packed in a bag labeled as OL-1-BOTTOM but the General Chemistry bottle within that bag was labeled OL-7. This fraction was logged in according to the label on the sealed bag (OL-1-BOTTOM).





#### Notice of Sub-contract Laboratory Service

#### Please be advised that the following tests will be subcontracted to the corresponding laboratory:

Ammonia in Water by Fluorescence subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Suspended solids subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA E. coli subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Alkalinity, Total (as CaCO3) subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Total P in Water by Colour subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA pH subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Nitrate in Water by IC subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Hardness subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Total Kjeldahl Nitrogen subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Fecal Coliforms subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Chloride by IC subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Sulfate in Water by IC subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Sulfate in Water by IC subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Soll subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Sulfate in Water by IC subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA BOD subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA Dissolved Organic Carbon subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Please contact your Account Manager immediately should you have questions or concerns regarding this arrangement. Approval of this arrangement shall be implied unless otherwise notified by you.

#### Sample Disposal Information:

Where possible, ALS will store samples for the following durations, measured from date of sample submission: 45 days for Soil and Water samples; 6 months for Tissue/Biota samples; 14 days for air samples collected on re-usable media; and 3 days for water samples submitted for microbiological testing. Longer storage times are available upon request.

For information about ALS accreditations and certifications please contact your Account Manager or visit our webpage at www.alsglobal.com (see Canada downloads).

ALS Group strives to deliver on-time results to our clients at all times. However, there are times when due to capacity issues or other unforeseen circumstances we are unable to meet our expected turnaround times. The information above is related to a recent workorder you have submitted to our laboratory. In the event that you have an inquiry, please refer to the Lab Work Order # when calling your Account Manager.

ALS Group appreciates your business. Thank you for the opportunity to work with you.



## Chain of Custody (COC) / Analytical

Request Form

Canada Toll Free: 1 800 668 9878



|COC Number: LON-190503

Page 1 of

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#### Chain of Custody (COC) / Analytical

Request Form

Canada Toll Free: 1 800 668 9878



COC Number: LON-190503

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#### Chain of Custody (COC) / Analy Request Form

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### COC Number: LON-190128/

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Report To Contact and company name below will appear on the final report Report Format / Distribution Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply) Company HUTCHINSON ENV Select Report Format: PpF From From COGTAL Regular IR1 V Standard TAT if received by 3 pm - business days - no surcharges apoly Contact: BRENT PARSONS Quality Control (QC) Report with Report 17 yes 1 NO 4 day [P4-20%] Π Business day (E - 100%) Ē Compare Results to Criteria on Report - provide details below if box checked Phone: 519-576-1711 3 day [P3-25%] Same Day, Weekend or Statutory holiday IE2 -200% FIEMAIL THAIL FIFAX Company address below will appear on the final report Select Distribution: 2 day [P2-50%] (Laboratory opening fees may apply) 1 501 KRUG ST ST 202 Date and Time Required for all E&P TATS Email 1 or Eax deborah sinclain@environmentalsciences.ca dd-mmm-vy hh:mm Street: KTICHENER ON City/Province Email 2 brent parsons@environmentalsciences.ca For tests that can not be netformed according to the service level selected, you will be contacted. Postal Code: N2B 1L3 Email 3 Analysis Request HOLD Same as Report To I/I YES INO Invoice Distribution Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below Invoice To S ECTED HAZARD (see Special Instructions) Myes INO Copy of Invoice with Report Select Invoice Distribution: 7 BMAIL MAIL G FAX ñ ш Email 1 or Fax accounting@environmentalsciences.ca Company: AIN Contact: Email 2 Project Information Z O Oil and Gas Required Fields (client use) È ALS Account # / Quote # Q69690 PO# AFF/Cost Center ខ្ល 180050 iob # Routing Code: Major/Minor Code: S Ш PO/AFE: LL\_ Requisitioner: ō AMPLI SD: Location: HYTOPLANKTON n c SEUDOMONAS CHLOROPHYLL ш STREP ALS Lab Work Order # (lab use only): ALS Contact: Gayle Sampler: Ξ NUM ECAL Sample Identification and/or Coordinates Date Time ALS Sample # Sample Type ഹ (lab use only) (This description will appear on the report) (dd-mmm-yy) (hh:mm) OL-1 11-02-19 WATER 3 R R R R ..... 01.2 WATER 2 R R R OL-4 R WATER 2 R R 01-7 2 R WATER R R OL-9 WATER 2 R R R OL-3 R WATER 1 OL-5 WATER R 1 OL-6 R WATER 1 OL-8 R WATER OL-10 WATER R 1 OI -11 R WATER SAMPLE CONDITION AS RECEIVED (lab use only) Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below Drinking Water (DW) Samples<sup>1</sup> (client use) (electronic COC only) SIF Observations Yes Frozen No . Are samples taken from a Regulated DW System? Ice Packs Ice Cubes 
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REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

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## Chain of Custody (COC) / Analytical Request Form



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Failure to complete all portions of this form may detay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

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Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy. 1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



# Chain of Custody (COC) / Analytical

Request Form

Canada Toll Free: 1 800 668 9878



|COC Number: LON-190503

Page 1 of

2

Report To	Contact and company name below will ap	pear on the final report		Report Format	/ D	-	ſ	Selec	t Serv	ice Le	vel Be	low -	Contac	rt you	r AM to	o confi	irm all	E&P T	ATs (su	ırcharge	s may apply	iy)
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## Chain of Custody (COC) / Analytical

Request Form

Canada Toll Free: 1 800 668 9878



COC Number: LON-190503

Page 2 of

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Hutchinson Environmental Sciences Ltd.

Date	Name	Question(s)	Response to Questions for HESL (where applicable)
August 2 <sup>nd</sup> , 2019	Bruce Kerr	<ol> <li>Are the 3 culverts mentioned at our discussion part of the overall scope of work being presented to council as presented?</li> <li>Assuming that QW is going to proceed, then I see an opportunity for another sales job to get people on side for a request for a septic bylaw. Would council be able to provide a mailing list for all the property owners being affected in let's say an area specific by law.</li> <li>Would you be able to produce a sheet of names of people for a canvassing campaign, asking for and against, that would be acceptable to council to pass or deny a septic bylaw specific to oak lake drainage area?</li> <li>could a by law, if available, include a period of time to complete any system changes?</li> <li>could a cost of system be added to tax bills for a time period for those requiring assistance.</li> </ol>	These questions are procedural points on how Quinte West plans to move forward with implementing the recommendations of the HESL report, specifically the potential for and implementation of a septic system bylaw. These questions cannot be addressed by HESL.
July, 11, 2019	Sandra Brett	"The survey that Hutchinson is doing w/ re: to Oak Lake, does it include testing for anitoxins which are created by the algae? If testing is being done, what sort of parameters are being set for levels that are decreed to humans and to animals? We have an excess of algae this year and some people are getting reactions in the water. I would like to know if Hutchinson is pursuing this as any part of their investigation?"	Our proposal included the possibility of testing for microcystin (an algal toxin produced by cyanobacteria which can be harmful to animals and humans). The HESL workplan included microcystin sampling if a blue-green algal bloom on the lake was identified or suspected during our routine sampling. Microcystin analysis was completed during the July 2019 sampling event despite the fact that a blue-green algal bloom did not appear to be present as part of a conservative assessment.
August 30, 2019	Chris Blackford	1. In many places of the report, they reference earlier reports that made recommendations for improving water quality. For example, reports in 2002 called for restrictions to property development (pg. 55-56), development of a by-law to ensure proper septic system functioning (pg. 60), and restrictions on shoreline development (p.g.61-62). All of these issues were still cause for concern in this report, 17 years later. Since we have spent many years and a lot of money figuring out the environmental problems of Oak Lake, I urge council to act on enforcement in some capacity. In section 5.1.3 the report recommends one way in which enforcement can be carried out effectively (e.g. under the municipal act).	<ol> <li>We agree enforcement and community support are key to the success of any plan moving forward.</li> <li>Pigeon Lake is a very different system from Oak Lake, which HESL has worked on in the past with the Alberta Government. The lakes differ not only in morphology and hydrology but also in sampling effort.</li> <li>Pigeon Lake is an intensively studied lake by the Government of Alberta with long term records on</li> </ol>



	2. The phosphorus budget created by Hutchinson is a great tool for understanding Phosphorus inputs into the lake. However, the Phosphorus budget only quantified the different sources of phosphorus inputs into the lake and didn't estimate phosphorus moving out of the lake (i.e. output). Typically, major phosphorus outputs in lakes are from rivers flowing out of the lake, phosphorus settling into the sediment, or uptake by plants. Phosphorus outputs from the lake are also often looked at when creating phosphorus budgets (eg. Pidgeon lake in Alberta https://open.alberta.ca/publications/9780778598787). If the phosphorus outflow from the lake is significant it is useful to know to help manage phosphorus levels of the lake. Is it possible to get an estimate from Hutchinson on how much Phosphorus is leaving the lake? Additionally, phosphorus outflow from the lake is important to understand because it relates to the water level of the lake. If there is no route for phosphorus to flow out of	stream inflow and outflow, and groundwater allowing a water budget to be created and phosphorus output load to be estimated. No such data exists for Oak Lake and collecting necessary data was outside of the scope of the RFP and our proposal so it is not possible to provide that estimate. We don't believe that an accurate estimation of phosphorus export is necessary since a) phosphorus sources have been characterized to influence management decisions, and b) phosphorus concentrations are relatively consistent throughout the lake so any changes associated with water level management will not directly affect the concentration of phosphorus concentrations in the lake (i.e. water
	the lake, this could increase phosphorus in the lake. The link between water levels in the lake and phosphorus was not made explicit in the report in my opinion. I recognize that public opinion is divided about appropriate water levels but I don't think there is recognition that the water level of the lake affects more than just flooding - it impacts the phosphorus concentrations of the lake.	remaining in the lake will have the same concentration). Water level management could indirectly affect phosphorus concentrations via a multitude of chemical and biological processes, but such multifactorial type assessments are beyond the
	This is an area where I think the recommendation of creating a water budget (pg. 64 of the report) would be beneficial. There are differing opinions of how the water flows in/out of the lake and I believe measuring flow rates at the culverts would help get people on the same page in terms of appropriate lake levels. As council works with homeowners around the lake, it would be great to relay information to homeowners on water flow and the importance of phosphorus outflow while homeowners are ensuring they follow good environmental practices (i.e. ensuring proper septic system functioning and property development).	<ul> <li>3. Correct. Reducing phosphorus from the catchment coming into the lake will not reduce the internal load but will reduce the overall amount of phosphorus in the system which should benefit the lake over time. Natural flow through the lake should gradually flush some phosphorus out of the lake over time, however this, mechanism will be dependent on the flow of water through the system after the culvert changes have</li> </ul>
Hutchinson Environme	3. Finally, the report mentions internal phosphorus loading as a significant contributor to the phosphorus input of the lake - i.e. 44%. (p.g. 40). Internal phosphorus loading means that even if external phosphorus inputs from the ntal Sciences Ltd.	been completed.



		1	
		watershed are reduced (e.g. from septic systems and runoff), it may take some time	
		for the phosphorus levels in the lake water to drop. This is because the phosphorus	
		inputs from the sediment can compensate for reductions of phosphorus from the	
		watershed.	
August 30, 2019	Carolyn	I am hopeful that Council will pass the recommendation to provide funding for tile	Thank you for the support.
	Deeth	rerouting as recommended by Hutchinson.	
August 30, 2019	David Muir	Leave the water levels the same as they are now. Do not adjust the levels.	We agree enforcement and community engagemen
		Enforce the regulations on septic inspections, care and maintenance of the septic	are key to the success of any plan moving forward.
		systems on Oak lake.	
		Have a concerted effort on information going to residences of Oak Lake on the use	
		of phosphates and commercially produced fertilizers (nitrogen phosphates).	
		Address the flow of agricultural usage toward the lake (Quinte West is committed)	
August 30, 2019	Rob and	Thank you everyone at Quinte West Council for your interest in and actions to date	Thanks for the information and your actions to
	Jane Aman	for, our gem of a lake and area, Oak Lake. We really appreciate any TIME, EFFORT	minimize impacts to Oak Lake.
		and FUNDS you are expending to help our very serious pollution situation from	
		getting worse and worse. It is true the pig manure spill from the farm, alarmed people	
		into realizing what can happen in a worse case scenario. It was so very hard to	
		believe this happened and also the lack of initial action on the part of many was very	
		discouraging. But nevertheless, we realized that there were actions that could be	
		initiated and taken. One of these very important steps was to get your attention and	
		ask for help. Your funding the Oak Lake Study was good in giving some facts. The	
		presentation at Batawa was informative with some aspects of it being a repeat of	
		things we have known for many years. It pointed out some action plans possible and	
		dealt with facts of a lake ecosystem and how to improve it.	
		We have to say that the thick algae blooms stayed ALL SUMMER LONG in the lake	
		which is really unusual. The usual is that we have about up to a foot of dots of it on	
		the shore in Spring for a week or so and then it is gone for the rest of the season. It	
		sinks and is present but not in the major volume it is this season. We have not been	
		able to swim off our shore AT ALL because it has been so full of thick algae and	
		more weed growth. It measured up to 30 feet out from shore and floated on the	
		surface on other parts of the lake. We read that with the SIGNIFICANT AMOUNT OF	



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		THE MANURE SPILL that happened, the more devastating effect can show up in	
		year two and later, after it happens. That may explain it. Redirection in the tiling of	
		the farmers' field areas would help prevent this from ever happening again.	
		Septic systems: I, Jane, was on the executive of the former Oak Lake Association	
		when we were seeking a septic system bylaw. I know at the Batawa meeting it was	
		shared that there wasn't enough good will agreement of the part of the lake lot	
		owners to support it. The real reason, and two other former executive members	
		concur with this, is that Quinte West Council did not want to endorse it because it	
		would take follow-up and extra work for them. The proposed by-law as I remember it,	
		was to require with the lot owner's tax bill possibly, proof of receipt that they had their	
		septic system pumped out. It was to be every five years for seasonal dwelling	
		cottage owners and every two years for permanent all year round dwellers. There	
		was a lack of support from you for this initiative and after that point we gave up but	
		feel we accomplished some essential things in our years of activity. We helped lake	
		dwellers and Quinte West Council, in conjunction with the Lower Trent Conservation	
		Authority, to become more aware of what actions needed to be taken to preserve the	
		environmental integrity of the lake. We are so glad that the cause has been taken up	
		again with a new organization to continue in this endeavour, of which I am a	
		member.	
		Yes, we have a buffer area on our shore, encouraged in the Batawa presentation.	
		We do not use pesticides or fertilizers on our mixed grass and weed growing lawn	
		areas. We have planted 25 trees and bushes on our property of less than an acre	
		over the 20 years of living here to restore overdevelopment of this property in the	
		past. Each day we enjoy looking out to see ducks, loons and wildlife aiming to keep	
		coexisting with humans on this water body.	
		It is our hope and request that you, Mr. Mayor and Quinte West Council continue to	
		help in every way possible to continue cleaning up this water. It is our most valuable	
		renewable resource.	
July 1, 2019	Don	1. There are dozens of large slime "balls" floating at or near the surface of the lake.	Thanks for the information. The filamentous green
	MacInnes	Some are at least 10 feet wide and at least five feet deep. I have never observed	algae was sampled and is characterized as part of our
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		these before.	report.
		2. There are extensive slime formations near the weed level of the lake. I have	
		snorkeled here for almost 70 years and have never observed this problem before,	
		either.	
August 29, 2019	Beverly	1) Water level - our home has been flooded for the past 2 years. We have had	1) It did not appear that the culverts were restricted b
	Shepard	between 2-3 feet in our basement. I am quite certain that Jake Talsma did not build	sediment during our visual assessments, but or
		our home in the lake but rather, a safe distance from what was then the 'high water	assessment was limited and we have recommende
		mark.'	that sediment removal be completed as needed.
		Any other concerns at this point are moot due to the fact that we cannot continue to	
		live in our home (approximate value \$700 - 800,000.00) if the foundation continues	2) and 3) We agree and have provided simila
		to be destroyed by record water levels.	recommendations in the report.
		We believe the level of the lake, although influenced by precipitation, is mainly	
		affected by the ability to drain/exit through the culverts located by the highway. We	
		have experienced a dramatic drop in water levels on both occasions when the	
		culverts were cleared, indicating that they do indeed impede the outflow of the lake.	
		When the culverts are blocked - we flood. When they are cleared - the flooding	
		subsides.	
		2) Water quality has been affected by the prevalence of weeds - our tap water tests	
		were returned for the first time due to 'murky' readings - we have UV and filter	
		systems at both of our residences. Hopefully if the agricultural runoff can be limited	
		or diverted completely, we could address the weeds in a real way. We would	
		welcome a collaborative approach to this. Also, we would welcome some	
		assessments and advise on the septic systems around the lake.	
		3) We would appreciate ongoing annual clearing of all culverts and ongoing	
		monitoring of water levels and quality.	
ugust 30, 2019	Mike Moffatt	I am glad that your organisation has been contracted to address the very serious	Thanks for your input. We are happy to mak
		situation facing Oak Lake.	recommendations to both the landowners and City
		I have enjoyed the lake for more than 35 years and cannot believe the impact the	however ensuring that they are carried out will requir
		agricultural spill has had. I have always enjoyed swimming out from my dock to the	continued cooperation between the city and th
		deeper water and this year I cannot make it out through the weeds.	landowners to better inform the community of step
			they can take to improve the lake and to better enforc



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		1. to ensure we don't have another catastrophe with dumping animal waste into the	
		I believe strongly the runoff from the farms needs to be diverted:	potential course of action by the city.
aguot 00, 2019	Jackson	environmental study.	alteration of the tile drain has been identified as a
August 30, 2019	Heather	As an Oak Lake resident, I'd like to express my concerns related to the	Diverting the agricultural waste from Oak Lake via
		making recommendations, but by making sure that they are actually carried out.	
		I sincerely hope that your Organisation will act, and be successful; not only by	
		only a few of the recommendations were followed.	
		earlier work and energy generated a necessary report at the time (early 2000) and	
		of the water quality of Oak Lake, by donating endless hours to this end. All of this	
		Over the years my family has been very involved in working towards the preservation	
		development. However, they are not being enforced.	
		cannot be allowed. There are bylaws currently in place restricting this type of	
		Finally, the illegal conversion of recreational residences to permanent residences	
		upgraded or at the very least replaced with holding tank systems.	
		inspection is scheduled to take place. It is essential that outdated systems be	
		Existing septic systems are also a problem and I am glad that a door to door	
		everyone else in Quinte West and we need assistance.	
		towards the residents in the Oak Lake basin? We are paying our taxes just like	
		the 2018 budget presentation) when will the city direct some of these resources	
		waste management infrastructure in other parts of the city (as quoted by the Mayor in	
		event of another spill. If the City of Quinte West can spend 30-50 million dollars on	
		sort of dam that will hold any future agricultural runoff from entering the lake in the	
		The City needs to remove from the equation all of the agricultural drainage tiles that act as a conduit for spills of this nature. In addition, the City needs to construct some	
		Why then are we in this situation at all? When will the City of Quinte West act?	
		documented by previous water quality studies conducted on the lake (early 2000).	as much as possible.
		for such a spill to have taken place? The possibility of this happening has been well	the early 2000's. We are planning on staying involved



		I	
		lake;	Septic system inspections done on the lake were
		2. to keep the farm sewage from, in general flowing to the lake.	performed to be comparable to those performed in the
			early 2000's when the lake was last studied. More
		An assessment was done on household septic systems, I was here when the young	thorough testing of septic systems where necessary
		man came to the house and it really wasn't much of an assessment. I'm concerned	was recommended by our study, however these tests
		there are many systems not working appropriately.	were not possible under the scope of work of the
			HESL report and require landowner permission so can
			be challenging to complete.
July 18, 2018	David Muir	Obtaining permits from the MOE to have weed harvester clean shoreline. Would the	We responded privately to Mr. Muir regarding the
		City of QW share cost for shoreline in front of road allowance? Also, MOE approved	potential impacts of macrophyte removal on the study.
		use of aquatic herbicide. Can someone please call and discuss w/ property owner?	The report also contains a section on Aquatic
			Vegetation Management.
		From Chris to Brent: I would appreciate your comment on the spraying and the weed	
		cutting and if this will affect your study	
August 31 2019	Tyler Vivian	I love the idea of replacing the culverts to try and fix some of the runoff as an	We agree long-term planning by the city and
		immediate plan.	landowners would be a valuable strategy moving
			forward.
		I would like to see some 5-20-year plans put in place also. Then when the council	
		has some extra money over the years these projects will be ready to go.	New implementation, bylaws and enforcement
			strategies will need to be discussed between the city
		I would like to see a bylaw that oak lake residents must submit their paperwork from	and the landowners moving forward as they will be a
		a septic tank inspection and pump out at least once every 5 years.	key component of the success of the management of
			Oak Lake in the future.
		I would like to see a plan for the bubbler system to be implemented within the next 5	
		years when funds allow for it.	
		My family and I want to use the lake that we live on and the weeds are so bad this	
		year my 3 year old daughter won't swim in it and even when I go out in it the weeds	
		are so bad you can get caught in them yourself. It could be a drowning hazard.	
		I appreciate your time in the matter. Please help clean up the lake for my family. We	
		want to enjoy it.	



August 30, 2019	Tony MacDonald	As far as priorities for lake and drinking water improvement we would suggest the following:	Thanks for your input.
		1. All residential (both year-round and seasonal) septic systems must be inspected	
		and maintenance or replacement made where needed. No grandfathering of current	
		systems!! In this day and age, this should be a "no-brainer" for those living on or near	
		waterways, especially those waterways that can be used for drinking water.	
		2. Diverting the east farm tile drainage outlet away from the lake should be done,	
		along with proposed culvert improvements on the Detlor/Barr farms. Sealing off the	
		"cow tunnel" should also be part of this project.	
		3. Lake levels are acceptable, however culverts running east must be maintained	
		annually.	
		4. On-going water quality stewardship programs should be reinstated.	
		5. An outboard motor horsepower restriction and/or motor ban should be considered.	
August 30, 2019	Sandra Brett	At the information night a proposal was put forward which would lead to the	The agricultural lands on the west side of Foxboro
		installation of irrigation tile on the Detlor farm area adjacent to highway 14 and	Stirling Road across from the Detlor Farm contained
		draining into the wetland situated on that side of the highway. I would like to know if	crops during our assessment. There is a swale
		consideration has been made by either Hutchinson or Quinte West with regard to	through that area which transits agricultural runoff from
		installing drainage tile on the land bordered by Highway 14, Oak Lake Road, The	the farms east of Foxboro Stirling Road. The lands will
		Pines and Detlor Lane. This piece of land has a natural swale which runs	not transmit agricultural runoff from the adjacent lands
		approximately North-west to South-east which leads to Oak Lake. It is my	after the tile drain is re-routed. We learned that those
		understanding that there may be some drainage tile in this field but that, in all	lands recently changed ownership but do not know
		likelihood, it drains either directly into Oak Lake or into a drainage ditch which leads	what the owner intends to do with the lands. Ideally
		to Oak Lake.	those lands will be used in a manner that does not
			produce nutrient-rich runoff or mitigation measures will
		I do not know if this land drainage has significant impact on Oak Lake but am curious	be used to reduce nutrient concentrations.
		about its disposition with regard to water quality.	
August 29, 2019	Sue and	1. Is the tile drain being rerouted to an area that is outside of the oak lake	1. The current plan being discussed reroutes the
	Brian	watershed?	agricultural drainage to the wetland north of Oak Lake
	Yuskow	2. The bulk of the mass of phosphorus currently in the lake is stored in the sediment.	which is still within the watershed, but the wetland
		The study authors recommended an aeration system be considered to reduce	flows predominantly away from the lake and various
		phosphate loading.	wetland processes act to transform and store nutrients
		a. Is this superior to other phosphate removal mechanisms?	within the wetland.



		<ul><li>b. Are there other specific measures that are recommended to remove the phosphorus in the sediment?</li><li>c. What near term targets can be used to see progress in phosphorus removal?</li><li>d. Is the city able to assist with phosphorus removal?</li></ul>	2. HESL does not recommend active in lake management at this time. Aeration was described as a potential option in the future depending on the outcomes of the phosphorus reduction strategies recommended for more immediate action and we believe it is the most suitable active lake management technique for application in Oak Lake. Targets and implementation can be discussed in the future if active lake management is implemented.
August 26, 2019	Heather Nash	As Oak Lake residents we would like to see the city support inspection of household septic systems around the lake. We feel this should be a mandatory enforcement which has been adopted in many municipalities. We would like water levels and the health of the water to be routinely monitored. We feel strongly that the culverts need to be cleared yearly to allow the lake to breathe and drain into the wetlands. We would also like the city to consider dredging to promote better water flow. Lastly, we would like to see the city ensure water levels remain below most septic beds around the lake to divert all agricultural run off.	Thanks for your input.
August 31, 2019	Mark and Trudy Matheson	<ul> <li>we believe that a long-range plan is required for the active and positive management of the lake. Specific concerns follow in descending order of priority: <ul> <li>Algae and aquatic plant life explosion</li> <li>Water levels (Close second)</li> <li>Phosphorus loading (likely related to the above-mentioned explosion)</li> </ul> </li> <li>We support the recommendations of the report. Suggest that the proposal to realign the adjacent agricultural tile drain so it no longer drains into Oak Lake, should be given priority for quick implementation. Similarly, we believe an assessment as to whether the outflow culverts are of an adequate size &amp; position to deal with run-off - especially relating to the spring melt - would be of value.</li> </ul>	Thanks for your input.
June 24, 2019	Glenn Bateman	I noticed my water supply is smothered in Algae, I was wondering if my water system is damaged because of the inaction on septics and the continuous flow of manure into the lake will the city compensate me financially for the damage?	This question is best answered by the City.



August 15, 2019	Rick Smith	First of all, thanks for listening to the residents and initiating the environmental study.	Thanks for your support.
-		There are several recommendations in the report that I believe would be helpful	
		going forth. Those being the continued sampling as indicated, the shoreline	
		development and the individual septic system analysis. It's very discerning that not	
		all property owners would allow the inspection, probably proof that we have some	
		issues that need to be resolved. I'm also encouraged that the City will recommend to	
		Council that the drainage culvert be re-routed to the north.	
August 21, 2019	Ted Reid		The main difference in water quality between the tw
		Oak Lake via water testing has significant improvement since the samples i.e.	studies was the reduction in bacteria concentration
		phosphorus, E. coli, nitrogen were taken in 2000/01	(i.e. E. Coli, fecal coliforms and fecal streptococcus
		Why then have we got algae now and we did not have it in 2000/01?	The abundance of algae is related to a multitude of
			factors, such as climate, and it can't be easi
		1) We understand that the decayed weed/silt is a major problem. Therefore, would it	attributed to differences in water quality between 200
		be logical to start removing the silt where possible?	and 2018/19.
		For example, could we have an annual program to remove silt from the cove at the	1) Silt removal is not recommended as
		corner of Neighbourly and John Meyers Rd, I understand the land on the north side	management consideration. Removal of s
		of the cove is owned by Quinte West. Thus this site could house equipment required.	results in dispersion of fine-grained s
		Obviously, the hole would fill again, requiring dredging (annually ???) however, we	throughout the water column which
		would lower silt levels that will be increasing every year because of more decaying	increases nutrients and can negative
		weeds.	impact aquatic life.
			2) This question is best answered by the City.
		2) Weed Removal:	3) Thanks for your input.
		The question of where do we put the weeds that we remove from the Lake.	
		Could we ask for the City's help on this one to deliver a dumpster at scheduled times	
		at various sites on the Lake i.e. on City owned land at corner of Neighbourly Rd, and	
		John Meyers Rd?	
		For example: The last weekend of June July and August (time intervals to be	
		discussed) The dumpster then would unloaded at a City approved location.	
		I know issues such as policing what goes in the dumpster and timelines would need	
		to be discussed further.	
		3) Septic Inspection	



		In 2019 it goes without question that mandatory sewage system inspection with appropriate action taken, if the test does not meet today's standards, is a priority action. Simply, where else can sewage go into other property owners front lawn (Oak Lake is our front lawn) without any consequence.	
March 11, 2019	Bruce Kerr	Here are photos of March 11 showing the water build up and the frozen underwater culverts. One at John Meyers and 14, one at Neighborly which can't be seen from snow cover and ice both under water. Note the water colour in the lake by 50 Oak Lake Rd is brown again as well as coming through underpass.	Thanks for the information.





August 00, 0040	Law Ota al		Therefore for a second second
August 28, 2019	Jan Steel	It is our hope the 'Powers that be' will mandate the inspection of all septic systems	Thanks for your input.
	Moffatt	bordering Oak Lake and decree the necessary upgrades be completed within two	
		years,	
		and all of the ditches from the farms located on the opposite side of Hwy. 14, that	
		have been for decades draining into Oak Lake, be damned and drained on the	
		farmers' own property.	
		Both of these predominant problems have been recognized for far too long.	
August 30, 2019	Jan Steel	As an addendum, following the blocking of all the farm runoff and the upgrading all	Thanks for your input.
	Moffatt	septic systems; the next effective steps could be to fix the culverts at the north end	
		of the lake so that the early spring high water levels may be cleared away; and then,	
		all the residents could leave the shoreline of their properties in a natural state for the	
		flora and fauna to flourish and replenish the waters	
		With incoming pollutants stopped, and then spring high water drained off and a	
		protective naturalized shoreline created, Oak Lake would be able to continue being a	
		jewel for each and everyone of us	
		Thanks to all of the council members, for the dedication, and consideration in helping	
		to protect and maintain this precious lake.	
August 11, 2019	Bruce Kerr	1/ Thank you for the meeting in Batawa it was well attended and quite informative. I	4) We have considered your input into the
		came away very pleased with information by Chris D'Angelo that a meeting of the	finalization of the report and considerations
		minds had been reached with the 2 farmers influencing the improvement of Oak	for water level management.
		Lake.	
		2/ It was stated that the existing tile drain was to be rerouted to run north to the	Thanks for your input regarding #1-#3, #5 and #6.
		wetlands and not to the lake as it did previously. Removing this nutrient influence to	
		the lake is wonderful.	
		3/ The announcement additionally mentioned the removal of 3 culverts on the 2	
		farmers property which at present are actually inhibiting flow for the lake to effectively	
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		farmers property which at present are actually inhibiting flow for the lake to effectively flush. Presently there is a large culvert of about 3ft under highway 14 and into the	
		farmers property which at present are actually inhibiting flow for the lake to effectively flush. Presently there is a large culvert of about 3ft under highway 14 and into the wetlands east of the highway where it immediately gets backed up by a 12" culvert	
		farmers property which at present are actually inhibiting flow for the lake to effectively flush. Presently there is a large culvert of about 3ft under highway 14 and into the wetlands east of the highway where it immediately gets backed up by a 12" culvert on the first farm and then 2 more culverts on the 2nd farm. The govt act for lakes and	



		before another spring run off.	
		4/ Why is this a problem? There are a number of properties in low areas with septic	
		beds and holding tanks that are effected by high water flooding and thus influencing	
		sewage waste directly to the lake and with reduced outflow to flush the lake we now	
		have a lake suffering from high nutrient and phosphorus load creating a poor habitat	
		for fish and great for weed growth.	
		5/ There is, I believe, a legal condition being created that may leave the municipality	
		in dangerous territory if it finds a challenge by injured parties due to negligence of	
		their required maintenance of culverts under the act. Residents are being flooded in	
		the spring mainly because of high water with lack of flush.	
		6) The survey taken regarding water levels and the result of that survey I believe was	
		stilted;	
		A/ By residents reasonably new with little or no history of levels to provide a valid	
		response.	
		B/ Many property owners didn't want change since part of the change would have	
		been scrutiny of their septic beds and holding tanks.	
		C/ Many people were part time summer residents who had little understanding of the	
		spring flooding and sewage leakage from their systems effecting sustainability of the	
		lake's eco-system.	
		D/ Properties have actually been reduced in size due to high levels and the once	
		lovely sand beaches in front of many properties are now underwater and highly	
		encroached on by weeds.	
		E/ Quinte West tax base has increased significantly with many new and newly	
		renovated expensive homes around the Oak Lake drainage area. This increase in	
		tax base should also dictate a greater municipal responsibility to the taxpayers on	
		the lake.	
ugust 30, 2019	Debbie	I am a cottage owner who, along with a group of people, just purchased land along	Septic system policy and enforcement will be a ke
	Hitchon	the north-east side of the lake. (Formerly owned by Doug Detlor). My concern is	part of lake management in Oak Lake moving forwar
		septic systemsor lack thereof. Of the the 20 properties that are involved in the	How that policy is shaped, implemented and enforce
		newly formed corporation that bought this property, only TWO have properly	will be an engagement between the City of Quin
		registered septic systems. (Myself and my father). This concerns me greatly. How	West, Council and the residents of the municipality.
		can we go about forcing these cottage/homeowners to be responsible and get proper	
		septics? I am convinced this is an attributing cause to the weeds in the lake.	



June 10, 2019	John	Perhaps you could send these photos to Hutchinson to review as part of their study.	Thanks for the information.
	Brewster	Note the brown on top of the algae bloom, plus the size of it. Blooms have begun	
		very early this year and far more aggressively. The north end of the lake, adjacent to	
		the highway, is really bad for this time of year. The spit alongside Neighbourly Way is	
		quickly filling in with nasty looking stuff. Maybe it is time to recheck the culverts at	
		this end?. They do not appear to be moving at all.	





February 9, 2019	John	Quick flowing brown water coming down from the hill across the Detlor property from	Thanks for the information.
	Brewster	the Barr property. The water is brown and the lake open at that point of ingress,	
		presumably, due to the warmth of what makes the water brown.	





August 29, 2019	Scott	At Batawa on July 30, 2019, I was very pleased to hear Chris Angelo state that	Thanks for your input.
	Symons	Quinte West had reached an understanding with local farmers which will stop the	
		delivery of farm runoff by means of an existing agricultural tile drain. Stopping the	
		daily delivery of agricultural by-product substances into Oak Lake will help to improve	
		water quality, habitat and human health unequivocally.	
		As stated by Hutchinson Environmental Services' final report, farm runoff accounts	
		for 15% of total phosphorus entering Oak Lake annually. However, phosphorus from	
		feces and urine is only one toxicity that has been flowing down hill from the farms	
		and into Oak Lake for far too long. Other historical 'Nasties' include animal blood,	
		saliva and puss, as well as, petrochemicals such as fertilizers, herbicides, pesticides,	
		industrial oils, gasoline and diesel fuel. Quite a barbaric cocktail to say the least!	
		Another advantage for Oak Lake as a result of the proposed re-routing of the tile	
		drain is protection against future manure spills/accidents. In fact, the unreported	
		2017 manure spill is what began this journey to educate both myself and others as to	
		the frailty of Oak Lake and its surrounding watershed. Without a doubt, 8000 gallons	
		of hog manure is 8000 gallons too much!	
		My hope is that when the tile drain is re-routed along the north side of HWY 14 as	
		proposed, that it is done correctly, the first time. We do not want to waste the scarce	
		resources of time, labour and money. This means at its base level, crews are using	
		current and accurate topographical surveys and information of the proposed re-	
		routing to ensure the proper construction of a working watercourse. Any work to be	
		done to the numerous culverts within the defined area, and which enable fluidity,	
		must be enhancements to the existing, erroneous drainage system. In addition,	
		ensuring an annual maintenance schedule for these specific culverts, as well as, all	
		culverts on Oak Lake, guarantees correct functionality. A half-ass, knee-jerk reaction	
		is not what any of the stakeholders want here, and doing so, will simply pass this	
		issue onto the agenda of Quinte West Council once again.	
		I want to thank his Worship the Mayor and Members of Council for their continued	
		interest and efforts on preserving one of Quinte West's most precious natural	
		attractions, Oak Lake.	



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Comment Forms from July 2019 Public Meeting	Wendy Emerson	<ol> <li>Would be interested in a public list of failed septic reviews.</li> <li>Is there a summary of (management) activities taken on Oak Lake?</li> <li>Septic systems should be reviewed for all lake residents and residents held accountable.</li> </ol>	1. We have not publicly released Information on individual septic systems. That information was provided to the City and they are responsible for managing it.
			2. The report includes previous recommendations related to lake management under various headings. Many previous recommendations have been incorporated into policy but completed activities are more uncommon and in many cases, difficult to summarize.
			3. We have provided recommendations regarding more detailed septic system inspections in the report.
	Carolyn Deeth	Would be interested in more information regarding shoreline buffers and other community incentives.	The LTCA produced a report in 2002 on shoreline buffers and management actions that can be impactful, and community led.
	Ivan Clare and Marlene	Impaired water activities due to weeds. 90% more motorboats on the lake compared to 40 years ago.	Thanks for your input.
	Unknown	<ol> <li>The volume of water diverted from lake via the tile drain would impact water levels and lake characteristics of Oak Lake.</li> <li>There is lots of dead vegetation in the bottom of the lake so a bubbler would stir that up and release those nutrients back into the water column.</li> </ol>	1. It isn't possible to forecast how water levels will be altered after the tile drain is re-routed under the current scope of work. The wetland is located within the same watershed, so we anticipate that water levels won't be altered substantially. We anticipate that lake characteristics will improve after re-routing of the tile drain as mentioned in the report.
			2. Active lake management and installation of an oxygenation or aeration system are not recommended at this time. We recommended in the report that if a



	system is utilized in the future, deep water conditions,
	including

