



# KITWANGA LANDFILL

## 2021 Annual Report

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## Executive Summary

The Kitwanga landfill began closure in 2016 and as of 2017, the Kitwanga facility has operated as a Transfer Station to consolidate waste for landfilling at the Hazelton Waste Management Facility.

During 2021, **690.7 tonnes** of refuse was collected at the Kitwanga Transfer Station and landfilled at the Hazelton Waste Management Facility. Approximately 145.65 tonnes of materials were collected at the Transfer Station for diversion. Diverted materials include **34.64 tonnes** of Packaging and Paper Products (PPP), **48.87 tonnes** of corrugated cardboard, **26.29 tonnes** of clean wood, **1.75 tonnes** of household electronics, **24.9 tonnes** of metal, **4.2 tonnes** of small appliances, and **5 tonnes** of tires.

There were no instances of wildlife breaching the facility fence observed during 2021 at the Kitwanga Landfill. There was minimal vector activity from birds, including raptor species (bald eagles), and corvid species (crows and ravens). There were no major works or projects carried out at the facility for 2021. The RDKS self reported one non-compliance for 2021 regarding water quality testing results. The two surface water compliance points were sampled and monitored according to their OC prescriptions. The compiled data, interpretation, and recommendations by Tattersfield Consulting will be contained in the *Kitwanga Landfill 2021 Annual Environmental Effects Monitoring (EEM) Report*.



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## 1 Introduction

This annual report covers the period from January to December 2021 and has been prepared to fulfill the requirements of Kitwanga Landfill Operational Certificate (OC) MR-5767. The Kitwanga OC was issued in 2012 and has not yet been updated to reflect the closure of the landfill. The OC authorizes the discharge of municipal solid and liquid wastes and outlines the criteria for environmental and human protection at the landfill.

This report meets the requirements in Section 10.5 of the Operational Certificate by providing the following information:

**Table 1: Report Objectives**

<p><b>Waste Tracking</b></p> <p>Quantity of Waste Received, Recycled and Composted</p> <p><b>Wildlife Observations</b></p> <p><b>Operations</b></p> <p>Facility Updates and Maintenance</p> <p>Non-Compliances</p> <p><b>Environmental Monitoring</b></p>	
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Environmental monitoring was conducted in accordance with the OC. The results of the water quality monitoring program, which includes surface water monitoring, are discussed in the Environmental Effects Monitoring Report prepared by Tattersfield Consulting, and contained in Appendix A of this report.

## 2 Background

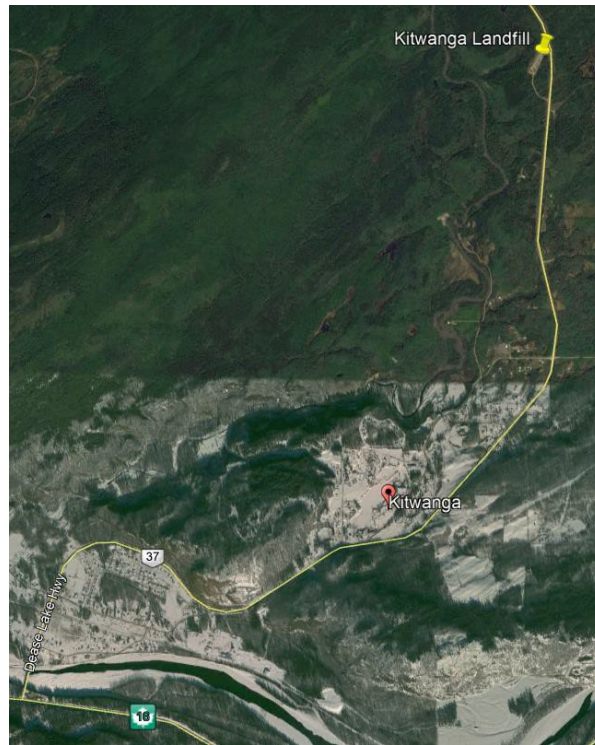
The Kitwanga Landfill (Figure 1) began closure activities in 2016, and in 2017 began operating as a transfer station to consolidate waste for landfilling at the Hazelton Waste Management Facility (HWMF), and to accept materials for recycling. The Kitwanga Landfill continues in the process of closure, with one third currently closed with liner and the remainder to be shaped and closed with clays sourced from the HWMF site over the next 3 years. The Kitwanga Landfill (the landfill) is located approximately 5 km north of the community of Kitwanga. Access is via the Stewart-Cassiar Highway.

The Kitwanga Transfer Station (the transfer station) opened in October of 2017 and is owned and operated by the Regional District of Kitimat-Stikine (RDKS). The transfer station is on the site of the closed Landfill. The transfer station accepts and manages municipal solid waste generated from commercial and residential sources in the Kitwanga area, including the communities of Kitwanga, Cedarvale, Gitanyow, Gitwangak, and Gitsegukla in accordance with the Regional District of Kitimat-Stikine Solid Waste



Management Plan (1995). Material is no longer discharged in the Landfill; waste is consolidated and hauled to the HWMF for landfilling or recycling through various stewards.

Landfill operations are regulated by the Ministry of Environment's Operation Certificate MR-5767, most recently amended in November 2012, and conducted in accordance with the Transfer Station Construction and Landfill Closure Design for The Kitwanga Landfill (Sperling Hansen Associates, 2016).



**Figure 1 Location of Kitwanga Facility.**

### **3 Waste Disposal**

The Kitwanga Transfer Station serves the Kitwanga area including the communities of: Kitwanga, Gitwangak, Gitanyow, Gitsegukla, and Cedarvale. The Landfill is in the process of closure and no waste was discharged at this location in 2021. Waste consolidated at the transfer station is landfilled at the Hazelton Waste Management Facility.

The total volumes of waste and diverted material collected at the Kitwanga Landfill from January through to December 2021 are shown in Table 2.



**Table 2 Waste and Diversion Volumes for Kitwanga Landfill 2021**

Waste Type	Tonnes
<b>Landfilled Waste</b>	<b>690.7</b>
Refuse <sup>1</sup>	690.7
<b>Diverted Waste<sup>2</sup></b>	<b>146.65</b>
Cardboard	48.87
Clean Wood	26.29
Household Electronics	1.75
Metal	24.9
Printed Paper Packaging	34.64
Small Appliances	4.2
Tires <sup>3</sup>	5



### 3.1 Landfilled Waste

#### Refuse

Refuse is defined as discharged materials, substances, or objects, not including Restricted Wastes (metal, organics, and recyclable materials), hazardous or radioactive waste, contaminated soil, smoldering or flammable material, explosive or highly combustible materials, or tires. Refuse is disposed of in the landfill.

In 2021, **690.7 tonnes** of garbage were consolidated at the Kitwanga Transfer Station for final disposal at the Hazelton Waste Management Facility. Refuse tonnage was converted from cubic meters using the U.S. EPA’s *Volume to Weight Conversion Factors* (2016) document. The mixed MSW-Residential, Institutional, Commercial: Uncompacted conversion factor of 1 cubic yard = 275lbs was used to calculate tonnage.

### 3.2 Diverted Materials

Diverted metals, tires, and large appliances are collected and held at the transfer station for collection by the designated Stewardship or metal salvage company. Diverted materials include clean wood, household electronics, metal, printed paper and packaging materials (PPP) and cardboard, small appliances and tires.

<sup>1</sup> Refuse tonnage was converted from cubic meters using the U.S. EPA’s *Volume to Weight Conversion Factors* (2016) document. The mixed MSW-Residential, Institutional, Commercial: Uncompacted conversion factor of 1 cubic yard = 275lbs was used to calculate tonnage.

<sup>2</sup> Diverted materials with \* indicates their tonnage values are sourced from each material stream’s appropriate EPR Stewardship.

<sup>3</sup> This tonnage is based off Staff Facility Inspection estimates and converted from cubic meter to tonnage using the U.S. EPA’s *Volume to Weight Conversion Factors* (2016) document. The automotive Scrap Tire: light duty tires (passenger, light truck) conversion factor of one tire = 22.5lbs.



### ***Clean Wood***

Clean wood waste is considered any wood product that has not be treated or painted. Clean wood is segregated is currently burned as outlined in Section 8 of the Operational Certificate. For 2021 the facility accepted approximately **26.29 tonnes** of clean wood. This value is based on estimates recorded in staff facility inspections and converted from cubic meters to tonnes using the U.S. EPA's *Volume to Weight Conversion Factors* (2016) document. The C&D Wood – Clean Dimensional Lumber conversion factor of 1 cubic yard = 169lbs was used to convert to tonnage.

### ***Household Electronics***

During 2021, **1.75 tonnes** of household electronics were collected at the Kitwanga Transfer Station for Stewardship recycling through the Encorp Electronics. The tonnage is also reported by Encorp Electronics.

### ***Metal***

In 2021, a total of **24.9 tonnes** of metal, including scrap, propane tanks, and large appliances were collected at the Kitwanga Transfer Station for recycling. All ozone depleting substances were removed from applicable appliances prior to collection by the scrap metal recycler.

Metal tonnages were converted from cubic meters using the U.S. EPA's *Volume to Weight Conversion Factors* (2016) document. The C&D Remainder/Composite Metal (avg of metals, without used oil filters) conversion factor of 1 cubic yard = 143lbs was used to convert to tonnage.

### ***Printed Paper and Packaging Materials (PPP) and Cardboard***

During 2021, **34.64 tonnes** of PPP and **48.87 tonnes** of corrugated cardboard was collected at the Kitwanga Transfer Station for recycling. The tonnage of PPP and Cardboard was provided through the EPR Steward reports.

### ***Small Appliances***

During 2021, **4.2 tonnes** of small appliances and power tools were collected at the Kitwanga Transfer Station for Stewardship recycling through Product Care's ElectroRecycle program. The tonnage reported is based on the ElectroRecycle invoices.

### ***Tires***

In 2021, **5 tonnes** of tires were collected at the Kitwanga Transfer Station for recycling through the Tire Stewardship of BC. This volume is an estimate based on waste tracking data for the facility.

The volume of tires on site was converted from individual tires to tonnage by utilizing the U.S. EPA's *Volume to Weight Conversion Factors* (2016) document. The automotive Scrap Tire: light duty tires (passenger, light truck) conversion factor of one tire = 22.5lbs was used to convert to tonnage.

## **4 Wildlife Occurrences and Observations**

The Kitwanga landfill is located in a region with bears, wolves, coyotes, several species of birds of prey, and many other species of mammals that may attempt access to the facility. An electric fence surrounds



the facility, including the entrance gate, to prevent wildlife access. The fence is kept charged from spring until late fall.

Facility operators are required to conduct fence line inspections at a minimum weekly interval, testing for proper voltage, proper tension on fence stands, overall condition of the fence, and signs of wildlife activity. Inspection results are recorded on the Daily Operation Inspection Form.

#### **4.1 Bird and Vector Control**

Birds, such as ravens and crows, are a nuisance at landfill sites, as they can scatter litter into the surrounding environment. As the landfill is undergoing closure and the transfer station is in an enclosed building, bird and vector activity is of minimal concern.

#### **4.2 Mammals**

In 2021, there were no recorded instances of mammalian wildlife breaching the facility.

### **5 Operations**

#### **5.1 Major Works and Projects**


There were no major operational works or projects at the closed Kitwanga landfill or transfer station during the duration of 2021.

#### **5.2 Non-Compliance Reports**

##### **5.2.1 Operational Certificate MR-5767**

The RDKS self reported one non-compliance in 2021 that was identified by staff after receiving surface water quality results for samples collected on September 27<sup>th</sup>, 2021. A summary of the non-compliance for the Kitwanga facility during the year of 2021 are presented in Table 3.

**Table 3 Summary the OC non-compliance for the Kitwanga Facility for the span of 2021.**

Operational Certificate Non-Compliance Section	Description of Non-Compliance	
<p><b>November 16, 2021</b></p> <p>Section 9 Monitoring Requirements</p>	<p>Exceedances of the BC WQG AW for total iron, dissolved iron, and dissolved aluminum.</p>	





## 6 Environmental Monitoring

Environmental monitoring for the Kitwanga Landfill was conducted by the Regional District of Kitimat-Stikine Environmental Technician, following the *British Columbia Field Sampling Manual for Continuous Monitoring and the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment, and Biological Samples* (BC MOECCS 2013). All in-situ and laboratory data for surface water results has been analyzed and reviewed by Tattersfield Consulting. The compiled data, interpretation, and recommendations can be found in Appendix A.

### 6.1.1 Surface Water

There are currently two surface water sites for the environmental monitoring program at the Kitwanga Landfill; an Upstream and a Downstream point along an unnamed creek. The surface water is downgradient and runs parallel along the facility's West side of the fence line. The two sites are sampled and monitored twice yearly during April and September. In-Situ parameters are monitored using a YSI. Lab parameters are collected in sample bottles and shipped to ALS for analysis.

## 7 Summary

During 2021, 690.7 tonnes of refuse was collected at the Kitwanga Transfer Station and landfilled at the Hazelton Waste Management Facility. Approximately 145.65 tonnes of materials were collected at the Transfer Station and diverted from landfill. Diverted materials include 34.64 tonnes of PPP and 48.87 tonnes of corrugated cardboard, 26.289 tonnes of clean wood, 1.75 tonnes of household electronics, 24.9 tonnes of metal, 4.2 tonnes of small appliances, and 5 tonnes of tires.

There were no instances of mammalian wildlife breaching the facility fence observed during 2021 at the Kitwanga Landfill. There was minimal vector activity from birds, including raptor species (bald eagles), and corvid species (crows and ravens). There were no major works or projects carried out at the facility for 2021. The RDKS self reported one non-compliance for 2021 regarding water quality testing results. The two surface water compliance points were sampled and monitored according to their OC prescriptions. The compiled data, interpretation, and recommendations by Tattersfield Consulting are provided contained in the Kitwanga Landfill 2021 Annual Environmental Effects Monitoring (EEM) Report (Appendix A).



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## **Appendix A Environmental Effects Monitoring Report**

# KITWANGA CLOSED LANDFILL 2021 ENVIRONMENTAL MONITORING REPORT

**Prepared for:**

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**June 2022**

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## 1. Introduction

The Regional District of Kitimat-Stikine (RDKS) is required to report annually on their environmental monitoring program for the Kitwanga Closed Landfill including an evaluation of surface water samples, identification of any potential impacts on the receiving environment and trend analysis for key parameters.

The on-going Environmental Monitoring program currently reflects interim monitoring requirements outlined in Section 10 – Monitoring Requirements in the Kitwanga Operational Certificate (Figure 1).

Sampling Locations <sup>1</sup> and EMS ID	Frequency <sup>3</sup>	Parameters <sup>3</sup>
Unnamed Creek U/S of Kitwanga Landfill E278450	twice annually, in April and September	<b>Field Measurements:</b> pH, dissolved oxygen, specific conductance, temperature
Unnamed Creek D/S of Kitwanga Landfill E278449		<b>Lab Analysis:</b> BOD, total nitrogen, phosphorous, ammonia, pH, total and dissolved metals <sup>2</sup>
<sup>1</sup> Sampling locations are shown on the site plan <sup>2</sup> Lab analysis for dissolved metals shall use a low level scan <sup>3</sup> May be altered in future, depending on results		

Figure 1. Interim monitoring requirements as shown in the Kitwanga Landfill OC.

### 1.1. Site Setting

The Kitwanga landfill is located approximately 4.5 km north of Kitwanga to the west of Highway 37 north (Figure 2). A steep escarpment spans the west side of the landfill; Unnamed Creek, runs north to south at the bottom of the escarpment.







## 2. Surface Water Quality Monitoring

Surface water sampling is currently completed twice annually at two locations along an Unnamed Creek, as per Section 10 – Monitoring Requirements in the Kitwanga Operational Certificate (Figure 1).

The sample creek is located to the north west of the closed landfill. Upstream (U/S) and downstream (D/S) sample locations have been established. The control site is located upstream from the landfill to establish background surface water conditions (receiving water in a location not affected by any potential leachate). The downstream site could potentially be impacted by any leachate from the landfill.

Sampling was completed April 28, 2021 and September 27, 2021. Historic sample dates include:

- May 12, 2014
- April 28, 2015
- April 6, 2016
- April 17, 2018
- May 15, 2019
- November 20, 2019
- April 29, 2020
- September 16, 2020

### 2.1. Protocol

Surface water samples were collected by a Regional District of Kitimat-Stikine Environmental Technician following methods that align with the Ministry of Environment and Climate Change Strategy, 2013 BC Field Sampling Manual and the Guidelines for Environmental Monitoring at Municipal Solid Waste Landfills. RDKS' general surface water sampling methods include the following:

- Samples are taken by dipping bottles into streams for those not requiring filtering.
- Syringes with filters are used for dissolved metals and dissolved mercury samples.
- Samples are transported in coolers with ice packs.
- Typically, RDKS obtains:
  - an unfiltered, unpreserved sample for general parameters,
  - an unfiltered sample for nutrients analysis, preserved with sulfuric acid,
  - an unfiltered sample for total metals analysis, preserved with nitric acid,
  - a filtered sample, for dissolved metals preserved with nitric acid,
  - an unfiltered sample for total mercury analysis, preserved with hydrochloric acid, and,
  - a filtered sample for dissolved mercury, preserved with hydrochloric acid.
- pH, dissolved oxygen, specific conductance and temperature recorded in the field using a YSI meter.

## 2.2. Analysis

Water samples were sent to ALS Environmental laboratory for analysis. The analytical reports for 2021 are attached in Appendix A. All data were compiled (Appendix B) and reviewed against the following guidelines:

- BC MoE Approved and Working Water Quality Guidelines for aquatic life (BCWQG -AW)
- BC MoE Approved and Working Water Quality Guidelines for drinking water (BCWQG-DW)

The following required parameters, as specified in the OC, are summarized for each site.

### Field:

- pH, dissolved oxygen, specific conductance and temperature

### Lab:

- BOD, total nitrogen, phosphorus, ammonia, and pH
- total and dissolved metals (not summarized, but collated in Appendix B)

Trends have been presented for both U/S and D/S locations for specific conductance, total copper, total aluminum and total and dissolved iron, as in previous reports. The BCWQG-AW require dissolved organic carbon (DOC) to determine the criteria for copper using biotic ligand modelling software. DOC was not collected during the 2021 field program and the copper criteria was not able to be determined.

## 3. Results

### 3.1.1. E278450 Unnamed Creek U/S from Kitwanga Landfill

The E278450 sample site is located U/S from potential leachate effects and establishes background surface water quality.

Table 1 summarizes the required parameters except total and dissolved metals. All other results, including total and dissolved metals, are collated in Appendix B. Exceedances to the BCWQG-AW guidelines were noted for dissolved aluminum in April 2021 at both U/S and D/S sample locations and total and dissolved iron in September 2021 at the U/S location (Table 1).

*Table 1. Summary of required water quality monitoring results for Unnamed creek U/S of Kitwanga Landfill (E278450).*

Required Field Parameters	BCWQG-AW Short-Term	BCWQG-DW	28-April-2021	27-Sep-2021
pH	6.5-9.0	-	7.26	7.32
Dissolved oxygen (mg/L)	-	-	12.2	10.6

	BCWQG-AW Short-Term	BCWQG-DW	28-April-2021	27-Sep-2021
<b>Required Field Parameters</b>				
Specific conductance ( $\mu$ S/cm)	-	-	60.6	142.8
Temperature ( $^{\circ}$ C)	-	-	6.0	10.4
<b>Required Lab Parameters</b>				
BOD (mg/L)	-	-	<2.0	<2.0
Total Nitrogen (mg/L)	-	-	0.334	0.534
Total Phosphorus (mg/L)	-	-	0.0105	0.0364
Dissolved Phosphorus (mg/L)	-	-	<0.050	<0.050
Ammonia, Total as N (mg/L)	16.7 (April) and 16.0 (September)*	-	<0.0050	0.0125
pH	6.5-9.0	-	7.51	7.89
<b>Exceedances or other parameters of concern</b>				
Total Iron (mg/L)	1.0	6.5	0.356	1.36 (Dup 1.35)
Dissolved Aluminum (mg/L)	0.1**	NA	0.150	0.0809 (Dup 0.122)
Dissolved Iron (mg/L)	0.35	NA	0.247	0.850 (Dup 0.827)

- No Standard

\*Temperature and pH dependent

\*\* pH Dependent

### 3.1.2. E278449 Unnamed creek D/S from Kitwanga Landfill

The E278449 sample site is located D/S from potential leachate effects.

Table 2 summarizes the required parameters except total and dissolved metals. All other results, including total and dissolved metals, are collated in Appendix B. Exceedances to the BCWQG-AW guidelines were noted for dissolved aluminum in April 2021 and total and dissolved iron in September 2021 at the D/S location; however, the D/S levels were lower than the U/S background levels.

Table 2. Summary of required water quality monitoring results for Unnamed creek D/S of Kitwanga Landfill (E278449).

Required Field Parameters	BCWQG-AW Short-Term	BCAQW-DW	28-April-2021	27-Sep-2021
pH	6.5-9.0	-	7.3	7.5
Dissolved oxygen (mg/L)	-	-	12.4	9.9
Specific conductance (uS/cm)	-	-	61.4	162.3
Temperature (°C)	-	-	5.7	10.3
Required Lab Parameters				
BOD (mg/L)	-	-	<2.0	<2.0
Total Nitrogen (mg/L)	-	-	0.407	0.414
Total Phosphorus (mg/L)	-	-	0.0170	0.0192
Dissolved Phosphorus (mg/L)	-	-	<0.050	<0.050
Ammonia, Total as N (mg/L)	16.7 (April) and 12.7 (September)*	-	0.0056	<0.0050
pH	6.5-9.0	-	7.53	8.0
Exceedances				
Total Iron (mg/L)	1.0	6.5	0.483	1.02 (Dup 1.35)
Dissolved Aluminum (mg/L)	0.1**	-	0.128 (Dup 0.149)	0.0608
Dissolved Iron (mg/L)	0.35	NA	0.218	0.573

- No Standard

\*Temperature and pH  
dependent

\*\* pH Dependent

## 4. Quality Assurance

Field duplicate samples were taken at the upstream location in September 2021, and the downstream location in April 2021 for quality assurance purposes. Results are reported as Relative Percent Difference (RPD) between the sample and duplicate sample (Appendix B).

Relative Percent Difference is calculated as:

$$RPD = 2*(A-B)/(A+B) *100$$

Where: RPD = Relative Percent Difference; A = Measured value of the first duplicate; B = Measured value of the second duplicate

Relative Percent Difference (RPD) is calculated when the result of the analyte is greater than 5x the lab report detection limit. RPD >20% between the sample and field duplicate results can indicate a problem, and >50% RPD indicates a definite problem with the sample according to the Ministry of Environment and Climate Change Strategy, 2013 BC Field Sampling Manual. The following tables summarize any RPD greater than 20% where the result is greater than 5x the lab report detection limit.

Table 3. Summary of Relative Percent Difference >20% between the September 2021 and Duplicate sample at the U/S monitoring site (E278450).

Lab Parameters	September 27, 2021	Duplicate	RPD
Manganese (Mn)-Dissolved	0.0205	0.0253	20.96%
Titanium (Ti)-Dissolved	0.00485	0.00358	30.13%
Zinc (Zn)-Dissolved	0.0015	0.0058*	117.81%

\*The dissolved concentration of Zn exceeded the total concentration. Zn was not detectable in the total metals analysis (Appendix B).

Table 4. Summary of Relative Percent Difference >20% between the April 2021 and Duplicate sample at the D/S monitoring site (E278449).

Lab Parameters	28-April-2021	Duplicate	RPD
Total Nitrogen	0.407	0.327	21.80%
Titanium (Ti)-Dissolved	0.00303	0.00372	20.44%

## 5. Trends

Trends are limited to data from 2014-2018, 2020 and 2021. No data were collected in 2019. Figures 4-7 illustrate existing data points for U/S (E274850) and D/S (E278449) for conductivity, total aluminum, total iron and total copper. Blanks in the data table indicate no data available.

Conductivity remains below 168 uS/cm, relatively low range for freshwater streams (Figure 4) and has been consistent between upstream and downstream sites over time. Field and laboratory results are comparable providing a high confidence in the field measurements

completed with the YSI meter. Specific Conductivity wasn't recorded for these sites in previous years, but will be in future years.

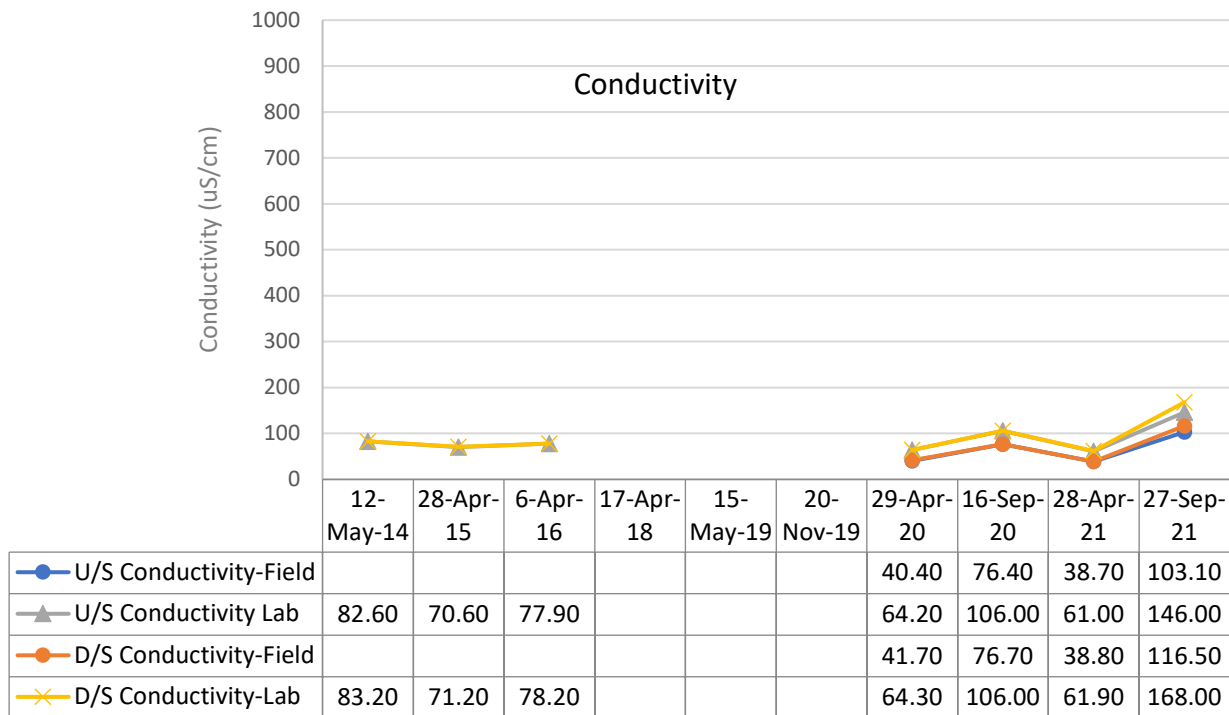


Figure 2. Specific Conductance over time.

Total Aluminum concentrations in 2021 increased, but remain lower than levels recorded in 2018. The BCWQG-DW guideline for total aluminum is 9.5 mg/L; analyte results are well below this level. (Figure 5).

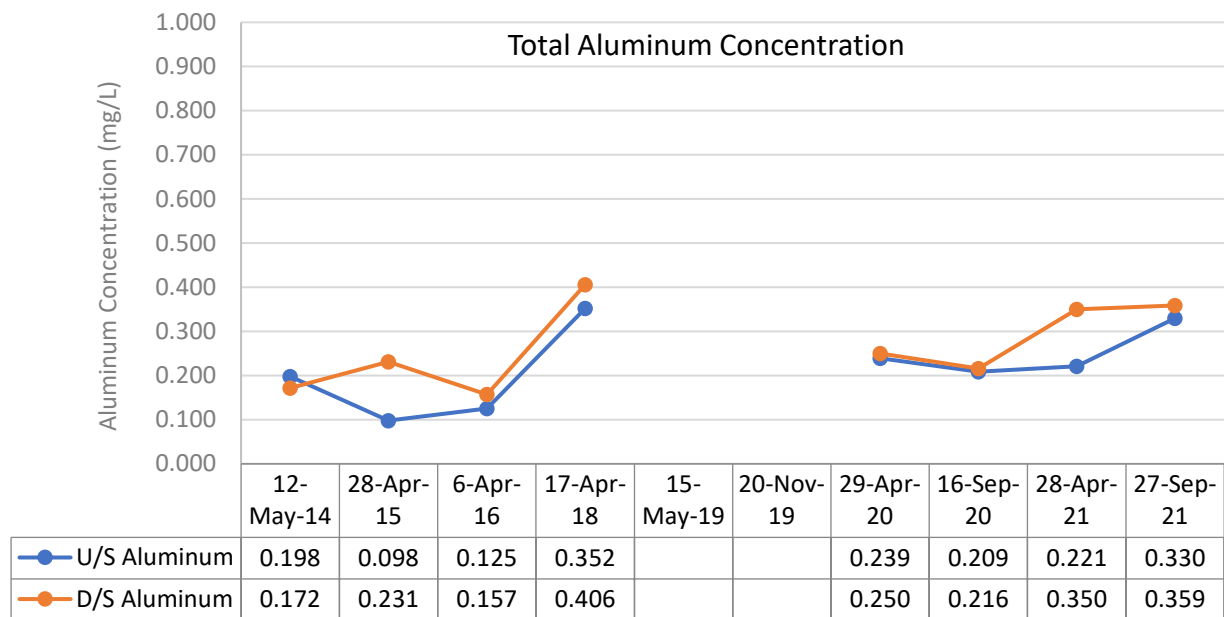


Figure 3. Total aluminum concentration over time.



Total iron concentrations were increased in September 2021 at both U/S and D/S locations, above the BCWQG-AW guideline for total iron 1.0 mg/L (Figure 6). The U/S levels were higher than D/S levels so it may be inferred that the elevated iron concentrations are not due to landfill leachate.

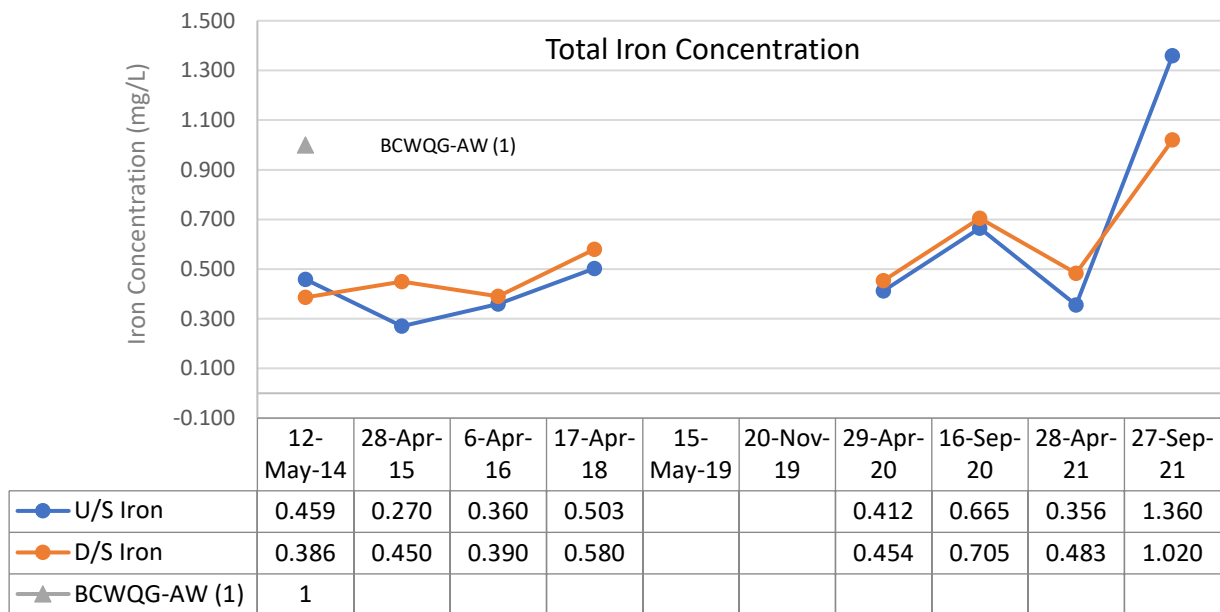


Figure 4. Total iron concentration over time.

Total Copper now requires DOC to calculate limits for the BCWQG-AW. This information was not collected in 2021. However, Total Copper concentrations have remained below the BCWQG-DW guideline for total copper of 2.0 mg/L.

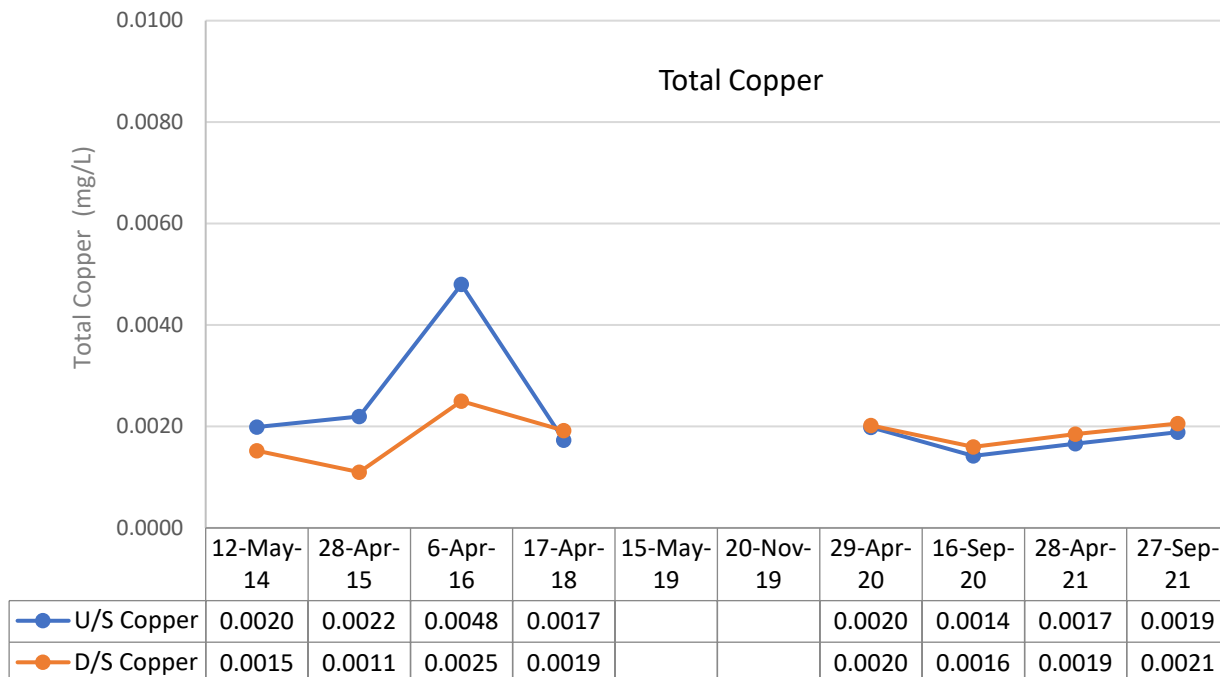


Figure 5. Total copper concentration over time.

## 6. Conclusion

Based on the data and guidelines provided for use by RDKS, and the assumption they accurately reflect the existing water quality conditions at the Kitwanga Closed Landfill and BC water quality standards respectively, the landfill operation was not causing significant water quality concerns in Unnamed Creek at the time of sampling.

Exceedances noted in September 2021 for total and dissolved iron exist at both the upstream and downstream sites, and therefore, are not likely caused by leachate. An exceedance of dissolved Aluminum was also noted in April 2021 at both the upstream and downstream locations.

Field duplicate samples with RPD >20% and 50% did occur at both locations and could indicate a possible contaminant in the sample process or lab precision limitations due to the very low concentrations being reported for a number of the parameters.

### 6.1. Recommendations

The following recommendations may be taken into consideration for future monitoring efforts:

- Twice annual surface water sampling at the U/S and D/S locations should be continued, as recommended in the OC.
- Sample timing should continue to be reviewed seasonally based on local weather conditions to facilitate successful sampling (i.e., the stream may contain water earlier in the spring; and less likely to be frozen earlier in the fall and/or time sampling during or after a rain event to capture surface water runoff).
- DOC should be collected to facilitate calculation of total Copper limits.
- As per Section 9 in the Kitwanga OC, an evaluation could be completed by a qualified professional to determine the need for an on-going environmental monitoring program and the necessity of establishing groundwater monitoring sites.
- It would be helpful to record the local weather and stream flow conditions at the time of sampling to identify any major runoff or flood events.

Report prepared by:



Carmen Tattersfield, MSc., RP.Bio.

Tattersfield Consulting

[carmen.tattersfield@gmail.com](mailto:carmen.tattersfield@gmail.com)

## Appendix A – 2021 Laboratory Data



## CERTIFICATE OF ANALYSIS

**Work Order** : **VA21A8197**  
**Client** : **Regional District of Kitimat-Stikine**  
**Contact** : H Shinton  
**Address** : # 300 - 4545 Lazelle Avenue  
Terrace BC Canada V8G 4E1  
**Telephone** : ----  
**Project** : Kitwanga Landfill Surface Water  
**PO** : ----  
**C-O-C number** : ----  
**Sampler** : H. Shinton  
**Site** :  
**Quote number** : Q62338  
**No. of samples received** : 5  
**No. of samples analysed** : 5

**Page** : 1 of 6  
**Laboratory** : Vancouver - Environmental  
**Account Manager** : Amber Springer  
**Address** : 8081 Lougheed Highway  
Burnaby BC Canada V5A 1W9  
**Telephone** : +1 604 253 4188  
**Date Samples Received** : 30-Apr-2021 11:55  
**Date Analysis Commenced** : 01-May-2021  
**Issue Date** : 07-May-2021 16:24

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

### Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Laboratory Department</i>
Ilnaz Badbezanchi	Team Leader - Metals preparation	Metals, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Metals, Burnaby, British Columbia
Miles Gropen	Department Manager - Inorganics	Inorganics, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia
Saron Kim	Analyst	Metals, Burnaby, British Columbia
Tracy Harley	Supervisor - Water Quality Instrumentation	Inorganics, Burnaby, British Columbia



## General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances  
LOR: Limit of Reporting (detection limit).

<i>Unit</i>	<i>Description</i>
-	No Unit
µS/cm	Microsiemens per centimetre
mg/L	milligrams per litre
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

## Qualifiers

<i>Qualifier</i>	<i>Description</i>
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).



## Analytical Results

Sub-Matrix: Water					Client sample ID	Upstream	Downstream	Field Blank	DUP	Travel Blank
(Matrix: Water)					Client sampling date / time	28-Apr-2021 14:17	28-Apr-2021 13:10	28-Apr-2021 15:05	28-Apr-2021 12:00	[28-Apr-2021]
Analyte	CAS Number	Method	LOR	Unit	VA21A8197-001	VA21A8197-002	VA21A8197-003	VA21A8197-004	VA21A8197-005	
					Result	Result	Result	Result	Result	
<b>Physical Tests</b>										
conductivity	----	E100	2.0	µS/cm	61.0	61.9	<2.0	60.2	----	
hardness (as CaCO3), dissolved	----	EC100	0.60	mg/L	26.8	27.6	<0.60	28.1	----	
hardness (as CaCO3), from total Ca/Mg	----	EC100A	0.60	mg/L	29.2	30.1	<0.60	29.8	<0.60	
pH	----	E108	0.10	pH units	7.51	7.53	5.56	7.54	----	
<b>Anions and Nutrients</b>										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	<0.0050	0.0056	<0.0050	0.0094	<0.0050	
nitrogen, total	7727-37-9	E366	0.030	mg/L	0.334	0.407	<0.030	0.327	----	
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0105	0.0170	<0.0020	0.0144	----	
<b>Total Metals</b>										
aluminum, total	7429-90-5	E420	0.0030	mg/L	0.221	0.350	<0.0030	0.324	<0.0030	
antimony, total	7440-36-0	E420	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00029	0.00035	<0.00010	0.00035	<0.00010	
barium, total	7440-39-3	E420	0.00010	mg/L	0.0200	0.0219	<0.00010	0.0212	<0.00010	
beryllium, total	7440-41-7	E420	0.000100	mg/L	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	
bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
boron, total	7440-42-8	E420	0.010	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	
cadmium, total	7440-43-9	E420	0.0000050	mg/L	<0.0000050	0.0000051	<0.0000050	<0.0000050	<0.0000050	
calcium, total	7440-70-2	E420	0.050	mg/L	8.08	8.21	<0.050	8.22	<0.050	
cesium, total	7440-46-2	E420	0.000010	mg/L	0.000014	0.000026	<0.000010	0.000027	<0.000010	
chromium, total	7440-47-3	E420	0.00050	mg/L	<0.00050	0.00052	<0.00050	<0.00050	<0.00050	
cobalt, total	7440-48-4	E420	0.00010	mg/L	0.00010	0.00018	<0.00010	0.00014	<0.00010	
copper, total	7440-50-8	E420	0.00050	mg/L	0.00166	0.00185	<0.00050	0.00176	<0.00050	
iron, total	7439-89-6	E420	0.010	mg/L	0.356	0.483	<0.010	0.459	<0.010	
lead, total	7439-92-1	E420	0.000050	mg/L	<0.000050	0.000076	<0.000050	0.000071	<0.000050	
lithium, total	7439-93-2	E420	0.0010	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	
magnesium, total	7439-95-4	E420	0.0050	mg/L	2.18	2.33	<0.0050	2.26	<0.0050	
manganese, total	7439-96-5	E420	0.00010	mg/L	0.0273	0.0292	<0.00010	0.0281	<0.00010	
mercury, total	7439-97-6	E508	0.0000050	mg/L	0.0000116	0.0000115	<0.0000050	0.0000117	<0.0000050	
molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.000050	0.000056	<0.000050	0.000058	<0.000050	
nickel, total	7440-02-0	E420	0.00050	mg/L	0.00056	0.00079	<0.00050	0.00063	<0.00050	



## Analytical Results

Sub-Matrix: Water (Matrix: Water)					Client sample ID	Upstream	Downstream	Field Blank	DUP	Travel Blank
Client sampling date / time					28-Apr-2021 14:17	28-Apr-2021 13:10	28-Apr-2021 15:05	28-Apr-2021 12:00	[28-Apr-2021]	
Analyte	CAS Number	Method	LOR	Unit	VA21A8197-001	VA21A8197-002	VA21A8197-003	VA21A8197-004	VA21A8197-005	
					Result	Result	Result	Result	Result	
<b>Total Metals</b>										
phosphorus, total	7723-14-0	E420	0.050	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	
potassium, total	7440-09-7	E420	0.050	mg/L	0.359	0.425	<0.050	0.388	<0.050	
rubidium, total	7440-17-7	E420	0.00020	mg/L	<0.00020	0.00025	<0.00020	0.00026	<0.00020	
selenium, total	7782-49-2	E420	0.000050	mg/L	0.000060	<0.000050	<0.000050	0.000050	<0.000050	
silicon, total	7440-21-3	E420	0.10	mg/L	3.28	3.55	<0.10	3.37	<0.10	
silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	
sodium, total	17341-25-2	E420	0.050	mg/L	2.76	3.02	<0.050	2.92	<0.050	
strontium, total	7440-24-6	E420	0.00020	mg/L	0.0853	0.0846	<0.00020	0.0852	<0.00020	
sulfur, total	7704-34-9	E420	0.50	mg/L	<0.50	<0.50	<0.50	<0.50	<0.50	
tellurium, total	13494-80-9	E420	0.00020	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	
thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	
thorium, total	7440-29-1	E420	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
titanium, total	7440-32-6	E420	0.00030	mg/L	0.00422	<0.00630 <sup>DLM</sup>	<0.00030	0.00643	<0.00030	
tungsten, total	7440-33-7	E420	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
uranium, total	7440-61-1	E420	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	
vanadium, total	7440-62-2	E420	0.00050	mg/L	0.00065	0.00095	<0.00050	0.00088	<0.00050	
zinc, total	7440-66-6	E420	0.0030	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	
zirconium, total	7440-67-7	E420	0.00020	mg/L	0.00053	0.00051	<0.00020	0.00047	<0.00020	
<b>Dissolved Metals</b>										
aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	0.150	0.128	<0.0010	0.149	----	
antimony, dissolved	7440-36-0	E421	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	----	
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00026	0.00024	<0.00010	0.00025	----	
barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0182	0.0181	<0.00010	0.0185	----	
beryllium, dissolved	7440-41-7	E421	0.000100	mg/L	<0.000100	<0.000100	<0.000100	<0.000100	----	
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	----	
boron, dissolved	7440-42-8	E421	0.010	mg/L	<0.010	<0.010	<0.010	<0.010	----	
cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	<0.0000050	<0.0000050	<0.0000050	<0.0000050	----	
calcium, dissolved	7440-70-2	E421	0.050	mg/L	7.47	7.65	<0.050	7.78	----	
cesium, dissolved	7440-46-2	E421	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	----	
chromium, dissolved	7440-47-3	E421	0.00050	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	----	







## Analytical Results

Sub-Matrix: Water (Matrix: Water)					Client sample ID	Upstream	Downstream	Field Blank	DUP	Travel Blank
Client sampling date / time					28-Apr-2021 14:17	28-Apr-2021 13:10	28-Apr-2021 15:05	28-Apr-2021 12:00	[28-Apr-2021]	
Analyte	CAS Number	Method	LOR	Unit	VA21A8197-001	VA21A8197-002	VA21A8197-003	VA21A8197-004	VA21A8197-005	
					Result	Result	Result	Result	Result	
<b>Aggregate Organics</b>										
biochemical oxygen demand [BOD]	----	E550	2.0	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	

Please refer to the General Comments section for an explanation of any qualifiers detected.



## General Comments

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Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances  
LOR: Limit of Reporting (detection limit).

<i>Unit</i>	<i>Description</i>
-	No Unit
µS/cm	Microsiemens per centimetre
mg/L	milligrams per litre
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

## Qualifiers

<i>Qualifier</i>	<i>Description</i>
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
DTC	Dissolved concentration exceeds total. Results were confirmed by re-analysis.



## Analytical Results

Sub-Matrix: Water					Client sample ID	Upstream	Downstream	Field Blank	DUP	Travel blank
(Matrix: Water)					Client sampling date / time	27-Sep-2021 08:08	27-Sep-2021 09:11	27-Sep-2021 09:37	27-Sep-2021 12:00	27-Sep-2021
Analyte	CAS Number	Method	LOR	Unit	VA21C1293-001	VA21C1293-002	VA21C1293-003	VA21C1293-004	VA21C1293-005	
					Result	Result	Result	Result	Result	
<b>Physical Tests</b>										
conductivity	----	E100	2.0	µS/cm	146	168	<2.0	148	----	
hardness (as CaCO3), dissolved	----	EC100	0.60	mg/L	62.1	66.5	<0.60	58.6	----	
hardness (as CaCO3), from total Ca/Mg	----	EC100A	0.60	mg/L	60.2	67.1	<0.60	59.7	<0.60	
pH	----	E108	0.10	pH units	7.89	7.96	4.92	7.89	----	
<b>Anions and Nutrients</b>										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	0.0125	<0.0050	<0.0050	0.0109	<0.0050	
nitrogen, total	7727-37-9	E366	0.030	mg/L	0.534	0.414	<0.030	0.536	----	
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0364	0.0192	<0.0020	0.0341	----	
<b>Total Metals</b>										
aluminum, total	7429-90-5	E420	0.0030	mg/L	0.330	0.359	<0.0030	0.333	<0.0030	
antimony, total	7440-36-0	E420	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00104	0.00073	<0.00010	0.00101	<0.00010	
barium, total	7440-39-3	E420	0.00010	mg/L	0.0352	0.0406	<0.00010	0.0341	<0.00010	
beryllium, total	7440-41-7	E420	0.000100	mg/L	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	
bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
boron, total	7440-42-8	E420	0.010	mg/L	<0.010	0.024	<0.010	<0.010	<0.010	
cadmium, total	7440-43-9	E420	0.0000050	mg/L	0.0000050	0.0000083	<0.0000050	0.0000062	<0.0000050	
calcium, total	7440-70-2	E420	0.050	mg/L	16.9	18.7	<0.050	16.9	<0.050	
cesium, total	7440-46-2	E420	0.000010	mg/L	0.000034	0.000042	<0.000010	0.000037	<0.000010	
chromium, total	7440-47-3	E420	0.00050	mg/L	0.00051	0.00052	<0.00050	<0.00050	<0.00050	
cobalt, total	7440-48-4	E420	0.00010	mg/L	0.00021	0.00020	<0.00010	0.00019	<0.00010	
copper, total	7440-50-8	E420	0.00050	mg/L	0.00189	0.00206	<0.00050	0.00187	<0.00050	
iron, total	7439-89-6	E420	0.010	mg/L	1.36	1.02	<0.010	1.35	<0.010	
lead, total	7439-92-1	E420	0.000050	mg/L	0.000144	0.000164	<0.000050	0.000150	<0.000050	
lithium, total	7439-93-2	E420	0.0010	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	
magnesium, total	7439-95-4	E420	0.0050	mg/L	4.36	4.95	<0.0050	4.26	<0.0050	
manganese, total	7439-96-5	E420	0.00010	mg/L	0.0457	0.0172	<0.00010	0.0464	<0.00010	
mercury, total	7439-97-6	E508	0.0000050	mg/L	0.0000129	<0.0000050	<0.0000050	<0.0000050	<0.0000050	
molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.000154	0.000108	<0.000050	0.000143	<0.000050	
nickel, total	7440-02-0	E420	0.00050	mg/L	0.00128	0.00132	<0.00050	0.00127	<0.00050	



## Analytical Results

Sub-Matrix: Water (Matrix: Water)					Client sample ID	Upstream	Downstream	Field Blank	DUP	Travel blank
Client sampling date / time					27-Sep-2021 08:08	27-Sep-2021 09:11	27-Sep-2021 09:37	27-Sep-2021 12:00	27-Sep-2021	
Analyte	CAS Number	Method	LOR	Unit	VA21C1293-001	VA21C1293-002	VA21C1293-003	VA21C1293-004	VA21C1293-005	
					Result	Result	Result	Result	Result	
<b>Total Metals</b>										
phosphorus, total	7723-14-0	E420	0.050	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	
potassium, total	7440-09-7	E420	0.050	mg/L	1.04	1.02	<0.050	1.02	<0.050	
rubidium, total	7440-17-7	E420	0.00020	mg/L	0.00057	0.00048	<0.00020	0.00057	<0.00020	
selenium, total	7782-49-2	E420	0.000050	mg/L	0.000073	0.000089	<0.000050	0.000092	<0.000050	
silicon, total	7440-21-3	E420	0.10	mg/L	3.77	3.92	<0.10	3.62	<0.10	
silver, total	7440-22-4	E420	0.000010	mg/L	0.000011	<0.000010	<0.000010	0.000012	<0.000010	
sodium, total	17341-25-2	E420	0.050	mg/L	7.24	8.21	<0.050	6.94	<0.050	
strontium, total	7440-24-6	E420	0.00020	mg/L	0.174	0.184	<0.00020	0.167	<0.00020	
sulfur, total	7704-34-9	E420	0.50	mg/L	<0.50	<0.50	<0.50	<0.50	<0.50	
tellurium, total	13494-80-9	E420	0.00020	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	
thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	
thorium, total	7440-29-1	E420	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
titanium, total	7440-32-6	E420	0.00030	mg/L	0.00594	0.00717	<0.00030	0.00573	<0.00030	
tungsten, total	7440-33-7	E420	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
uranium, total	7440-61-1	E420	0.000010	mg/L	<0.000010	0.000018	<0.000010	0.000011	<0.000010	
vanadium, total	7440-62-2	E420	0.00050	mg/L	0.00113	0.00113	<0.00050	0.00114	<0.00050	
zinc, total	7440-66-6	E420	0.0030	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	
zirconium, total	7440-67-7	E420	0.00020	mg/L	0.00030	0.00029	<0.00020	0.00026	<0.00020	
<b>Dissolved Metals</b>										
aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	0.0809	0.0608	<0.0010	0.122	----	
antimony, dissolved	7440-36-0	E421	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	----	
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00079	0.00051	<0.00010	0.00074	----	
barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0303	0.0340	<0.00010	0.0321	----	
beryllium, dissolved	7440-41-7	E421	0.000100	mg/L	<0.000100	<0.000100	<0.000100	<0.000100	----	
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	----	
boron, dissolved	7440-42-8	E421	0.010	mg/L	<0.010	0.021	<0.010	<0.010	----	
cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	0.0000052	0.0000058	<0.0000050	0.0000083	----	
calcium, dissolved	7440-70-2	E421	0.050	mg/L	18.0	18.8	<0.050	16.6	----	
cesium, dissolved	7440-46-2	E421	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	----	
chromium, dissolved	7440-47-3	E421	0.00050	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	----	



## Analytical Results

Sub-Matrix: Water (Matrix: Water)					Client sample ID	Upstream	Downstream	Field Blank	DUP	Travel blank
Client sampling date / time					27-Sep-2021 08:08	27-Sep-2021 09:11	27-Sep-2021 09:37	27-Sep-2021 12:00	27-Sep-2021	
Analyte	CAS Number	Method	LOR	Unit	VA21C1293-001	VA21C1293-002	VA21C1293-003	VA21C1293-004	VA21C1293-005	
					Result	Result	Result	Result	Result	
<b>Dissolved Metals</b>										
cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	0.00010	<0.00010	<0.00010	0.00012	----	
copper, dissolved	7440-50-8	E421	0.00020	mg/L	0.00143	0.00156	<0.00020	0.00135	----	
iron, dissolved	7439-89-6	E421	0.010	mg/L	0.850	0.573	<0.010	0.827	----	
lead, dissolved	7439-92-1	E421	0.000050	mg/L	0.000139	0.000074	<0.000050	0.000097	----	
lithium, dissolved	7439-93-2	E421	0.0010	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	----	
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	4.17	4.74	<0.0050	4.17	----	
manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.0205	0.00403	<0.00010	0.0253	----	
mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	<0.0000050	<0.0000050	----	
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.000155	0.000112	<0.000050	0.000145	----	
nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.00094	0.00089	<0.00050	0.00082	----	
phosphorus, dissolved	7723-14-0	E421	0.050	mg/L	<0.050	<0.050	<0.050	<0.050	----	
potassium, dissolved	7440-09-7	E421	0.050	mg/L	0.980	0.935	<0.050	0.978	----	
rubidium, dissolved	7440-17-7	E421	0.00020	mg/L	0.00041	0.00024	<0.00020	0.00040	----	
selenium, dissolved	7782-49-2	E421	0.000050	mg/L	0.000082	0.000091	<0.000050	0.000091	----	
silicon, dissolved	7440-21-3	E421	0.050	mg/L	3.60	3.55	<0.050	3.54	----	
silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	----	
sodium, dissolved	17341-25-2	E421	0.050	mg/L	6.94	8.04	<0.050	6.80	----	
strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.166	0.181	<0.00020	0.166	----	
sulfur, dissolved	7704-34-9	E421	0.50	mg/L	<0.50	<0.50	<0.50	<0.50	----	
tellurium, dissolved	13494-80-9	E421	0.00020	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	----	
thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	----	
thorium, dissolved	7440-29-1	E421	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	----	
tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	----	
titanium, dissolved	7440-32-6	E421	0.00030	mg/L	0.00485	0.00260	<0.00030	0.00358	----	
tungsten, dissolved	7440-33-7	E421	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	----	
uranium, dissolved	7440-61-1	E421	0.000010	mg/L	<0.000010	0.000015	<0.000010	<0.000010	----	
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	0.00052	<0.00050	<0.00050	<0.00050	----	
zinc, dissolved	7440-66-6	E421	0.0010	mg/L	0.0015	<0.0010	<0.0010	0.0058 <sup>DTC</sup>	----	
zirconium, dissolved	7440-67-7	E421	0.00020	mg/L	0.00043	0.00028	<0.00020	<0.00080 <sup>DLM</sup>	----	
dissolved mercury filtration location	----	EP509	-	-	Field	Field	Field	Field	----	
dissolved metals filtration location	----	EP421	-	-	Field	Field	Field	Field	----	



## Analytical Results

Sub-Matrix: Water (Matrix: Water)					Client sample ID	Upstream	Downstream	Field Blank	DUP	Travel blank
Client sampling date / time					27-Sep-2021 08:08	27-Sep-2021 09:11	27-Sep-2021 09:37	27-Sep-2021 12:00	27-Sep-2021	
Analyte	CAS Number	Method	LOR	Unit	VA21C1293-001	VA21C1293-002	VA21C1293-003	VA21C1293-004	VA21C1293-005	
					Result	Result	Result	Result	Result	
<b>Aggregate Organics</b>										
biochemical oxygen demand [BOD]	----	E550	2.0	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	

Please refer to the General Comments section for an explanation of any qualifiers detected.



CERTIFICATE OF ANALYSIS

Work Order : **VA21C1293**  
Client : **Regional District of Kitimat-Stikine**  
Contact : Hannah Shinton  
Address : # 300 - 4545 Lazelle Avenue  
Terrace BC Canada V8G 4E1  
Telephone : ----  
Project : Kitwanga Landfill Surface Water  
PO : ----  
C-O-C number : ----  
Sampler : H. Shinton  
Site :  
Quote number : Q62338  
No. of samples received : 5  
No. of samples analysed : 5

Page : 1 of 6  
Laboratory : Vancouver - Environmental  
Account Manager : Amber Springer  
Address : 8081 Lougheed Highway  
Burnaby BC Canada V5A 1W9  
Telephone : +1 604 253 4188  
Date Samples Received : 27-Sep-2021 21:15  
Date Analysis Commenced : 29-Sep-2021  
Issue Date : 14-Oct-2021 13:42

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

**Signatories**

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Laboratory Department</i>
Angela Ren	Team Leader - Metals	Metals, Burnaby, British Columbia
Caleb Deroche	Lab Analyst	Metals, Burnaby, British Columbia
Dee Lee	Analyst	Metals, Burnaby, British Columbia
Jay Jang	Lab Assistant	Metals, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Lindsay Gung	Supervisor - Water Chemistry	Inorganics, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia





## General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances  
LOR: Limit of Reporting (detection limit).

<i>Unit</i>	<i>Description</i>
-	No Unit
µS/cm	Microsiemens per centimetre
mg/L	milligrams per litre
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

## Qualifiers

<i>Qualifier</i>	<i>Description</i>
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
DTC	Dissolved concentration exceeds total. Results were confirmed by re-analysis.



## Analytical Results

Sub-Matrix: Water					Client sample ID	Upstream	Downstream	Field Blank	DUP	Travel blank
(Matrix: Water)					Client sampling date / time	27-Sep-2021 08:08	27-Sep-2021 09:11	27-Sep-2021 09:37	27-Sep-2021 12:00	27-Sep-2021
Analyte	CAS Number	Method	LOR	Unit	VA21C1293-001	VA21C1293-002	VA21C1293-003	VA21C1293-004	VA21C1293-005	
					Result	Result	Result	Result	Result	
<b>Physical Tests</b>										
conductivity	----	E100	2.0	µS/cm	146	168	<2.0	148	----	
hardness (as CaCO <sub>3</sub> ), dissolved	----	EC100	0.60	mg/L	62.1	66.5	<0.60	58.6	----	
hardness (as CaCO <sub>3</sub> ), from total Ca/Mg	----	EC100A	0.60	mg/L	60.2	67.1	<0.60	59.7	<0.60	
pH	----	E108	0.10	pH units	7.89	7.96	4.92	7.89	----	
<b>Anions and Nutrients</b>										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	0.0125	<0.0050	<0.0050	0.0109	<0.0050	
nitrogen, total	7727-37-9	E366	0.030	mg/L	0.534	0.414	<0.030	0.536	----	
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0364	0.0192	<0.0020	0.0341	----	
<b>Total Metals</b>										
aluminum, total	7429-90-5	E420	0.0030	mg/L	0.330	0.359	<0.0030	0.333	<0.0030	
antimony, total	7440-36-0	E420	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00104	0.00073	<0.00010	0.00101	<0.00010	
barium, total	7440-39-3	E420	0.00010	mg/L	0.0352	0.0406	<0.00010	0.0341	<0.00010	
beryllium, total	7440-41-7	E420	0.000100	mg/L	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	
bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
boron, total	7440-42-8	E420	0.010	mg/L	<0.010	0.024	<0.010	<0.010	<0.010	
cadmium, total	7440-43-9	E420	0.0000050	mg/L	0.0000050	0.0000083	<0.0000050	0.0000062	<0.0000050	
calcium, total	7440-70-2	E420	0.050	mg/L	16.9	18.7	<0.050	16.9	<0.050	
cesium, total	7440-46-2	E420	0.000010	mg/L	0.000034	0.000042	<0.000010	0.000037	<0.000010	
chromium, total	7440-47-3	E420	0.00050	mg/L	0.00051	0.00052	<0.00050	<0.00050	<0.00050	
cobalt, total	7440-48-4	E420	0.00010	mg/L	0.00021	0.00020	<0.00010	0.00019	<0.00010	
copper, total	7440-50-8	E420	0.00050	mg/L	0.00189	0.00206	<0.00050	0.00187	<0.00050	
iron, total	7439-89-6	E420	0.010	mg/L	1.36	1.02	<0.010	1.35	<0.010	
lead, total	7439-92-1	E420	0.000050	mg/L	0.000144	0.000164	<0.000050	0.000150	<0.000050	
lithium, total	7439-93-2	E420	0.0010	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	
magnesium, total	7439-95-4	E420	0.0050	mg/L	4.36	4.95	<0.0050	4.26	<0.0050	
manganese, total	7439-96-5	E420	0.00010	mg/L	0.0457	0.0172	<0.00010	0.0464	<0.00010	
mercury, total	7439-97-6	E508	0.0000050	mg/L	0.0000129	<0.0000050	<0.0000050	<0.0000050	<0.0000050	
molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.000154	0.000108	<0.000050	0.000143	<0.000050	
nickel, total	7440-02-0	E420	0.00050	mg/L	0.00128	0.00132	<0.00050	0.00127	<0.00050	



## Analytical Results

Sub-Matrix: Water (Matrix: Water)					Client sample ID	Upstream	Downstream	Field Blank	DUP	Travel blank
Client sampling date / time					27-Sep-2021 08:08	27-Sep-2021 09:11	27-Sep-2021 09:37	27-Sep-2021 12:00	27-Sep-2021	
Analyte	CAS Number	Method	LOR	Unit	VA21C1293-001	VA21C1293-002	VA21C1293-003	VA21C1293-004	VA21C1293-005	
					Result	Result	Result	Result	Result	
<b>Total Metals</b>										
phosphorus, total	7723-14-0	E420	0.050	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	
potassium, total	7440-09-7	E420	0.050	mg/L	1.04	1.02	<0.050	1.02	<0.050	
rubidium, total	7440-17-7	E420	0.00020	mg/L	0.00057	0.00048	<0.00020	0.00057	<0.00020	
selenium, total	7782-49-2	E420	0.000050	mg/L	0.000073	0.000089	<0.000050	0.000092	<0.000050	
silicon, total	7440-21-3	E420	0.10	mg/L	3.77	3.92	<0.10	3.62	<0.10	
silver, total	7440-22-4	E420	0.000010	mg/L	0.000011	<0.000010	<0.000010	0.000012	<0.000010	
sodium, total	17341-25-2	E420	0.050	mg/L	7.24	8.21	<0.050	6.94	<0.050	
strontium, total	7440-24-6	E420	0.00020	mg/L	0.174	0.184	<0.00020	0.167	<0.00020	
sulfur, total	7704-34-9	E420	0.50	mg/L	<0.50	<0.50	<0.50	<0.50	<0.50	
tellurium, total	13494-80-9	E420	0.00020	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	
thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	
thorium, total	7440-29-1	E420	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
titanium, total	7440-32-6	E420	0.00030	mg/L	0.00594	0.00717	<0.00030	0.00573	<0.00030	
tungsten, total	7440-33-7	E420	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
uranium, total	7440-61-1	E420	0.000010	mg/L	<0.000010	0.000018	<0.000010	0.000011	<0.000010	
vanadium, total	7440-62-2	E420	0.00050	mg/L	0.00113	0.00113	<0.00050	0.00114	<0.00050	
zinc, total	7440-66-6	E420	0.0030	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	
zirconium, total	7440-67-7	E420	0.00020	mg/L	0.00030	0.00029	<0.00020	0.00026	<0.00020	
<b>Dissolved Metals</b>										
aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	0.0809	0.0608	<0.0010	0.122	----	
antimony, dissolved	7440-36-0	E421	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	----	
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00079	0.00051	<0.00010	0.00074	----	
barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0303	0.0340	<0.00010	0.0321	----	
beryllium, dissolved	7440-41-7	E421	0.000100	mg/L	<0.000100	<0.000100	<0.000100	<0.000100	----	
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	----	
boron, dissolved	7440-42-8	E421	0.010	mg/L	<0.010	0.021	<0.010	<0.010	----	
cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	0.0000052	0.0000058	<0.0000050	0.0000083	----	
calcium, dissolved	7440-70-2	E421	0.050	mg/L	18.0	18.8	<0.050	16.6	----	
cesium, dissolved	7440-46-2	E421	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	----	
chromium, dissolved	7440-47-3	E421	0.00050	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	----	



## Analytical Results

Sub-Matrix: Water (Matrix: Water)					Client sample ID	Upstream	Downstream	Field Blank	DUP	Travel blank
					Client sampling date / time	27-Sep-2021 08:08	27-Sep-2021 09:11	27-Sep-2021 09:37	27-Sep-2021 12:00	27-Sep-2021
Analyte	CAS Number	Method	LOR	Unit	VA21C1293-001	VA21C1293-002	VA21C1293-003	VA21C1293-004	VA21C1293-005	
					Result	Result	Result	Result	Result	
<b>Dissolved Metals</b>										
cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	0.00010	<0.00010	<0.00010	0.00012	---	
copper, dissolved	7440-50-8	E421	0.00020	mg/L	0.00143	0.00156	<0.00020	0.00135	---	
iron, dissolved	7439-89-6	E421	0.010	mg/L	0.850	0.573	<0.010	0.827	---	
lead, dissolved	7439-92-1	E421	0.000050	mg/L	0.000139	0.000074	<0.000050	0.000097	---	
lithium, dissolved	7439-93-2	E421	0.0010	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	---	
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	4.17	4.74	<0.0050	4.17	---	
manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.0205	0.00403	<0.00010	0.0253	---	
mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	<0.0000050	<0.0000050	---	
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.000155	0.000112	<0.000050	0.000145	---	
nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.00094	0.00089	<0.00050	0.00082	---	
phosphorus, dissolved	7723-14-0	E421	0.050	mg/L	<0.050	<0.050	<0.050	<0.050	---	
potassium, dissolved	7440-09-7	E421	0.050	mg/L	0.980	0.935	<0.050	0.978	---	
rubidium, dissolved	7440-17-7	E421	0.00020	mg/L	0.00041	0.00024	<0.00020	0.00040	---	
selenium, dissolved	7782-49-2	E421	0.000050	mg/L	0.000082	0.000091	<0.000050	0.000091	---	
silicon, dissolved	7440-21-3	E421	0.050	mg/L	3.60	3.55	<0.050	3.54	---	
silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	---	
sodium, dissolved	17341-25-2	E421	0.050	mg/L	6.94	8.04	<0.050	6.80	---	
strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.166	0.181	<0.00020	0.166	---	
sulfur, dissolved	7704-34-9	E421	0.50	mg/L	<0.50	<0.50	<0.50	<0.50	---	
tellurium, dissolved	13494-80-9	E421	0.00020	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	---	
thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	---	
thorium, dissolved	7440-29-1	E421	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	---	
tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	---	
titanium, dissolved	7440-32-6	E421	0.00030	mg/L	0.00485	0.00260	<0.00030	0.00358	---	
tungsten, dissolved	7440-33-7	E421	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	---	
uranium, dissolved	7440-61-1	E421	0.000010	mg/L	<0.000010	0.000015	<0.000010	<0.000010	---	
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	0.00052	<0.00050	<0.00050	<0.00050	---	
zinc, dissolved	7440-66-6	E421	0.0010	mg/L	0.0015	<0.0010	<0.0010	0.0058 <sup>DTC</sup>	---	
zirconium, dissolved	7440-67-7	E421	0.00020	mg/L	0.00043	0.00028	<0.00020	<0.00080 <sup>DLM</sup>	---	
dissolved mercury filtration location	----	EP509	-	-	Field	Field	Field	Field	---	
dissolved metals filtration location	----	EP421	-	-	Field	Field	Field	Field	---	



## Analytical Results

Sub-Matrix: Water (Matrix: Water)					Client sample ID	Upstream	Downstream	Field Blank	DUP	Travel blank
Client sampling date / time					27-Sep-2021 08:08	27-Sep-2021 09:11	27-Sep-2021 09:37	27-Sep-2021 12:00	27-Sep-2021	
Analyte	CAS Number	Method	LOR	Unit	VA21C1293-001	VA21C1293-002	VA21C1293-003	VA21C1293-004	VA21C1293-005	
					Result	Result	Result	Result	Result	
<b>Aggregate Organics</b>										
biochemical oxygen demand [BOD]	----	E550	2.0	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	

Please refer to the General Comments section for an explanation of any qualifiers detected.

Appendix B – Compiled Data

**Table 1. Analytical Results for General Parameters and Anions & Nutrients**

Work Order	BCWQG AW	BCWQG DW	Units	VA21A8197					Lab Report Limit	Lab Report Limit x 5	RPD	DF	VA21C1293					Lab Report Limit	Lab Report Limit x 5	RPD	DF
				us	ds	Field Blank	dup	Travel Blank					us	ds	Field Blank	dup	Travel Blank				
				28-Apr-21	28-Apr-21	28-Apr-21	28-Apr-21	28-Apr-21					27-Sep-2021	27-Sep-2021	27-Sep-2021	27-Sep-2021	27-Sep-2021				
				14:17	13:10	15:05	12:00	00:00					08:08	09:11	09:37	12:00	00:00				
ALS Sample ID				VA21A8197-001	VA21A8197-002	VA21A8197-003	VA21A8197-004	VA21A8197-005					VA21C1293-001	VA21C1293-002	VA21C1293-003	VA21C1293-004	VA21C1293-005				
<b>Physical Tests</b>																					
Conductivity			mg/L	61	61.9	<2.0	60.2		2	10	2.8%	0.85	146	168	<2.0	148		2	10	1.4%	1.00
alkalinity, total (as CaCO3)			mg/L																		
hardness (as CaCO3), dissolved			mg/L	26.8	27.6	<0.60	28.1		0.6	3	1.8%	0.83	62.1	66.5	<0.60	58.6		0.6	3	5.8%	5.83
hardness (as CaCO3), from total Ca/Mg			mg/L	29.2	30.1	<0.60	29.8	<0.60	0.6	3	1.0%	0.50	60.2	67.1	<0.60	59.7		0.6	3	0.8%	0.83
pH	6.5-9.0		pH Units	7.51	7.53	5.56	7.54		0.1	0.5	0.1%	0.10	7.89	7.96	4.92	7.89		0.1	0.5	0.0%	0.00
<b>Field Parameters</b>																					
Temperature				6	5.7								10.4	10.3							
Conductivity				38.7	38.8								103.1	116.5							
pH				7.26	7.3								7.32	7.5							
Dissolved Oxygen %				102	102								100	93							
Dissolved Oxygen				12.2	12.4								10.6	9.9							
ORP				249.9	241.2								260	240.6							
<b>Anions and Nutrients</b>																					
Ammonia, total (as N)	Temperature and pH Dependent Look up in guideline table for temp and pH		mg/L	<0.0050	0.0056	<0.0050	0.0094	<0.0050	0.005	0.025	50.7%	0.76	0.0125	<0.0050	<0.0050	0.0109	<0.0050	0.005	0.025	NA	NA
BOD			mg/L	<2.0	<2.0	<2.0	<2.0	<2.0					<2.0	<2.0	<2.0	<2.0	<2.0				
Nitrogen, total			mg/L	0.334	0.407	<0.030	0.327		0.03	0.15	21.8%	2.67	0.534	0.414	<0.030	0.536		0.03	0.15	0.4%	0.07
Phosphorus Total			mg/L	0.0105	0.017	<0.0020	0.0144		0.002	0.01	16.6%	1.30	0.0364	0.0192	<0.0020	0.0341		0.002	0.01	6.5%	7.45

Table 2. Analytical Results for Total metals in Surface Water

Work Order Cinet Sample ID	BCWQG AW	BCWQG DW	Units	VA21A8197					Lab Report Limit	Lab Report Limit x 5	RPD	DF	VA21C1293					Lab Report Limit	Lab Report Limit x 5	RPD	DF
				us	ds	Field Blank	dup	Travel Blank					us	ds	Field Blank	dup	Travel Blank				
				28-Apr-21	28-Apr-21	28-Apr-21	28-Apr-21	28-Apr-21					27-Sep-2021	27-Sep-2021	27-Sep-2021	27-Sep-2021	27-Sep-2021				
				14:17	13:10	15:05	12:00	00:00					08:08	09:11	09:37	12:00	00:00				
ALS Sample ID				VA21A8197-001	VA21A8197-002	VA21A8197-003	VA21A8197-004	VA21A8197-005					VA21C1293-001	VA21C1293-002	VA21C1293-003	VA21C1293-004	VA21C1293-005				
<b>Total Metals</b>																					
aluminum, total	pH Dependent Applies to only the dissolved fraction	9.5	mg/L	0.221	0.35	<0.0030	0.324	<0.0030	0.003	0.015	7.7%	8.67	0.33	0.359	<0.0030	0.333	<0.0030	0.003	0.015	0.9%	1.00
antimony, total		0.006	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.0001	0.0005	NA	NA	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.0001	0.0005	NA	NA
arsenic, total	0.005	0.01	mg/L	0.00029	0.00035	<0.00010	0.00035	<0.00010	0.0001	0.0005	0.0%	0.00	0.00104	0.00073	<0.00010	0.00101	<0.00010	0.0001	0.0005	2.9%	0.30
barium, total			mg/L	0.02	0.0219	<0.00010	0.0212	<0.00010	0.0001	0.0005	3.2%	7.00	0.0352	0.0406	<0.00010	0.0341	<0.00010	0.0001	0.0005	3.2%	11.00
beryllium, total			mg/L	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	0.0001	0.0005	NA	NA	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	0.0001	0.0005	NA	NA
bismuth, total			mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.00005	0.00025	NA	NA	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.00005	0.00025	NA	NA
boron, total	Long Term Chronic 1.2	5	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.01	0.05	NA	NA	<0.010	0.024	<0.010	<0.010	<0.010	0.01	0.05	NA	NA
cadmium, total	Hardness Dependent Applies to only the dissolved fraction Short Term	0.005	mg/L	<0.0000050	0.0000051	<0.0000050	<0.0000050	<0.0000050	0.000005	0.000025	NA	NA	0.000005	0.0000083	<0.0000050	0.0000062	<0.0000050	0.000005	0.000025	21.4%	0.24
	Hardness- Dependent BCAWQG to protect AW (3) (instant max)		mg/L	0.152	0.156	#VALUE!	0.159	#NUM!		0	NA	NA	0.360	0.386	#VALUE!	0.339	#NUM!			NA	NA
	Hardness- Dependent BCAWQG to protect AW (3) (30-d average)		mg/L	0.080	0.082	#VALUE!	0.083	#NUM!		0	NA	NA	0.149	0.157	#VALUE!	0.143	#NUM!			NA	NA
calcium, total			mg/L	8.08	8.21	<0.050	8.22	<0.050	0.05	0.25	0.1%	0.20	16.9	18.7	<0.050	16.9	<0.050	0.05	0.25	0.0%	0.00
cesium, total				0.000014	0.000026	<0.000010	0.000027	<0.000010	0.00001	0.00005	3.8%	0.10	0.000034	0.000042	<0.000010	0.000037	<0.000010	0.00001	0.00005	8.5%	0.30
chromium, total		0.05	mg/L	<0.00050	0.00052	<0.00050	<0.00050	<0.00050	0.0005	0.0025	NA	NA	0.00051	0.00052	<0.00050	<0.00050	<0.00050	0.0005	0.0025	NA	NA
cobalt, total	0.110 (Short Term), 0.004 (Long Term Average)	0.001	mg/L	0.0001	0.00018	<0.00010	0.00014	<0.00010	0.0001	0.0005	25.0%	0.40	0.00021	0.0002	<0.00010	0.00019	<0.00010	0.0001	0.0005	10.0%	0.20
copper, total	DOC Dependent - Biotic Ligand Model equation Freeware from Ministry ENV BC Applies to only the dissolved fraction. Standards are unique to each sampling event	2	mg/L	0.00166	0.00185	<0.00050	0.00176	<0.00050	0.0005	0.0025	5.0%	0.18	0.00189	0.00206	<0.00050	0.00187	<0.00050	0.0005	0.0025	1.1%	0.04
iron, total	Short Term Acute 1	NA	mg/L	0.356	0.483	<0.010	0.459	<0.010	0.01	0.05	5.1%	2.40	1.36	1.02	<0.010	1.35	<0.010	0.01	0.05	0.7%	1.00
lead, total	Hardness Dependent - Total Only	0.005	mg/L	<0.000050	0.000076	<0.000050	0.000071	<0.000050	0.00005	0.00025	6.8%	0.10	0.000144	0.000164	<0.000050	0.00015	<0.000050	0.00005	0.00025	4.1%	0.12
	Hardness Dependent Short Term Acute		mg/L	0.015274	0.015856	#VALUE!	0.016223	0.000003			NA	NA	0.044518	0.048572	#VALUE!	0.041349	0.000003			NA	NA
	Hardness Dependent Long Term Chronic		mg/L	0.003906	0.003929	#VALUE!	0.003943	#NUM!			NA	NA	0.005047	0.005205	#VALUE!	0.004923	#NUM!			NA	NA
lithium, total			mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	0.005	NA	NA	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	0.005	NA	NA
magnesium, total			mg/L	2.18	2.33	<0.0050	2.26	<0.0050	0.005	0.025	3.1%	14.00	4.36	4.95	<0.0050	4.26	<0.0050	0.005	0.025	2.3%	20.00



Table 2. Analytical Results for Total metals in Surface Water

Work Order Cinet Sample ID	BCWQG AW	BCWQG DW	Units	VA21A8197					Lab Report Limit	Lab Report Limit x 5	RPD	DF	VA21C1293					Lab Report Limit	Lab Report Limit x 5	RPD	DF	
				us	ds	Field Blank	dup	Travel Blank					us	ds	Field Blank	dup	Travel Blank					
				28-Apr-21	28-Apr-21	28-Apr-21	28-Apr-21	28-Apr-21					27-Sep-2021	27-Sep-2021	27-Sep-2021	27-Sep-2021	27-Sep-2021					
				14:17	13:10	15:05	12:00	00:00					08:08	09:11	09:37	12:00	00:00					
ALS Sample ID				VA21A8197-001	VA21A8197-002	VA21A8197-003	VA21A8197-004	VA21A8197-005					VA21C1293-001	VA21C1293-002	VA21C1293-003	VA21C1293-004	VA21C1293-005					
manganese, total	Hardness Dependent - Total Only	0.12	mg/L	0.0273	0.0292	<0.00010	0.0281	<0.00010	0.0001	0.0005	3.8%	11.00	0.0457	0.0172	<0.00010	0.0464	<0.00010	0.0001	0.0005	1.5%	7.00	
	Hardness Dependent Short Term Acute		mg/L	0.835	0.844	#VALUE!	0.850	0.540			NA	NA	1.224	1.273	#VALUE!	1.186	0.540			NA	NA	
	Hardness Dependent Long Term Chronic		mg/L	0.723	0.726	#VALUE!	0.729	0.605			NA	NA	0.878	0.898	#VALUE!	0.863	0.605			NA	NA	
Methyl Mercury	1		mg/L								NA	NA										
mercury, total	.00002 when MeHg is ≤0.5% Calculated when MeHg is >.5% of total Hg	0.001	mg/L	0.0000116	0.0000115	<0.0000050	0.0000117	<0.0000050	0.000005	0.000025	1.7%	0.04	0.0000129	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.000005	0.000025	NA	NA	
	MeHg %		mg/L	0	0	#VALUE!	0	#VALUE!			NA	NA										
	MeHg > 0.05% Short Term 46		mg/L	#DIV/0!	#DIV/0!	#VALUE!	#DIV/0!	#VALUE!			NA	NA	#DIV/0!	#VALUE!	#VALUE!	#VALUE!	#VALUE!				NA	NA
molybdenum, total	Long Term 7.6	0.088	mg/L	0.00005	0.000056	<0.000050	0.000058	<0.000050	0.00005	0.00025	3.5%	0.04	0.000154	0.000108	<0.000050	0.000143	<0.000050	0.00005	0.00025	7.4%	0.22	
nickel, total		0.08	mg/L	0.00056	0.00079	<0.00050	0.00063	<0.00050	0.0005	0.0025	22.5%	0.32	0.00128	0.00132	<0.00050	0.00127	<0.00050	0.0005	0.0025	0.8%	0.02	
phosphorus, total			mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.05	0.25	NA	NA	<0.050	<0.050	<0.050	<0.050	<0.050	0.05	0.25	NA	NA	
potassium, total			mg/L	0.359	0.425	<0.050	0.388	<0.050	0.05	0.25	9.1%	0.74	1.04	1.02	<0.050	1.02	<0.050	0.05	0.25	1.9%	0.40	
rubidium, total			mg/L	<0.00020	0.00025	<0.00020	0.00026	<0.00020	0.0002	0.001	3.9%	0.05	0.00057	0.00048	<0.00020	0.00057	<0.00020	0.0002	0.001	0.0%	0.00	
selenium, total	Long Term Chronic Alert: 0.001 WQG: 0.002	0.01	mg/L	0.00006	<0.000050	<0.000050	0.00005	<0.000050	0.00005	0.00025	NA	NA	0.000073	0.000089	<0.000050	0.000092	<0.000050	0.00005	0.00025	23.0%	0.38	
silicon, total			mg/L	3.28	3.55	<0.10	3.37	<0.10	0.1	0.5	5.2%	1.80	3.77	3.92	<0.10	3.62	<0.10	0.1	0.5	4.1%	1.50	
silver, total	Hardness Dependent		mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.00001	0.00005	NA	NA	0.000011	<0.000010	<0.000010	0.000012	<0.000010	0.00001	0.00005	8.7%	0.10	
	Long Term Hardness Short Term Hardness Calculation		mg/L	0.00005	0.00005	0.00150	0.00005	0.00005			NA	NA	0.00005	0.00005	0.00150	0.00005	0.00005			NA	NA	
			mg/L	0.0001	0.0001	0.0030	0.0001	0.0001			NA	NA	0.0001	0.0001	0.0030	0.0001	0.0001			NA	NA	
sodium, total			mg/L	2.76	3.02	<0.050	2.92	<0.050	0.05	0.25	3.4%	2.00	7.24	8.21	<0.050	6.94	<0.050	0.05	0.25	4.2%	6.00	
strontium, total	7		mg/L	0.0853	0.0846	<0.00020	0.0852	<0.00020	0.0002	0.001	0.7%	3.00	0.174	0.184	<0.00020	0.167	<0.00020	0.0002	0.001	4.1%	35.00	
sulfur, total			mg/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.5	2.5	NA	NA	<0.50	<0.50	<0.50	<0.50	<0.50	0.5	2.5	NA	NA	
tellurium, total			mg/L	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	0.0002	0.001	NA	NA	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	0.0002	0.001	NA	NA	
thallium, total			mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.00001	0.00005	NA	NA	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.00001	0.00005	NA	NA	
thorium, total			mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.0001	0.0005	NA	NA	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.0001	0.0005	NA	NA	
tin, total			mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.0001	0.0005	NA	NA	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.0001	0.0005	NA	NA	
titanium, total			mg/L	0.00422	<0.00630	<0.00030	0.00643	<0.00030	0.0063	0.0315	NA	NA	0.00594	0.00717	<0.00030	0.00573	<0.00030	0.0003	0.0015	3.6%	0.70	
tungsten, total			mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.0001	0.0005	NA	NA	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.0001	0.0005	NA	NA	
uranium, total		0.02	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.00001	0.00005	NA	NA	<0.000010	0.000018	<0.000010	0.000011	<0.000010	0.00001	0.00005	NA	NA	
vanadium, total			mg/L	0.00065	0.00095	<0.00050	0.00088	<0.00050	0.0005	0.0025	7.7%	0.14	0.00113	0.00113	<0.00050	0.00114	<0.00050	0.0005	0.0025	0.9%	0.02	
zinc, total	Hardness Dependent	3	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.003	0.015	NA	NA	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.003	0.015	NA	NA	
	Long Term		mg/L	0.00750	0.00750	#VALUE!	0.00750	0.00750			NA	NA	0.00750	0.00750	#VALUE!	0.00750	0.00750			NA	NA	

**Table 2. Analytical Results for Total metals in Surface Water**

Work Order	BCWQG AW	BCWQG DW	Units	VA21A8197					Lab Report Limit	Lab Report Limit x 5	RPD	DF	VA21C1293					Lab Report Limit	Lab Report Limit x 5	RPD	DF
				us	ds	Field Blank	dup	Travel Blank					us	ds	Field Blank	dup	Travel Blank				
Clinet Sample ID				28-Apr-21	28-Apr-21	28-Apr-21	28-Apr-21	28-Apr-21					27-Sep-2021	27-Sep-2021	27-Sep-2021	27-Sep-2021	27-Sep-2021				
Date Sampled				14:17	13:10	15:05	12:00	00:00					08:08	09:11	09:37	12:00	00:00				
Time Sampled				VA21A8197-001	VA21A8197-002	VA21A8197-003	VA21A8197-004	VA21A8197-005					VA21C1293-001	VA21C1293-002	VA21C1293-003	VA21C1293-004	VA21C1293-005				
ALS Sample ID	Short Term			0.0330	0.0330	#VALUE!	0.0330	0.0330			NA	NA	0.0330	0.0330	#VALUE!	0.0330	0.0330			NA	NA
zirconium, total			mg/L	0.00053	0.00051	<0.00020	0.00047	<0.00020	0.0002	0.001	8.2%	0.20	0.00030	0.00029	<0.00020	0.00026	<0.00020	0.0002	0.001	14.3%	0.20

Table 3. Analytical Results for Dissolved Metals in Surface Water

Work Order	BCWQG AW	BCWQG DW	Units	VA21A8197					Lab Report Limit	Lab Report Limit x 5	RPD	DF	VA21C1293					Lab Report Limit	Lab Report Limit x 5	RPD	DF
				us	ds	Field Blank	dup	Travel Blank					us	ds	Field Blank	dup	Travel Blank				
Cinet Sample ID				28-Apr-21	28-Apr-21	28-Apr-21	28-Apr-21	28-Apr-21					27-Sep-2021	27-Sep-2021	27-Sep-2021	27-Sep-2021	27-Sep-2021				
Date Sampled				14:17	13:10	15:05	12:00	00:00					08:08	09:11	09:37	12:00	00:00				
Time Sampled				VA21A8197-001	VA21A8197-002	VA21A8197-003	VA21A8197-004	VA21A8197-005					VA21C1293-001	VA21C1293-002	VA21C1293-003	VA21C1293-004	VA21C1293-005				
ALS Sample ID																					
<b>Dissolved Metals</b>																					
aluminum, dissolved	pH Dependent Applies to only the dissolved fraction		mg/L	0.15	0.128	<0.0010	0.149		0.001	0.005	15.2%	21.00	0.0809	0.0608	<0.0010	0.122		0.002	0.01	40.5%	20.55
	Short Term Acute			0.100	0.100	0.032	0.100	3.350			NA	NA	0.100	0.100	0.022	0.100	3.350			NA	NA
	Long-Term Chronic			0.050	0.050	0.011	0.050	4.953			NA	NA	0.050	0.050	0.006	0.050	4.953			NA	NA
antimony, dissolved	-		mg/L	<0.00010	<0.00010	<0.00010	<0.00010		0.0001	0.0005	NA	NA	<0.00010	<0.00010	<0.00010	<0.00010		0.0001	0.0005	NA	NA
arsenic, dissolved	-		mg/L	0.00026	0.00024	<0.00010	0.00025		0.0001	0.0005	4.1%	0.10	0.00079	0.00051	<0.00010	0.00074		0.0001	0.0005	6.5%	0.50
barium, dissolved	-		mg/L	0.0182	0.0181	<0.00010	0.0185		0.0001	0.0005	2.2%	4.00	0.0303	0.034	<0.00010	0.0321		0.0001	0.0005	5.8%	18.00
beryllium, dissolved	-		mg/L	<0.000100	<0.000100	<0.000100	<0.000100		0.0001	0.0005	NA	NA	<0.000100	<0.000100	<0.000100	<0.000100		0.0001	0.0005	NA	NA
bismuth, dissolved	-		mg/L	<0.000050	<0.000050	<0.000050	<0.000050		0.00005	0.00025	NA	NA	<0.000050	<0.000050	<0.000050	<0.000050		0.00005	0.00025	NA	NA
boron, dissolved	-		mg/L	<0.010	<0.010	<0.010	<0.010		0.01	0.05	NA	NA	<0.010	0.021	<0.010	<0.010		0.01	0.05	NA	NA
cadmium, dissolved	Hardness Dependent Applies to only the dissolved fraction Short Term applies to water hardness between 7 - 455 Chronic applies to hardness between 3.4 - 285		mg/L	<0.000050	<0.000050	<0.000050	<0.000050		0.000005	0.000025	NA	NA	0.000052	0.000058	<0.000050	0.000083		0.000005	0.000025	45.9%	0.62
	Short Term Acute		mg/L	0.000152	0.000156	Site Specific	0.000159	0.000288			NA	NA	0.000360	0.000386	Site Specific	0.000339	Site Specific			NA	NA
	Long Term Chronic		mg/L	0.000080	0.000082	Site Specific	0.000083	0.000127			NA	NA	0.000149	0.000157	Site Specific	0.000143	Site Specific			NA	NA
calcium, dissolved	-		mg/L	7.47	7.65	<0.050	7.78		0.05	0.25	1.7%	2.60	18	18.8	<0.050	16.6		0.05	0.25	8.1%	28.00
cesium, dissolved	-		mg/L	<0.000010	<0.000010	<0.000010	<0.000010		0.00001	0.00005	NA	NA	<0.000010	<0.000010	<0.000010	<0.000010		0.00001	0.00005	NA	NA
chromium, dissolved	-		mg/L	<0.00050	<0.00050	<0.00050	<0.00050		0.0005	0.0025	NA	NA	<0.00050	<0.00050	<0.00050	<0.00050		0.0005	0.0025	NA	NA
cobalt, dissolved	-		mg/L	<0.00010	<0.00010	<0.00010	<0.00010		0.0001	0.0005	NA	NA	0.0001	<0.00010	<0.00010	0.00012		0.0001	0.0005	18.2%	0.20
copper, dissolved	DOC Dependent - Biotic Ligand Model equation Freeware from Ministry ENV BC Applies to only the dissolved fraction.		mg/L	0.00145	0.00142	<0.00020	0.00152		0.0002	0.001	6.8%	0.50	0.00143	0.00156	<0.00020	0.00135		0.0002	0.001	5.8%	0.40
	Calculated BLM Standard Short Term Dissolved 0.35			Not Calculated - No DOC	Not Calculated - No DOC	Not Calculated - No DOC	Not Calculated - No DOC				NA	NA	Not Calculated - No DOC	Not Calculated - No DOC	Not Calculated - No DOC	Not Calculated - No DOC				NA	NA
iron, dissolved	-		mg/L	0.247	0.218	<0.010	0.244		0.01	0.05	11.3%	2.60	0.85	0.573	<0.010	0.827		0.01	0.05	2.7%	2.30
lead, dissolved	-		mg/L	<0.000050	<0.000050	<0.000050	<0.000050		0.00005	0.00025	NA	NA	0.000139	0.000074	<0.000050	0.000097		0.00005	0.00025	35.6%	0.84
lithium, dissolved	-		mg/L	<0.0010	<0.0010	<0.0010	<0.0010		0.001	0.005	NA	NA	<0.0010	<0.0010	<0.0010	<0.0010		0.001	0.005	NA	NA
magnesium, dissolved	-		mg/L	1.99	2.07	<0.0050	2.11		0.005	0.025	1.9%	8.00	4.17	4.74	<0.0050	4.17		0.005	0.025	0.0%	0.00
manganese, dissolved	-		mg/L	0.0134	0.01	<0.00010	0.00968		0.0001	0.0005	3.3%	3.20	0.0205	0.00403	<0.00010	0.0253		0.0001	0.0005	21.0%	48.00
mercury, dissolved	-		mg/L	0.0000092	0.0000099	<0.0000050	0.0000102		0.000005	0.000025	3.0%	0.06	<0.0000050	<0.0000050	<0.0000050	<0.0000050		0.000005	0.000025	NA	NA
molybdenum, dissolved	-		mg/L	0.000076	0.00005	<0.000050	0.000054		0.00005	0.00025	7.7%	0.08	0.000155	0.000112	<0.000050	0.000145		0.00005	0.00025	6.7%	0.20
nickel, dissolved	-		mg/L	0.00062	0.00059	<0.00050	0.00064		0.0005	0.0025	8.1%	0.10	0.00094	0.00089	<0.00050	0.00082		0.0005	0.0025	13.6%	0.24
phosphorus, dissolved	-		mg/L	<0.050	<0.050	<0.050	<0.050		0.05	0.25	NA	NA	<0.050	<0.050	<0.050	<0.050		0.05	0.25	NA	NA
potassium, dissolved	-		mg/L	0.36	0.38	<0.050	0.376		0.05	0.25	1.1%	0.08	0.98	0.935	<0.050	0.978		0.05	0.25	0.2%	0.04
rubidium, dissolved	-		mg/L	<0.00020	<0.00020	<0.00020	<0.00020		0.0002	0.001	NA	NA	0.00041	0.00024	<0.00020	0.0004		0.0002	0.001	2.5%	0.05
selenium, dissolved	-		mg/L	0.000052	0.000065	<0.000050	0.000062		0.00005	0.00025	4.7%	0.06	0.000082	0.000091	<0.000050	0.000091		0.00005	0.00025	10.4%	0.18
silicon, dissolved	-		mg/L	2.96	3.01	<0.050	3.07		0.05	0.25	2.0%	1.20	3.6	3.55	<0.050	3.54		0.05	0.25	1.7%	1.20
silver, dissolved	-		mg/L	<0.000010	<0.000010	<0.000010	<0.000010		0.00001	0.00005	NA	NA	<0.000010	<0.000010	<0.000010	<0.000010		0.00001	0.00005	NA	NA

Table 3. Analytical Results for Dissolved Metals in Surface Water

Work Order	BCWQG AW	BCWQG DW	Units	VA21A8197					Lab Report Limit	Lab Report Limit x 5	RPD	DF	VA21C1293					Lab Report Limit	Lab Report Limit x 5	RPD	DF
				us	ds	Field Blank	dup	Travel Blank					us	ds	Field Blank	dup	Travel Blank				
Client Sample ID				28-Apr-21	28-Apr-21	28-Apr-21	28-Apr-21	28-Apr-21					27-Sep-2021	27-Sep-2021	27-Sep-2021	27-Sep-2021	27-Sep-2021				
Date Sampled				14:17	13:10	15:05	12:00	00:00					08:08	09:11	09:37	12:00	00:00				
Time Sampled																					
ALS Sample ID				VA21A8197-001	VA21A8197-002	VA21A8197-003	VA21A8197-004	VA21A8197-005					VA21C1293-001	VA21C1293-002	VA21C1293-003	VA21C1293-004	VA21C1293-005				
sodium, dissolved	-		mg/L	2.8	2.88	<0.050	2.96		0.05	0.25	2.7%	1.60	6.94	8.04	<0.050	6.8		0.05	0.25	2.0%	2.80
strontium, dissolved	-		mg/L	0.0843	0.0845	<0.00020	0.087		0.0002	0.001	2.9%	12.50	0.166	0.181	<0.00020	0.166		0.0002	0.001	0.0%	0.00
sulfur, dissolved	-		mg/L	<0.50	<0.50	<0.50	<0.50		0.5	2.5	NA	NA	<0.50	<0.50	<0.50	<0.50		0.5	2.5	NA	NA
tellurium, dissolved	-		mg/L	<0.00020	<0.00020	<0.00020	<0.00020		0.0002	0.001	NA	NA	<0.00020	<0.00020	<0.00020	<0.00020		0.0002	0.001	NA	NA
thallium, dissolved	-		mg/L	<0.000010	<0.000010	<0.000010	<0.000010		0.00001	0.00005	NA	NA	<0.000010	<0.000010	<0.000010	<0.000010		0.00001	0.00005	NA	NA
thorium, dissolved	-		mg/L	<0.00010	<0.00010	<0.00010	<0.00010		0.0001	0.0005	NA	NA	<0.00010	<0.00010	<0.00010	<0.00010		0.0001	0.0005	NA	NA
tin, dissolved	-		mg/L	<0.00010	<0.00010	<0.00010	<0.00010		0.0001	0.0005	NA	NA	<0.00010	<0.00010	<0.00010	<0.00010		0.0001	0.0005	NA	NA
titanium, dissolved	-		mg/L	0.00346	0.00303	<0.00030	0.00372		0.0003	0.0015	20.4%	2.30	0.00485	0.0026	<0.00030	0.00358		0.0003	0.0015	30.1%	4.23
tungsten, dissolved	-		mg/L	<0.00010	<0.00010	<0.00010	<0.00010		0.0001	0.0005	NA	NA	<0.00010	<0.00010	<0.00010	<0.00010		0.0001	0.0005	NA	NA
uranium, dissolved	-		mg/L	0.000015	<0.000010	<0.000010	<0.000010		0.00001	0.00005	NA	NA	<0.000010	0.000015	<0.000010	<0.000010		0.00001	0.00005	NA	NA
vanadium, dissolved	-		mg/L	<0.00050	<0.00050	<0.00050	<0.00050		0.0005	0.0025	NA	NA	0.00052	<0.00050	<0.00050	<0.00050		0.0005	0.0025	NA	NA
zinc, dissolved	-		mg/L	0.0011	<0.0010	<0.0010	<0.0010		0.001	0.005	NA	NA	0.0015	<0.0010	<0.0010	0.0058		0.001	0.005	117.8%	4.30
zirconium, dissolved	-		mg/L	0.00055	0.00051	<0.00020	0.00058		0.0002	0.001	12.8%	0.35	0.00043	0.00028	<0.00020	<0.00080		0.0008	0.004	NA	NA

Appendix C – Kitwanga Landfill Operational Certificate



File: MR-5767

Date: November 8, 2012

**REGISTERED MAIL**

Regional District of Kitimat-Stikine  
300-4545 Lazelle Avenue  
Terrace, BC  
V8G 4E1

Dear Operational Certificate Holder:

Enclosed is Operational Certificate MR-5767 issued under the provisions of the *Environmental Management Act*. Your attention is respectfully directed to the terms and conditions outlined in the operational certificate.

This operational certificate does not authorize entry upon, crossing over, or use for any purpose of private or Crown lands or works, unless and except as authorized by the owner of such lands or works. The responsibility for obtaining such authority rests with the operational certificate holder. It is also the responsibility of the operational certificate holder to ensure that all activities conducted under this authorization are carried out with regard to the rights of third parties, and comply with other applicable legislation that may be in force.

This decision may be appealed to the Environmental Appeal Board in accordance with Part 8 of the *Environmental Management Act*. An appeal must be delivered within 30 days from the date that notice of this decision is given. For further information, please contact the Environmental Appeal Board at (250) 387-3464.

Administration of this operational certificate will be carried out by staff from the Skeena Region. Plans, data and reports pertinent to the operational certificate are to be submitted to the Director, Environmental Protection, at Ministry of Environment, Regional Operations, Skeena Region, 3726 Alfred Avenue, Box 5000, Smithers, BC, V0J 2N0.

Yours truly,

Mark Love, P. Ag.  
for Director, *Environmental Management Act*  
Skeena Region

Enclosure



MINISTRY OF ENVIRONMENT

OPERATIONAL CERTIFICATE  
MR-5767

for the

KITWANGA LANDFILL

*Under the Provisions of the Environmental Management Act  
and in accordance with the approved  
Regional District of Kitimat-Stikine Solid Waste Management Plan, the*

**Regional District of Kitimat-Stikine**

**Suite 300-4545 Lazelle Avenue**

**Terrace, British Columbia**

**V8G 4E1**

is authorized to store, handle, treat and discharge municipal solid waste from Kitwanga and surrounding area at the Kitwanga landfill, subject to the conditions listed below. Contravention of any of these conditions is a violation of the *Environmental Management Act* and may result in prosecution.

**1. LOCATION OF LANDFILL PROPERTY**

The location of the property where discharges are authorized to occur is District Lot 1335 Cassiar Land District.



## 2. AUTHORIZED DISCHARGES

### 2.1 Discharge of Municipal Solid Waste

This section applies to the discharge of municipal solid waste to ground at the landfill located approximately as shown on the attached site plan. The site reference number for this discharge is E209210. Refer to Section 5 for the operational requirements associated with this discharge.

- 2.1.1 Subject to Sections 4.2, 4.3 and 4.4, the characteristics of the discharge shall be typical of municipal solid waste.
- 2.1.2 The quantity of solid wastes discharged to ground shall not exceed the design capacity of the landfill facility specified as follows: (1) by an engineered final design footprint (see Section 3.3); and (2) by engineered excavation and final grade contours (see Section 3.4).
- 2.1.3 The authorized works are a separate municipal solid waste disposal area and related appurtenances located approximately as shown on the attached site plan.

### 2.2 Storage and Handling of Wastes for Salvage and Recycling

This section applies to the storage and handling of municipal solid wastes for salvage and recycling. Refer to Section 7 for the operational requirements associated with this discharge.

- 2.2.1 Subject to Section 4.2, the characteristics of the discharge shall be typical of recyclable municipal solid waste.
- 2.2.2 The quantity of recyclable wastes stored or handled is indeterminate.
- 2.2.3 The authorized works are a separate recyclable municipal solid waste storage area and related appurtenances located approximately as shown on the attached site plan.

### 2.3 Discharge of Air Contaminants from Open Burning

This section applies to the discharge of air contaminants to the atmosphere from the regulated open burning of wood and selected combustibles from a burn pile located approximately as shown on the attached site plan. The site reference number for this discharge is E219223. Refer to Section 8 for the operational requirements associated with this discharge.



Mark Love, P.Ag.

For Director, Environmental Management Act

OPERATIONAL CERTIFICATE: MR-5767



- 2.3.1 The characteristics of the discharge shall be typical of those resulting from the regulated open burning of selected combustibles as per Section 8.3.
- 2.3.2 The maximum authorized rate of discharge is indeterminate.
- 2.3.3 The authorized works are a separate burn area associated with a landfill operation and related appurtenances located approximately as shown on the attached site plan.

### **3 LANDFILL DESIGN**

#### **3.1 Design by Qualified Professional(s)**

The landfill and associated works [including but not limited to the size(s) and location(s) of disposal area(s), maximum allowable slopes of disposal area(s), leachate management system, progressive and final closure details, etc.] shall be designed by qualified professionals [such as engineer(s) and/or geoscientist(s)] registered in the Province of British Columbia who have expertise in the field of landfill design. These details shall be incorporated into a "Design, Operations and Closure Plan" (DOCP) and made available to the Director upon request. Where a design feature prepared by a qualified professional is in conflict with any requirement of this operational certificate, it shall be brought to the attention of the Director who shall determine a resolution to the conflict.

#### **3.2 Construction**

The landfill and associated works shall be constructed in accordance with the design prepared by qualified professionals, and as documented in the DOCP.

#### **3.3 Engineered Footprint**

The landfill design shall include preparation of an engineered final design footprint delineating the maximum extent of solid waste disposal allowable at the facility horizontally (in plan view). The engineered final design footprint shall be clearly shown on a scaled plan of the site and the plan made available in PDF format (see Section 3.6). These details shall be documented in the DOCP.

#### **3.4 Engineered Excavation and Final Grade Contours**

The landfill design shall include preparation of engineered excavation grade (if below grade landfilling is to occur) and final grade contours delineating the maximum extent of solid waste disposal allowable at the facility vertically (in cross-sectional view). The engineered excavation and final grade contours shall be clearly shown on scaled drawings (accompanied with typical cross sections to

aid in depicting the landfill profile) and the drawings shall be made available in PDF format (see Section 3.6). These details shall be documented in the DOCP.

**3.5 Legal Survey**

The landfill property shall be legally surveyed on or before June 30, 2016, or a minimum of 6 months prior to closure, whichever is sooner.

**3.6 Scaled Drawings**

A scaled site plan accurately showing the legal survey (when completed), the engineered final design footprint, and final design contours, shall be included in the DOCP and made available in PDF format upon request by the Director. Additional scaled drawings showing excavation contours (if relevant) and typical cross sectional views of the site shall also be included in the DOCP.

**4. GENERAL REQUIREMENTS**

**4.1 Site Identification**

A sign shall be erected at the main entrance to the landfill which identifies the following: site name, owner, operator, contact phone number and address, hours of operation, tipping fees (if applicable) and prohibition of hazardous wastes. The lettering on the sign shall be such that it is clearly readable by the public upon approach.

**4.2 Prohibited Wastes**

No wastes as defined by the *Hazardous Waste Regulation* shall be received, stored, treated or disposed of at this site except as authorized by the Director. Lead-acid batteries shall not be landfilled but may be salvaged/recycled provided they are stored, handled and shipped in compliance with the *Hazardous Waste Regulation* and with Section 8 of this operational certificate. Tires equal to or less than 22" in rim size and autohulks shall not be landfilled.

**4.3 Waste Asbestos**

Notwithstanding Section 4.2 of this operational certificate, the disposal of waste asbestos under Section 2.1 of this operational certificate and in compliance with the requirements of Section 40 of the *Hazardous Waste Regulation* is hereby authorized.



#### 4.4 Contaminated Soil

Soil that contains contaminants in concentrations less than "Hazardous Waste" as defined by the *Hazardous Waste Regulation* may be disposed at the landfill site. Disposal includes monofilling, co-disposal with other wastes, use as a refuse cell berm material and use as a refuse cell cover material. Disposal must occur within a disposal area as authorized by Section 5 of this operational certificate. Disposal does not include use as final cover material.

#### 4.5 Waste Measurement

The quantity of waste material landfilled at the site shall be measured or estimated by means suitable to the Director. The results shall be submitted in accordance with Section 10.5, once per year on or before June 30 for the previous year, expressed in tonnes/yr and/or m<sup>3</sup>/yr.

#### 4.6 Ozone Depleting Substances

Release of ozone depleting substances from the storage, handling and transport of used refrigerator equipment, freezers, motor vehicle air conditioners and other air conditioning equipment, fire extinguishers and the like is strictly forbidden as per the requirements of the *Ozone Depleting Substances Regulation and Other Halocarbons Regulation*.

#### 4.7 Fire Prevention

The operational certificate holder shall make all reasonable efforts to prevent unauthorized fires from occurring at the landfill site. As a minimum, a fire break clear of all combustible materials at least 15 metres wide shall surround all disposal, treatment and individual storage areas which have received or are receiving combustible materials. Disposal areas that have had 30 cm of compacted mineral soil cell cover or final cover applied are exempt. Water supply and pumping capabilities and/or soil and earth moving equipment shall be maintained at a sufficient level to extinguish fires. In addition, reasonable efforts shall include, but are not necessarily limited to, the preparation of a Fire Prevention and Response Plan.

#### 4.8 Extinguishment of Fires

In the event of an unauthorized fire (including any smouldering fire), the operational certificate holder shall immediately make all reasonable efforts to extinguish the fire. The operational certificate holder shall also immediately notify the Provincial Emergency Program (phone: 1-800-663-3456) and any local fire authority of an unauthorized fire.

**4.9 Buffer Zone**

No material shall be landfilled within 50 metres of the property boundary.

**4.10 Litter Control**

The operational certificate holder shall make all reasonable efforts to prevent litter from scattering. Any litter scattered on neighbouring property shall be cleaned up as soon as practicable.

**4.11 Water Table Restriction**

Wastes shall not be deposited or stored less than 1.2 metres above the highest groundwater level.

**4.12 Surface Water Management**

The distance between a natural body of surface water and any stored or buried materials shall be a minimum of 25 metres.

**4.13 Inert Materials**

Specific inert materials may be exempted from the requirements of Section 4.11 by the Director. The permission of the Director must be obtained in writing prior to any disposal or handling of inert materials on an exemption basis.

**4.14 Landfill Gas Lower Explosive Limit**

The landfill shall be operated such that combustible gas concentrations do not exceed the lower explosive limit in soils at the property boundary or 25% of the lower explosive limit in any on-site or off-site structure or facility, including any services (water, sewer, electrical, etc.).

**4.15 Water Quality and Protection**

The landfill shall be operated in a manner such that ground or surface water quality does not decrease beyond that specified by the Director, at the landfill property boundary or other specified location.

If exceedences of the specified criteria occur as a result of landfill operations, the Director may require that leachate management control measures or works be undertaken. Terms of reference for any leachate management study and/or design work shall be submitted to the Director for approval prior to conducting the work.

In addition to requirements specified by the director, groundwater must be managed in accordance with the Contaminated Sites Regulation.



#### 4.16 Maintenance of Works and Emergency Procedures

The operational certificate holder shall inspect the operation regularly and maintain it in good working order. The operational certificate holder shall immediately notify the Director of any circumstance which prevents continuing operation in the approved manner or results in non-compliance with the requirements of this operational certificate.

#### 4.17 Electric Fencing

##### 4.17.1 Design, Construction and Maintenance

Wherever required, electric fencing and gate systems at the landfill shall be designed, constructed, and maintained such that bears are prevented from entering into the landfill through any portion of the fence or gates at any time of the day.

##### 4.17.2 Fence Type

Fencing may be either high tensile smooth wire or fence fabric (e.g., mesh-wire, page-wire, chainlink or the like). The configuration of a high tensile smooth wire fence shall consist of a minimum of eight strands, with four energized strands alternating with four grounded strands as follows: the bottom strand shall be a grounded or (-) strand and shall not be more than 10 cm from the ground (soil) at any location; and thence starting from the bottom strand, the other seven strands shall be spaced  $15 \pm 2$  cm,  $15 \pm 2$  cm,  $15 \pm 2$  cm,  $20 \pm 2$  cm,  $20 \pm 2$  cm,  $20 \pm 2$  cm, and  $25 \pm 2$  cm. Additional strands to this minimum configuration may be used.

A fence fabric may be used instead of high tensile smooth wire. The fence fabric shall: be a minimum of 1.22 metre high; be constructed of a minimum wire thickness of 11 gauge, and have a maximum mesh size of 15 cm. The bottom of the fabric shall not be more than 10 cm from the ground (soil) at any location. Any uncharged fence fabric must have a minimum of four strands of charged wires on an outrigger system, spaced as follows: the first strand shall not be higher than 25 cm from the ground; and each of the remaining three strands shall be spaced approximately 25 cm apart from adjacent charged strands.

##### 4.17.3 Wire Tension

For a high tensile smooth wire fence construction, all strands shall be tightened to a minimum of 125 lbs tension at 20°C. The required tension is to

be corrected for temperature by use of the following formula for 12-½ gauge high tensile steel wire:

$$Tension = 125 - 2.5(Temperature - 20)$$

where: *Tension* is in lbs force

*Temperature* is in °C

#### 4.17.4 Post Spacing

Fence posts shall be spaced a maximum of 7.5 metres apart.

#### 4.17.5 Grounding System

A grounding system shall be installed consisting of solid grounding rods (i.e., not pipe) with a minimum diameter of 16 mm (5/8 inch) that have a buried length of at least 2 metres. A minimum of three grounding rods (spaced at least 3 metres apart) shall be installed and connected to the energizer. Alternative energizer grounding systems (e.g., grounding plates, or a deep-driven grounding system) may be used provided the grounding is equivalent to or better than three grounding rods. A grounding rod (or equivalent) shall be installed at least once every 450 metres along the fence and connected to the grounded wire strands or uncharged fence fabric. Additional grounding may be required for dry sites or if other conditions affect proper grounding.

#### 4.17.6 Period of Operation

Electric fencing shall be fully operational during the period of April 1 to October 31 inclusive each year and at any other time of year when there is bear activity in the immediate surrounding area. If snow is present during this period, any electrified strands above snow line shall be isolated from the remainder of the system and energized.

#### 4.17.7 Minimum Voltage

Electric fencing shall be operated with a minimum voltage of 6,000 volts.

#### 4.17.8 Gate(s)

Any access through electric fencing for vehicles, equipment and personnel shall consist of an electrified gate system that is closed during non-operating hours. The gate system shall be electrified to a minimum voltage of 6,000 volts at all times except when being opened or closed. Any gate that is open during operating hours shall be periodically checked by the attendant for bear activity during hours of operation. Gaps between the gate and the fence and



ground, and between gate panels (for a double-hung gate), shall not exceed 10 cm.

#### 4.17.9 Fence Inspections

The entire perimeter of the electric fencing shall be inspected at least once every seven days and the voltage of the fencing measured at several points along the fencing and at each gate using a proper electric fence voltmeter matched to the brand of the fence charging unit. The results of voltage testing shall be recorded in a log book. Any results less than the minimum 6,000 volts shall be immediately investigated for the cause of the low voltage (e.g., low battery, litter, vegetation, loose or crossed wires, broken insulators, breaks in the grounding system, etc.). Corrective actions to restore proper voltage shall be immediately undertaken.

Signs of digging or other attempts by bears to penetrate electric fencing shall be recorded in a log book. Any penetrations through electric fencing by bears shall be immediately reported to the Conservation Officer Service at 1-877-952-7277 and to the Director at 250-847-7260.

In cases of low voltage or signs of penetration attempts, inspections shall be increased from once per week to once per day until proper voltage is fully restored and until there are no new signs of penetration attempts, respectively.

#### 4.18 Other Agency Requirements

This operational certificate does not relieve the operational certificate holder from complying with requirements of federal, provincial, regional district or municipal authorities.

### 5. OPERATIONAL REQUIREMENTS FOR THE DISPOSAL OF SOLID WASTE

#### 5.1 Location

The operational certificate holder shall identify an area for disposal of solid waste (herein referred to as the solid waste disposal area) that is within the authorized municipal solid waste disposal footprint (see Section 2.1.3). Signs which identify the nature of the waste acceptable at the designated solid waste disposal area shall be erected and maintained. The lettering on the sign shall be such that it is clearly readable by the public upon approach.

#### 5.2 Nature of Wastes

Wastes disposed at the active face of the solid waste disposal area may include any municipal solid waste except liquid wastes and hot ashes or as otherwise restricted by Section 4.2.



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**5.3 Bear-Proofing**

The solid waste disposal area shall be maintained inside an electric fence. The electric fence shall comply with all requirements of Section 4.17.

**5.4 Waste Compaction**

Wastes at the active face of the solid waste disposal area shall be spread in layers of 60 centimetres or less on the active face and then compacted with a minimum of three (3) passes with heavy equipment.

**5.5 Maximum Lift Height**

The maximum height of any lift of compacted waste in the solid waste disposal area shall be 5 metres.

**5.6 Waste Cover**

Cover shall be applied to waste in the solid waste disposal area as specified below. The operational certificate holder shall maintain a log book to record all dates of cover application.

**5.6.1 Active Face Cover**

Except as otherwise stated in Sub-section 5.6.2, the active face of the solid waste disposal area does not normally require cover. Based on information concerning environmental or public health concerns related to exposed waste at the active face, however, the Director may require that the active face be covered completely at a specified frequency with 0.15 m of soil (or functional equivalent) for a specified period.

**5.6.2 Cell Cover**

A uniform cover of 30 cm compacted soil shall be applied to all sides of the active waste cell in the solid waste disposal area such that no more than 200 m<sup>2</sup> of waste are exposed at the active face at any time and such that the volume of waste in the cell does not exceed 2000 m<sup>3</sup>. Once the maximum volume of waste has been reached in a cell, the active face shall be covered with 30 cm of compacted soil and a new waste cell begun.

**5.6.3 Final Cover**

Completed portions of the solid waste disposal area shall progressively receive final cover during the active life of the landfill (see Section 11.5).



**5.7 Dead Animal Disposal**

Dead animals and animal parts shall be disposed of in the solid waste disposal area and covered as soon as practicable with a minimum of 60 centimetres of soil and/or waste material such that flies and scavenging animals are prevented from accessing the carrion. Disposal of Specified Risk Material from cattle shall only be done in accordance with Canadian Food Inspection Agency requirements and procedures.

**6. OPERATIONAL REQUIREMENTS FOR COMPOSTING**

**6.1 Composting**

Composting operations shall comply with the requirements of the *Organic Matter Recycling Regulation* and any other relevant legislation.

**6.2 Bear-Proofing**

If the composting operation is to receive any organic wastes that are potential attractants to bears, then composting shall be completely enclosed by an electric fence or contained in a bear-proof structure (building or composting vessel). The electric fence shall comply with all requirements of Section 4.17.

**7. OPERATIONAL REQUIREMENTS FOR STORAGE OF SELECTED WASTES FOR SALVAGE AND RECYCLING**

**7.1 Location**

The operational certificate holder may identify an area for the storage of selected wastes for salvage and recycling (herein referred to as the salvage/recycling area). Any salvage/recycling shall be restricted to the designated salvage/recycling area. This area shall be clearly identified at the landfill site. Signs which identify the nature of the materials acceptable at the designated salvage/recycling area shall be erected and maintained. The lettering on the sign shall be such that it is clearly readable by the public upon approach.

**7.2 Nature of Wastes**

Wastes to be salvaged/recycled may be any items with potential salvage or recycling value such as tires, lead-acid batteries, auto hulks, white goods, furniture, used lumber, used goods and the like, but shall not include any refuse consisting of or containing putrescibles, any liquid wastes, hot ashes or materials otherwise restricted by Section 4.2.



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**7.3 Compliance**

Salvage/recycling shall comply with the requirements of the *Storage of Recyclable Material Regulation* and any other relevant legislation and any additional requirements contained in this operational certificate.

**7.4 Contamination**

Contamination of any of the designated salvage/recycling storage piles with putrescible wastes shall be cleaned up immediately.

**8. OPERATIONAL REQUIREMENTS FOR REGULATED OPEN BURNING**

**8.1 Location**

The operational certificate holder may identify an area for the use of open burning to dispose of selected combustibles (herein referred to as the open burning area). Any open burning of selected wastes shall be restricted to the designated open burning area. This area shall be clearly identified at the landfill site. Signs which identify the nature of the waste acceptable at the designated open burning area shall be erected and maintained. The lettering on the sign(s) shall be such that it is clearly readable by the public upon approach.

**8.2 Quantity, Timing, and Duration of Discharge**

The maximum authorized quantity of wood residue to be open burned during each event is that which has accumulated at the time of burn initiation. The pile(s) shall be constructed so as to ensure a rapid and complete burn. The quantity of air contaminants is indeterminate.

The maximum authorized duration of each burn shall be limited to the period between two hours after sunrise on the day of ignition, and sunset on the following day. Each open burn must be completely extinguished at the end of the authorized burn duration.

Should a condition arise which prevents the burn pile(s) from being burned within this period, the Director must be notified in accordance with Section 8.10 of this authorization.

**8.3 Nature of Wastes**

No wastes shall be burned which are unacceptable to the Director. Acceptable materials for burning may only include dry, unpainted, untreated demolition, construction and packing-related wood residue, clean stumps and brush, but must exclude nuisance-causing combustibles such as glue-containing wood, painted





and treated wood, sawdust, yard wastes, mulch, wood chips, rubber, plastics, tars, insulation, roofing material, asphalt shingles, etc.

**8.4 Favourable Weather for Smoke Dispersion**

Open burning shall not proceed unless weather conditions are such that emissions are dispersed away from populated areas.

The operational certificate holder must also obtain a burn registration number from the Ministry of Forests (1-888-797-1717) prior to ignition.

Open burning of wood residue must not be initiated or continued if the local air flow will cause the smoke to negatively impact a nearby population or cause pollution.

No burning shall occur during periods of fire hazard or when burning is prohibited by other agencies.

**8.5 Fire Accelerant**

A suitable amount of approved fire accelerant such as diesel fuel or commercial fire starter gel or a flame-thrower shall be used to ensure efficient and rapid ignition of the waste material.

**8.6 Minimization of Smoke**

The burn shall be tended and fed in a manner that ensures minimization of smoke emissions. Measures to minimize smoke shall include, but not necessarily be limited to: stacking of waste in a manner that eliminates dirt; waiting to burn until wastes are reasonably dry after any significant precipitation event; and using adequate equipment and staff.

**8.7 Contingency Plan**

Prior to burning, a contingency plan must be in place detailing how the open burn will be extinguished in the event of any of the following occurring:

- i) Inadequate smoke dispersion in the surrounding environment;
- ii) wood residue continues to smoulder after the authorized burn period; and,
- iii) the Director requires that the open burn be extinguished for environmental protection reasons.

At a minimum, the plan must detail the actions to be taken to extinguish the open burn should any of the above conditions occur. The plan shall be made available to the Director upon request.

**8.8 Extinguishment**

All combustion shall be completely extinguished at the end of the authorized period as set out in Section 8.2 "Quantity, Timing and Duration of Discharge."

**8.9 Fire Supervision and Suppression**

An attendant shall be on-site to supervise the burn. Adequate fire suppression equipment shall be available for the entire duration of the event, and must be capable of extinguishing the fire if necessary. Local fire departments must be notified of the operational certificate holder's intent to burn, prior to ignition.

**8.10 Maintenance of Works and Emergency Procedures**

The operational certificate holder shall inspect the burn piles regularly and ensure that they are burning well. In the event of an emergency, or condition beyond the control of the operational certificate holder which prevents continuing operation of the approved method of open burning, the operational certificate holder shall notify the Director within two hours. If notification is necessary, it shall be accomplished by contacting the Environmental Protection program at (250) 847 – 7260.

The Director may require additional controls on the burning process and may require that the burn be extinguished at any time based on its impacts on the receiving environment.

**8.11 Documentation**

Following completion of each burn, notice shall be sent to the Director by fax (250-847-7591) or by e-mail to a Skeena Environmental Protection staff member advising of the following details: time of burn initiation, time of burn cessation, volume of wood residue burned, venting index values obtained for burning, and any extraordinary conditions encountered during the burn

**9. MONITORING REQUIREMENTS**

The operational certificate holder shall have a qualified professional evaluate whether an environmental effects monitoring program is needed. The assessment and recommended monitoring program, should one be required, shall be submitted for Director's approval on or before June 30, 2013. In addition to surface water sites, the qualified professional should consider the necessity of establishing ground water



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monitoring locations.

Until June 30, 2013, an interim monitoring program shall be implemented as follows:

Sampling Locations <sup>1</sup> and EMS ID	Frequency <sup>3</sup>	Parameters <sup>3</sup>
Unnamed Creek U/S of Kitwanga Landfill E278450	twice annually, in April and September	<b>Field Measurements:</b> pH, dissolved oxygen, specific conductance, temperature
Unnamed Creek D/S of Kitwanga Landfill E278449		<b>Lab Analysis:</b> BOD, total nitrogen, phosphorous, ammonia, pH, total and dissolved metals <sup>2</sup>
<sup>1</sup> Sampling locations are shown on the site plan <sup>2</sup> Lab analysis for dissolved metals shall use a low level scan <sup>3</sup> May be altered in future, depending on results		

## 10. REPORTING REQUIREMENTS

### 10.1 Reporting

All reports, drawings, data, studies and the like shall be submitted in hardcopy and electronic formats unless otherwise specified by the Director.

### 10.2 Log Book

As required by Sections 4.17.9 and 5.6 the operational certificate holder shall maintain a log book. The log book shall be made available for inspection by Ministry staff upon request.

### 10.3 Non-compliance Reporting

The operational certificate holder shall immediately notify the Director of any non-compliance with the requirements of this operational certificate and take appropriate remedial action. Written confirmation of all non-compliance events, including available test results, is required by facsimile or email to Environmental Protection staff within 24 hours of the original notification unless otherwise directed by the Director.

### 10.4 Non-compliance Follow-up

Upon request, the operational certificate holder shall submit to the Director a written report within 30 days of the non-compliance



occurrence. The report shall include, but not necessarily be limited to, the following:

- i) All relevant information and test results related to the non-compliance;
- ii) an explanation of the most probably cause(s) of the non-compliance; and,
- iii) remedial action planned and/or taken to prevent similar non-compliance(s) in the future.

### 10.5 Annual Report

The operational certificate holder shall submit a basic annual report to the Director on or before June 30 each year for the previous calendar year.

The report shall contain, at a minimum:

- i) The type and tonnage or volume of waste received, recycled, and landfilled for the year;
- ii) occurrences or observations of wildlife attempting to access the facility;
- iii) the results of any monitoring programs undertaken by the operational certificate holder for this site. Trend analysis, as well as an evaluation of any identified impacts of the discharges on the receiving environment in the previous year shall be carried out by a qualified professional, if determined to be necessary by the Director.

## 11. CLOSURE REQUIREMENTS

### 11.1 Notification of Closure

The operational certificate holder shall notify the Director in writing of intentions to close the landfill site.

### 11.2 Closure Plan

A closure plan shall be submitted to the Director no later than 6 months in advance of scheduled closure. The closure plan shall, at a minimum, include the following:

- i) Proposed end-use of the landfill property after closure;



- ii) anticipated total waste volume, tonnage, and life remaining of the landfill;
- iii) a topographic plan showing the final elevation contours of the landfill and surface water diversion and drainage controls;
- iv) design of the final cover suited to the intended end-use of the site, including the thickness and permeability of barrier layers and drainage layers, and information on topsoil, vegetative cover and erosion prevention controls;
- v) procedures for notifying the public about the closure and about alternative waste disposal facilities;
- vi) rodent and nuisance wildlife control procedures;
- vii) a comprehensive monitoring plan, if determined to be necessary by a qualified professional, including groundwater monitoring, surface water monitoring, landfill gas monitoring, leachate monitoring, final cover monitoring, and erosion and settlement monitoring, for a minimum post-closure period of 25 years;
- viii) a plan and accompanying design for the collection, storage and treatment/use of landfill gas for a minimum 25 year post-closure period (if required);
- ix) a plan for operation of any required pollution abatement engineering works such as leachate collection and treatment systems, for a minimum post-closure period of 25 years; and,
- x) an estimated cost, updated annually, to carry out closure and post-closure activities for a minimum period of 25 years.

### **11.3 Closure Funding**

The operational certificate holder shall ensure that sufficient funds will be available to provide for all closure and post-closure requirements as outlined in the closure plan required by Section 11.2, plus a reasonable contingency for any remediation which may be required.

### **11.4 Final Cover**

The final cover system shall be designed by a qualified professional to match the intended end-use of the landfill site and to match the needs of any required environmental management systems (leachate minimization or recirculation, as the case may be, landfill gas collection and treatment, etc.). Generally, the final

cover shall consist of a layer of 1 metre of low permeability ( $<1 \times 10^{-5}$  cm/s) compacted soil followed by a layer of topsoil suitable for establishment of vegetation. Higher permeability soil may be used if determined to be acceptable by a qualified professional and specified in the DOCP. The final cover shall be constructed with minimum and maximum slopes as specified by a qualified professional (see Section 3.4) to promote runoff and minimize erosion, with appropriate runoff drainage controls, erosion controls, and gas venting controls. The site shall be seeded with a grass/legume mixture suited to the local climate.

### **11.5 Progressive Application of Final Cover**

Completed portions of the landfill shall progressively receive final cover during the active life of the landfill. The maximum area of disposed refuse that has not yet received final cover shall not exceed 25% of the total final footprint area. Final cover is to be applied according to the specifications identified in Section 11.4.

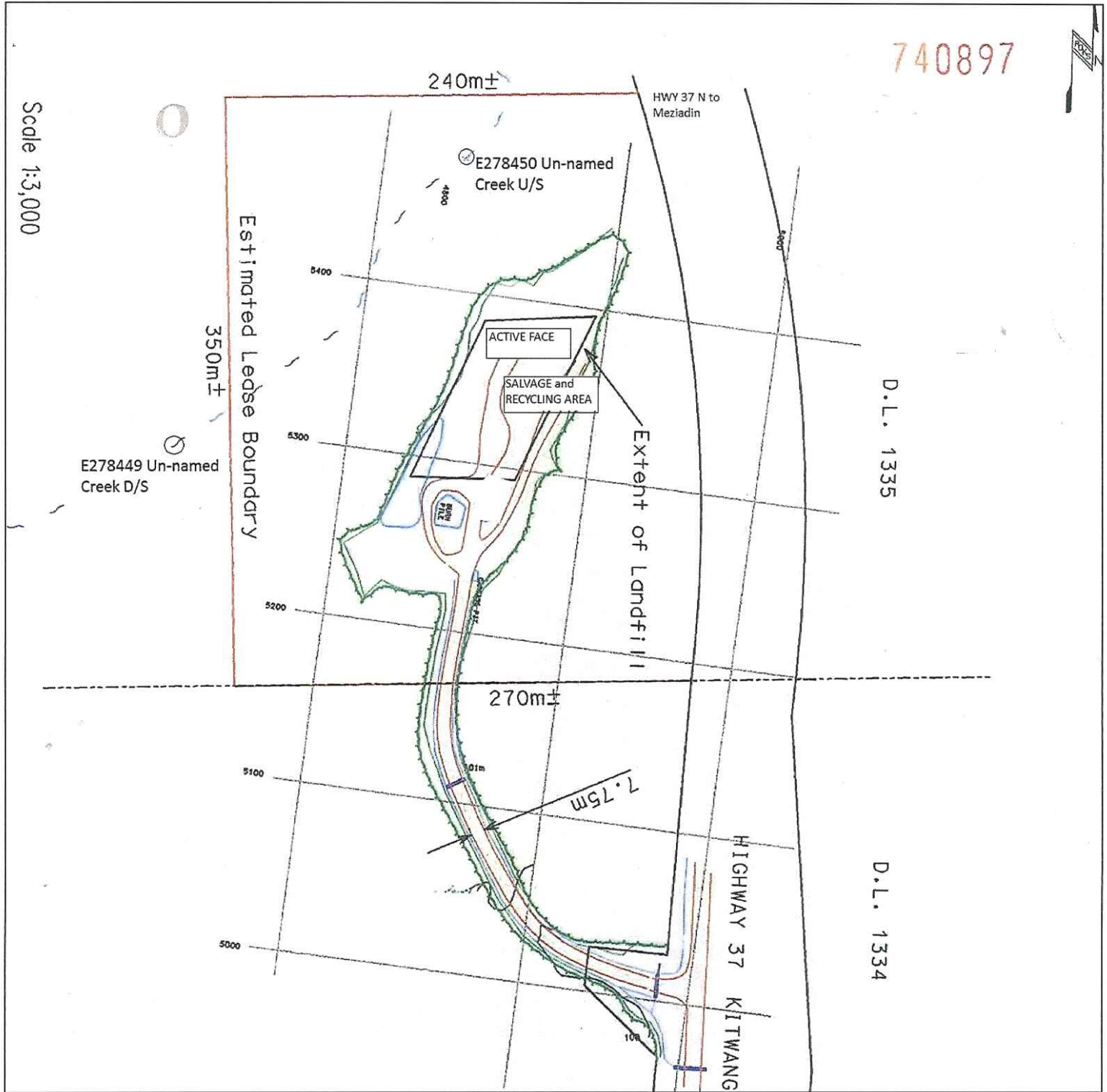
## **12. ENVIRONMENTAL IMPACT**

Inspections of the discharge will be carried out by Environmental Protection personnel as a part of the routine operational certificate inspection procedure. Based on these inspections and any other information available to the Director on the effect of the discharge on the receiving environment, the operational certificate holder may be required to undertake additional monitoring, undertake additional studies, install additional pollution control works, or change the method of operation.





SITE PLAN



Date Issued: November 8, 2012

Date Amended:  
(most recent)

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for Director, *Environmental Management Act*  
Skeena Region  
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